# Towards a sustainable mobility system : leveraging corporate car fleets to foster innovation

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PhD. thesis

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# Abstract

The mobility system in France faces increasing sustainability challenges. In response, French public authorities have endeavoured to foster *innovation* in the mobility system, with a particular focus on the automotive subsystem, where the challenges are most acute.

Corporations have a special position in the mobility system: their decisions influence mobility behaviours well beyond corporate mobility patterns alone. Every year in France, 4 out of 10 *new* light-duty vehicles (including passenger cars and light commercial vehicles) are sold to corporations. Yet, corporate mobility in general, and corporate car fleets in particular, are still *blind spots* in the collective understanding of the mobility system. The main contribution of our work is to demonstrate that, given their effects on the larger mobility system, and given their sensitivity to public policies, corporate car fleets are a relevant object for research and a relevant matter for public policy discussion.

Our research is a *multi-method investigation*, collecting information from a wide range of sources, including professional journals and legal archives, and cross-checking quantitative results on the composition and use patterns of corporate car fleets from large mobility surveys in France against qualitative insights gained from an exploratory survey of fleet managers in the Paris region.

We develop a set of definitions and analytical frameworks for investigating corporate car fleets, including a typology of vehicles based on the various levels of 'rights' granted to the employee over the vehicle. We show that corporate car fleets could account for 15% of the total light-duty vehicle fleet in France, 25% of its total mileage and 25% to 30% of its $CO_2$ emissions.

We also reveal the instrumental role that corporate car fleets can play in setting *new trends* for France's global vehicle stock. We highlight that the day-to-day patterns of use of corporate vehicles are highly diverse, and partly compatible with electric vehicles. Finally, we show that tax policies have significant effects on the dynamics of the spread of innovations in corporate car fleets.

We discuss the implications of these results for policy-making and stress the need for *further integration* between industrial policies, transport policies, and tax policies. We further emphasise the need for *greater coordination* between the various levels of government, and for *adequate phasing* of public policies. At present, *more transparency* is needed about how long current 'initiating' policies (e.g. purchase bonus) will last, and how strong the 'supporting' policies (e.g. low-emission zones) will be in the medium- to long-term.

# Résumé

Pour relever les défis grandissants auxquels est confronté le système de mobilité en termes de durabilité, les autorités publiques françaises ont entrepris de soutenir l'*innovation*, notamment dans le domaine automobile.

Les entreprises occupent une position particulière au sein du système de mobilité : leurs décisions influencent les comportements de mobilité bien au-delà des seuls déplacements professionnels. Chaque année en France, 4 véhicules légers sur 10 parmi les voitures particulières et véhicules utilitaires *neufs* mis sur le marché sont acquis par des entreprises. Pourtant, la mobilité professionnelle en général, et les flottes automobiles d'entreprise en particulier, demeurent des *zones d'ombre* de la connaissance du système de mobilité. L'objet de notre travail et sa contribution principale est de démontrer que, compte tenu de leurs effets sur l'ensemble du système de mobilité d'une part, de leur sensibilité aux politiques publiques d'autre part, les flottes automobiles d'entreprise constituent un objet pertinent tant pour la recherche que pour l'action publique.

Notre investigation s'appuie sur *des méthodes multiples* : outre une synthèse de sources bibliographiques variées (journaux professionnels, archives légales, etc.), nous proposons des recoupements originaux entre, d'une part, des données quantitatives sur la composition et l'usage des flottes automobiles d'entreprise issues d'enquêtes de grande envergure et, d'autre part, les résultats qualitatifs d'une enquête exploratoire menée auprès de gestionnaires de flotte en région parisienne.

Nous développons un ensemble de définitions et de cadres analytiques pour étudier les flottes automobiles d'entreprise, et notamment une typologie de véhicules basée sur les différents niveaux de « droits » accordés à l'utilisateur du véhicule d'entreprise. Nous montrons que les flottes automobiles d'entreprise totalisent 15% de l'ensemble des véhicules légers en France, 25% de leur kilométrage et 25% à 30% de leurs émissions de $CO_2$.

Par ailleurs, nous révélons le rôle essentiel que peuvent jouer les flottes automobiles d'entreprise pour *amorcer des changements* dans le parc automobile français. Nous montrons que les usages quotidiens des véhicules d'entreprise sont très divers, et dans certains cas compatibles avec les véhicules électriques. Enfin, nous mettons en évidence les effets tangibles des politiques fiscales sur la dynamique de diffusion des innovations au sein des flottes automobiles d'entreprise.

Nous examinons les implications de ces résultats en termes de politiques publiques, en soulignant le besoin d'une plus grande *intégration* entre politiques

industrielles, politiques de transport et politiques fiscales. Nous mettons en particulier en évidence le besoin d'une *coordination* accrue entre les politiques publiques menées à différentes échelles et d'un *phasage* approprié de ces politiques. Dans le contexte actuel, une plus grande *transparence* semble requise quant à la pérennité des mesures d'« amorçage » (par exemple, le bonus à l'achat) et au volontarisme des mesures de « soutien » (par exemple, les zones à basses émissions) qui pourraient être adoptées à moyen ou long terme.

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# Introduction

## Context

The mobility of people and goods is a complex phenomenon, vital to societies, and yet a source of major *challenges*, in terms of greenhouse gas emissions, local air pollution, congestion or oil dependency. That is why, from the public policy standpoint, in most developed countries the mobility system has begun to shift from being an entity to provide for (e.g. infrastructure, funding) to being an entity to *manage*. On the path to sustainability, mobility is still in an adolescent phase.

The *transition* towards sustainable mobility has been the focus of increasing research over the last two decades (see, for instance: Kemp and Rotmans, 2004; Banister, 2008; Geels, 2012; Geerlings, Shiftan and Stead, 2012). Among other findings, this research has highlighted the need for *system innovation* in order for the transition to happen. Indeed, innovation is a salient feature of the present era and many argue that it carries great potential to meet the challenges of sustainable development. Yet, the mobility systems of most developed countries have been locked into the dominant paradigm of the private car, and this paradigm in turn has been locked into the dominant design of the internal combustion engine (ICE[1]), for over a century. This technological lock-in limits the prospects for sustainability improvement within the current mobility paradigm to incremental change at best. Innovation is therefore needed at systemic level.

Research on sustainable mobility transitions has also highlighted the need for *adequate public policies* for the transitions to happen. Yet for various reasons, designing and implementing public policies that would effectively support such transitions is bound to be a difficult task for public policy-makers. Indeed, a transition is a non-deterministic process ultimately leading to a new, and *unknown*, dynamic equilibrium among actors, objects, processes and institutions – some old, some recent, and some yet to be discovered – and which is subject to influence by decisions taken in the short- and medium-term,

[1] ICE vehicles are also described as ‘conventional vehicles’. See, for instance: Funk and Rabl (1999), and Aguirre *et al.* (2012).

conflicting interests, wider changes in the economic, social and cultural climate, and inertia at all levels of the system. In order to deal with such uncertainty, public policies further need to be *adaptable* to a wide range of possible developments in the transition process and *agile* enough to exploit windows of opportunity for options with the greatest expected benefits for the system as a whole. Moreover, the mobility system is a complex structure, in which decisions are taken by a wide range of actors (e.g. individuals, corporations, governments, NGOs) at various levels (e.g. international, national, local). In order to deal with such complexity, public policy-makers need to adopt an *integrated* approach to the transition process.

Mobility management policies used to focus on individuals and households, and on their mobility decisions (OECD/ITF, 2010). However, since the late 1980s in Europe and the USA, public authorities have widened the scope of mobility management to include companies, because of the significant effects of *their* decisions on the mobility system as a whole (Rye, 1999a; Coleman, 2000; Van Malderen *et al.*, 2012). Thus, for roughly 25 years now, companies have been identified by policy-makers as potential key players in the targeted change towards more sustainable mobility.

# Problem statement

Faced with significant sustainability challenges combined with the effects on the national economy of the 2008 economic and financial crisis, French public authorities have endeavoured to promote *innovations* in the mobility system, with a particular focus on the automotive subsystem, where the challenges were most acute (worsening congestion and air quality in urban areas, rising greenhouse gas emissions and massive job losses in the manufacturing sector). In particular, over the last decade, policy-makers at the national level have sought to foster the introduction and diffusion of low-emission vehicles (e.g. electric vehicles and hybrid-electric vehicles) in the national light-duty vehicle stock, through the implementation of a set of flagship policies, including the most famous environmental 'bonus' programme (a purchase incentive for new passenger cars with low $CO_2$ emissions).

Every year in France, 4 out of 10 *new* light-duty vehicles on the market (including passenger cars and light commercial vehicles) are purchased by corporations. After a few years in corporate car fleets, most of these vehicles would then be sold on the second-hand market to households (or other corporations). If for no other than these two reasons, corporate car fleets make an attractive target for automotive innovation. Yet up to now, corporate car fleets have remained largely unexplored by academic research, and the knowledge and expertise available on this topic among decision-makers is partial and fragmentary.

The starting point of this dissertation is the acknowledgement of a critical need for a sound and shared corpus of knowledge about corporate car fleets in France, with a view to building a more comprehensive understanding of sustainability issues in the mobility system, and gaining valuable insights into how corporate car fleets may be leveraged by public policy-makers to foster the spread of innovations across France's global light-duty vehicle stock.

# Objectives

The main objective of this dissertation is to investigate corporate car fleets in France and to construct a corpus of knowledge on this new research object, not only as an isolated entity, but also as a component in the wider mobility system and as a means to foster the dissemination of innovations across the automotive subsystem.

First, we aim to analyse how corporate car fleets fit into the broader context of corporate mobility, and how in turn corporate mobility fits into the broader context of the mobility system as a whole. We will discuss the hypothesis that corporations are significant players in the mobility system.

In addition, we aim to open the 'black box' of corporate car fleets, analyse their composition and patterns of use and examine their management processes. We will highlight some of the main differences (in terms of composition and/or use patterns) between the private vehicle stock and the corporate car fleet, and some of the interactions between the two. On the basis of the insights gained through this analysis, we will try and assess the part corporate car fleets play in the wider sustainability issues facing the French mobility system.

Finally, we aim to analyse the opportunities and challenges for the introduction of automotive innovations into corporate car fleets. We will examine how innovations are perceived by corporations and how they fit into their typical fleet management processes. Last, we will discuss the role public policies can play in encouraging the adoption of innovations.

# Approach

Due to the lack of prior research on the issues at stake, we conceived this research as a *multi-method investigation*. We collected information from a wide range of sources, both academic and non-academic, including ministerial documents, professional journals, legal archives and special features in the mainstream press. We progressively developed analytical frameworks and definitions to allow for a more accurate description of the dynamics of corporate car fleets. We were able to cross-check quantitative results on the composition and use patterns of corporate car fleets from large mobility surveys in France against qualitative insights gained from an exploratory survey based on face-to-face interviews with fleet decision-makers in the Paris region. Finally, by testing their impacts on the total costs of ownership of corporate vehicles, we were able to assess the relative effectiveness of various tax schemes applicable to corporate car fleets in France. Besides its focus on France, the outcome of this investigation as it is presented in this dissertation has four salient features.

First, when considering sustainability issues in mobility, the primary focus of our analysis is on the *economic* dimension of sustainability and, to a lesser extent, on its *environmental* dimension. Although the social issues of mobility may occasionally be touched on, they are not dealt with in depth.

Second, our analysis is based on a conception of the mobility system as a *system of stakeholders*, which are classified into four main categories: *i)* public policy-makers, *ii)* companies on the supply side of the mobility system (e.g. car manufacturers, transport service providers), *iii)* corporations[2] on the demand side of the mobility system (i.e. corporations considered as users of the mobility system), and *iv)* private individuals and households. In our analysis of the issues at stake in the dynamics of corporate car fleets, the standpoint is most often that of either the *public policy-maker* or the *corporate fleet decision-maker*. We may occasionally adopt the standpoint of the employee or car manufacturer (or service provider), but each of these would merit an analysis in its own right, which we did not have the resources to undertake.

Third, our analysis of mobility-related decisions is based on the assumption that the mobility system is a *complex system*, with the implication that sustainability challenges at the higher level stem from decisions that are taken at multiple levels, and that, reciprocally, initiatives at any level can generate sustainability gains at the higher level. In order to unravel the complexity of these multi-level interactions, we can adopt a micro-level perspective (e.g. operational decisions at the fleet manager level), or a meso-level perspective (e.g. economic decisions at company level), or indeed a macro-level perspective (e.g. public policies at the national level), depending on which level is more relevant to the issue under consideration.

Fourth and lastly, the analyses we develop aim to highlight *pathways of change*. Although our main focus is on the present state and features of the mobility system in general, and corporate car fleets in particular, we endeavour to: *i)* analyse recent developments in the system when they provide useful context, and *ii)* discuss the future prospects for innovation in the system on the basis of our understanding of its present state and dynamics.

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[2] Unless otherwise specified, we will use 'corporations' and 'companies' as meaning: all legal entities (i.e. entities which are not natural persons), whether public or private, large or small. See Chapter 3 for more detail.

# Thesis outline

The diagram in Figure 0.1 is a graphic presentation of the structure and content of this dissertation. The first part consists of two chapters which provide an overview of current sustainability issues in the French transport system (Chapter 1) and a discussion of the physical flows, financial flows and management tools associated with corporate mobility (Chapter 2). The second part of the dissertation consists of three chapters dedicated to the analysis of corporate car fleets in France, starting with some key definitions and issues (Chapter 3), then analysing large survey databases to investigate the use of corporate vehicles by private households on the one hand (Chapter 4), and the use of light commercial vehicles in corporate fleets on the other hand (Chapter 5). The third and last part of this dissertation also consists of three chapters. Building on a qualitative analysis of fleet management processes and their receptiveness to innovations (Chapter 6), a retrospective analysis of the role of taxes in triggering change in corporate car fleets (Chapter 7), it proposes a discussion of the opportunities and challenges for the introduction of innovations in corporate car fleets (Chapter 8). A concluding section highlights and discusses our main findings.

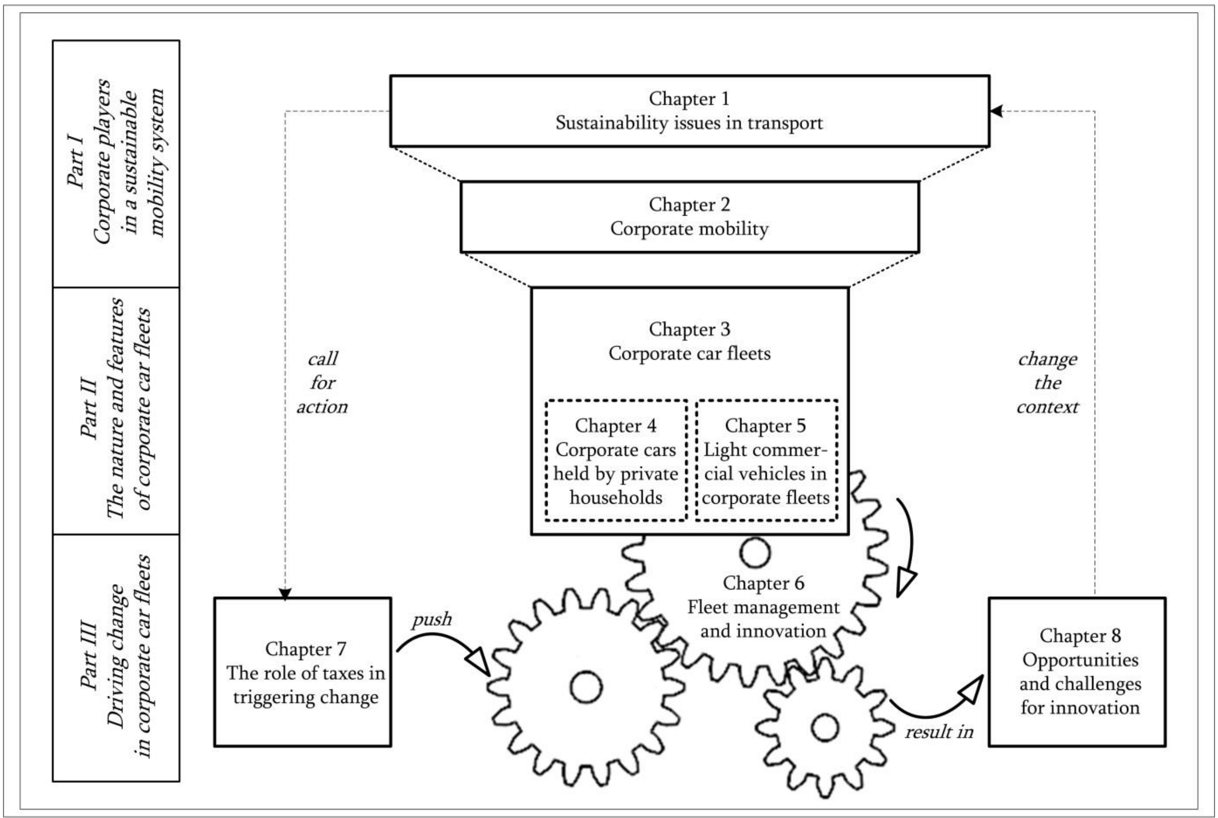


Figure 0.1: Structure of the dissertation

# *Part I*

# *Corporate players in a sustainable mobility system*

# Chapter 1
# Sustainability issues in transport: A French public-policy perspective

## 1.1 Introduction

### 1.1.1 Background and purpose of the chapter

**Transport acts as a powerful catalyst for the whole economy**

Efficient transport systems are essential to the functioning of nations. Not only do they irrigate their economic fabric, they also play a decisive role in shaping it.

The relationship between transport infrastructure and the economic fabric was already discussed in Adam Smith's *Inquiry into the Nature and Causes of the Wealth of Nations* (1776). Smith clearly included the development and maintenance of 'public works' (which, in modern terms, would obviously include transport infrastructure) among the state's responsibilities. He would argue that the provision of efficient transport infrastructure enables the specialisation of local economies, thereby resulting in economies of scale and comparative advantages.

As highlighted by Duranton (1997) and Redding and Turner (2014), a rich academic literature (in particular, research described as the 'new economic geography') has since investigated the mutually causal relationship between transport systems and the economic development of territories. On an international scale, this research has shown how transport costs contribute to the industrial specialisation of nations, thereby helping to shape international trade patterns (Krugman, 1980). On a more local scale, it has also shed light on how transport costs influence the distribution of manufacturing production, and in particular its relative concentration, across a given territory (Krugman, 1991).

The question of how to assess the overall costs and benefits of transport to a particular national economy has given rise to much academic debate (Offner, 1993; Lakshmanan *et al.*, 2001; Banister and Berechman, 2001; Lakshmanan, 2011; CGSP, 2013a: p.27). As Lakshmanan *et al.* (2001) put it: '*Transport undoubtedly belongs to the most complicated, and therewith fascinating economic sectors. The transport sector exhibits a number of specific features that renders common economic wisdom of only limited use in the assessment of the sector's costs and benefits. Nevertheless, such an assessment is an important input for the design of transport policies based on solid economic principles.*' Here, in the eyes of economists, are a few of the features specific to the transport sector: *i)* transport demand is a 'derived demand', meaning that it results from the need to match supply and demand on *other* markets; *ii)* transport costs and benefits can display very different distributions across space and time; *iii)* transport costs are very diverse in nature (internal or external, fixed or variable, instantaneous or cumulative, with a local or global impact, etc.); *iv)* transport infrastructures typically have long lifetimes, and can therefore be either the victims or the cause of inertia; and *v)* transport infrastructure is a quasi-public good (in the microeconomic sense that, to a certain extent, it exhibits properties of non-rivalry and non-excludability).

On the basis of the results of economic research, we acknowledge that transport systems can be powerful catalysts of economic development, although the linkages between transport and the economic development of nations and their territories are complex.

### Why this look into the French transport system and the issues at stake?

Notwithstanding its effects on other sectors, transport can also be considered as an industry in its own right, with stakeholders, dynamics, issues and policies of its own. Although, as of 2014, its highest political leaders still thought of France as '*the country of transport*',[1] information on the overall performance of the French transport industry is rather piecemeal, and the issues at stake, at least from the French public policy-making perspective, are usually discussed independently of one another: here the focus is employment, elsewhere

[1] Those were the words of the French President, during his official visit to Brazil in May 2014, as reported by the magazine Challenges. Source: http://www.challenges.fr/economie/20140430.CHA3335/pourquoi-les-patrons-de-total-edf-alstom-airbus-ou-dassault-sont-de-tous-les-voyages-presidentiels.html. [Accessed: 14th October 2014]

environmental impact, on another occasion action against geographical segregation, etc.

The starting point for this chapter, therefore, was the postulate that French policy-makers need to develop a more integrated view of transport issues, a unified grasp of the main direct effects, both positive and negative, of transport activities on the French economy and society and on the environment. We acknowledge that the issues at stake are complex and require a holistic, level-headed approach. The main objective of this chapter is to provide insight into the context of transport-related issues in France, so that our research on corporate car fleets is placed in appropriate perspective.

As we gradually progressed in our search for relevant data and documents, it became clear that this chapter was particularly crucial to our argument in that very little had been written in English about the French perspective on public policy-making in the field of transport. Indeed, very few of the French strategic documents on transport, let alone policies or laws, were translated into 'the language of Shakespeare'[2] – with a few exceptions, such as some rare executive summaries of official reports. The same held for most research papers on transport challenges and policies in France. This observation strengthened our resolve to start this dissertation with brief background information on the wider issues at stake in the sphere of transport in France.

### 1.1.2 Method and data

This chapter reviews the main transport-related issues from a French policy-making standpoint. We use a descriptive approach to provide some practical insights into: *i)* the major contributions of transport-related activities to the economy, *ii)* the massive challenges posed by the negative impacts of transport on the economy and society, and on the environment, *iii)* the increasingly strained funding conditions for transport infrastructure and public transport services, and *iv)* France's innovation-based strategy for a more sustainable transport system.

The geographical focus of our analysis is on France, but we extend it to Europe when this is relevant for purposes of benchmarking, or to put national policies in the context of the European legislative framework.

When considering the transport industry, we include in our analysis the widest possible range of activities, from the manufacturing of transport equipment, through to the operation of transport services. However, we were sometimes limited in our ability to isolate from their 'original' sectors the data concerning such transport-related activities as the supply of transport

[2] A French circumlocution, here loosely translated, used to refer to the English language.

infrastructure (from the 'construction' sector), or the supply of insurance services for transport activities (from the 'financial services' sector). Therefore, we adjusted the scope of activities covered in our analysis depending on the type and depth of available data.

The main data we use for our analysis are: *i)* transport-specific data sets from the national transport database (SOeS sources), *ii)* additional transport-related macroeconomic data sets from the national statistics database (INSEE sources), and *iii)* emission data sets from the national emissions inventory database (CITEPA sources). When insights for Europe are considered a relevant benchmark, we refer to data sets from Eurostat sources.

We endeavour to provide the most recent data available at the time of writing on every topic of interest. We include references to prior years or decades when we deem them relevant to the discussion of recent developments and trends.

Basic information on the national policy framework is provided to help understand the recent developments and trends observed in the transport industry and their effects on the French economy and society. Additional information is given on the European legislative framework when it provides useful context.

### 1.1.3 Outline of the chapter

The chapter is structured into four main parts and a conclusion. First, we review the significant contributions of transport-related activities to the French economy, with a twofold focus on output and employment (Section 1.2). Second, we run through the massive challenges posed by the negative impacts of transport on the French economy and society, and on the environment, including: the effects of oil dependency on the national trade balance, the negative effects of transport emissions on human health and the environment, the heavy toll of transport accidents on human lives, and the societal costs of congestion (Section 1.3). Third, we provide some insights into the increasingly strained funding conditions for transport infrastructure and public transport servicesservices (Section 1.4). Then, we describe France's innovation-based strategy for a more sustainable transport system (Section 1.5). The final section (1.6) contains a number of concluding remarks.

## 1.2 Transport-related activities in the economy

#### The scope of our analysis

There are numerous perspectives from which to look at the components of a transport system, each of which can be more or less relevant depending on the objective of the analysis. One can look at the transport system from a spatial development and planning perspective (distinguishing between urban, interurban and rural transport), from a governance perspective (distinguishing between public and private transport), from an end-use perspective (distinguishing between passenger and freight transport), from a technical perspective (distinguishing between transport modes, such as road, rail, air and waterways), or finally from a production perspective (distinguishing between individual and collective transport).

Instead, given that our objective is to reflect the overall contribution of transport to the French economy, we choose here to look at the transport system from an *economic activity* perspective and include the widest possible range of transport-related manufacturing and service activities within the scope of our analysis, subject to data availability. This approach will help us show the contributions of transport activities to the French economy from a macroscopic standpoint, with a twofold focus on: *i)* output, and *ii)* jobs.

According to NAF, France's classification of economic activities, revised in 2008 (INSEE, 2008a; SOeS, 2013a), the transport and storage activity sector (section H of NAF-2008, activity codes from 49 to 53) includes all activities relating to transport services, scheduled or unscheduled, for passengers and/or freight, by rail, road, pipelines, waterways or air, together with ancillary activities such as the operation of transport infrastructure, freight handling, storage, etc. It includes such activities as the rent of transport equipment *with* a driver (e.g. taxis) or operator, as well as postal and mail services. It does not, however, include such activities as the construction, maintenance and repair of roads, railways, ports and airfields, the trade and repair of motor vehicles and motorcycles, the repair and conversion of transport equipment other than motor vehicles, or the rent of transport equipment *without* a driver or operator (e.g. car rental).

Therefore, on top of the activities listed in section H of NAF-2008, we include in our scope the following manufacturing activities: *i)* automotive manufacturing (activity code 29), and *ii)* manufacturing of other transport equipment (activity code 30); as well as the following service activities: *iii)* wholesale and retail trade and repair of motor vehicles and motorcycles (activity code 45). The construction, maintenance and repair of roads, railways, ports and airfields (activity code 42) are activities that have been excluded from the scope of our analysis for lack of available data sets from the online national statistics database (INSEE website). In addition, the repair and conversion of transport equipment other than motor vehicles and motorcycles on the one hand, and the rent of transport equipment *without* a driver or operator on the other hand, are activities that have been excluded from the scope of our analysis because the related data sets in the national statistics database aggregate these transport-related activities with others that clearly fall outside the scope of this discussion (e.g. the rent of transport equipment *without* a driver or operator is aggregated with office machinery and computer rental activities under activity code 77). For similar reasons of data availability, we leave out of the scope of our analysis certain activities that would naturally be considered as an integral part of the transport system, such as: travel agents (their activity depends as much on the hotel sector as it does on the transport and storage sector), fuel distribution and retail, or motor vehicle insurance.

To avoid any ambiguity regarding the data presented in this section, we hereafter refer to the 'transport and storage sector' when dealing only with activities included in section H of NAF-2008, and to the 'transport industry' when both the manufacture of automotive and other transport equipment, and the trade and repair of motor vehicles and motorcycles, are included.

### 1.2.1 A major sector for national output

As illustrated in Table 1.1, according to French national statistics, the transport industry accounted for nearly *10% of national output* in France in 2011 (312 billion EUR, in constant 2005 Euros): 117 billion EUR in manufacturing activities (close to 14% of France's total manufacturing output), and 195 billion EUR in services. This ratio was only down 0.5 percentage point on its 2000 level, indicating transport's fairly steady contribution to France's overall national output despite the economic and financial crisis of 2008 (INSEE, 2013a). Manufacturing activities still accounted for 38% of the transport industry's output in 2011 (down from just 39% in 2000), while service activities made up the remaining 62% (up from 61% in 2000). The fall in output from automotive manufacturing activities over the period 2000-2011 (-14.6 billion EUR) was more than offset by the increase in the output from the other transport equipment manufacturing activities over the same period (+20 billion EUR).

Focusing on the transport and storage sector *stricto sensu* (i.e. section H in NAF-2008), SOeS gives the following breakdown for its output value in 2011: 26% stemmed from passenger transport services (including urban, interurban and international, including road and other land transport, air transport, inland waterways and maritime transport), and another 36% from freight transport services (*idem*). The remaining 37% of the output of the transport and storage sector came from other services, such as mail and postal services, handling and storage, and other supporting services. (SOeS, 2013a)

| Transport activties by activity branch | National output (EUR 2005, millions - *as a % of total)* | | | |
|---|---|---|---|---|
| | 2000 | | 2011 | |
| **Manufacturing** | **111,586** | ***3.9%*** | **116,930** | ***3.6%*** |
| Automotive | 73,356 | *2.6%* | 58,705 | *1.8%* |
| Other transport equipment | 38,230 | *1.3%* | 58,225 | *1.8%* |
| **Services** [(1)] | **175,739** | ***6.2%*** | **194,580** | ***6.0%*** |
| Motor veh. trade & repair [(2)] | 32,126 | *1.1%* | 33,913 | *1.0%* |
| Land and pipeline transport | 64,434 | *2.3%* | 73,497 | *2.3%* |
| Waterways transport | 8,109 | *0.3%* | 11,437 | *0.4%* |
| Air transport | 16,170 | *0.6%* | 16,329 | *0.5%* |
| Storage & supporting services | 41,445 | *1.5%* | 47,732 | *1.5%* |
| Postal & mail services | 13,455 | *0.5%* | 11,672 | *0.4%* |
| **Transport total** | **287,325** | ***10.1%*** | **311,510** | ***9.6%*** |

*Notes: 1. Travel agents, tour operators, reservation services, and related activities are not included here because their activities are as much related to the transport industry as they are to the hotel industry. They produced 6,080 million euros in 2000 (0.2% of national production) and 6,882 million euros in 2011 (0.2% of national production). 2. Including wholesale and retail trade, as well as repair, of motor vehicles and motorcycles.*

**Table 1.1: Contribution of the transport industry to French national output (INSEE, 2013a)**

| Services in the transport and storage sector [(1)] | Output in 2011 | |
|---|---|---|
| | in current EUR, millions | *as a % of total production in the sector* |
| Passenger transport | 47,370 | *26%* |
| Freight transport [(2)] | 64,942 | *36%* |
| Other services [(3)] | 67,046 | *37%* |
| *incl. Mail & postal serv.* | *12,940* | *7%* |
| **All transport services** | **179,358** | ***100%*** |

*Notes: 1. Including all activities under section H of NAF-2008, but excluding trade and repair of motor vehicles and motorcycles. 2. Including parcel delivery and express freight. 3. Including mail and postal services, handling and storage services, other supporting services, etc.*

**Table 1.2: Output of passenger and freight transport services in 2011 (SOeS, 2013a)**

Table 1.3 displays the number of companies in the transport and storage sector (section H of NAF-2008) in 2011. It shows that both passenger transport and freight transport (respectively 37,833 and 41,067 companies in 2011) are rather diffuse activities. For instance, among passenger transport activities, taxis alone accounted for 31,682 companies in 2011, 35% of the total number of companies in the sector (SOeS, 2013e). It can be inferred, however, that the remaining 6,151 companies involved in passenger transport (including all urban and interurban transport operators) are more concentrated than the taxi industry. Freight transport activities are likely to present the same type of 'dichotomy' between very small enterprises and much bigger players.

Linking these statistics with those presented in Table 1.2, we can compute indicative values for the average annual turnover of companies in the transport and storage sector: around 1.3 million EUR for companies with a passenger transport activity, and around 1.6 million EUR for companies with a freight transport activity. In both cases, such annual turnover fits the official definition of a micro-enterprise.[3] It is, however, likely that the output value of the sector would be unevenly distributed among companies involved in these fields of activity.

| Services in the transport and storage sector (1) | Number of companies on January 1, 2011 | |
|---|---|---|
| | units | *as a % of total units in the sector* |
| Passenger transport | 37,833 | *42%* |
| *incl. Taxis* | *31,682* | *35%* |
| Freight transport (2) | 41,067 | *45%* |
| Other services (3) | 11,856 | *13%* |
| **All transport services** | **90,756** | ***100%*** |

*Notes: 1. Including all activities under section H of NAF-2008, but excluding trade and repair of motor vehicles and motorcycles. 2. Including parcel delivery and express freight. 3. Including mail and postal services, handling and storage services, other supporting services, etc.*

**Table 1.3: Number of companies in passenger and freight transport services in 2011 (SOeS, 2013e)**

[3] According to French national statistics, micro-enterprises are businesses employing fewer than 10 people, and with an annual turnover or a total balance sheet which does not exceed 2 million EUR (Source: http://www.insee.fr/en/methodes/default.asp?page=definitions/microentreprise.htm).

## 1.2.2 A significant employment sector

Following these initial insights into the transport industry's contribution to the French economy, we can further observe that this industry has been one of the main employment sectors over the last fifty years. Table 1.4 shows that the respective situations of wage employment in transport manufacturing activities on the one hand, and in transport service activities on the other hand, have followed very different paths since 1970 (end of the thirty-year boom that followed the Second World War in France). Because of discontinued data sets from 1990 onwards, self-employment could not be included in our analysis of the employment situation in the transport industry.

In keeping with the progressive deindustrialisation France experienced over that period,[4] automotive manufacturing industries lost 80,000 jobs in the 20 years from 1990 to 2010 (approximately 4,000 per year), and were still losing jobs in 2013. Industries manufacturing other transport equipment (such as aircraft, trains, etc.) shed 40,000 jobs over the same two decades (2,000 per year), although they started to recoup jobs after 2010. Altogether, wage employment in the transport manufacturing industries decreased from 2.6% of total national jobs in 1970, to just 1.4% in 2010. (INSEE, 2014a and 2014b)

Looking now at transport service activities, the employment situation has evolved very differently indeed. The transport and storage sector (section H of NAF-2008) gained 363,000 jobs in the 40 years from 1970 to 2010 (a little over 9,000 jobs per year). Most of this increase occurred before 2000, with this sector growing from 4.6% of total jobs in France in 1970 to 5.3% in 2000. The following decade however saw less dynamic growth, and the share of national jobs in the transport and storage sector seems to have stabilised at a little over 5%. (INSEE, 2014a)

Services that fall within the definition of 'wholesale and retail trade and repair of motor vehicles and motorcycles' (activity code 45.20 under NAF-2008) gained 100,000 jobs from 1970 to 2000 (approximately 3,300 jobs a year), before levelling off in 2002-2003 (397,000 jobs) and losing 34,000 jobs in the next 10 years. (INSEE, 2007 and 2014b)

Altogether, the transport industry provided 8.0% of total wage employment in France in 2010: 0.9% in automotive manufacturing, 0.5% in manufacturing of other transport equipment, 1.4% in wholesale and retail trade and repair of motor vehicles, and 5.1% in the transport and storage sector.

[4] Between 1980 and 2007, employment in the manufacturing industries in France declined by 1.9 million jobs (36% of their total in 1980), or by approximately 71,000 jobs per year. (Demmou, 2010)

According to Eurostat sources, EU-27 gave very similar statistics for transport employment in 2010, with a total of 8.7% of jobs either in manufacturing of motor vehicles and other transport equipment (1.8%), or in wholesale and retail trade and repair of motor vehicles (another 1.8%), or in the transport and storage sector (5.1% overall: 3.0% in transport services, 1.3% in warehousing and support activities for transport, 0.8% in postal and courier activities).

When we look at the restricted perimeter of the transport and storage sector in France (see Table 1.5), we observe that land transport provided 55% of the total headcount in the sector in 2011 (740,000 jobs out of 1,352,000), split equally between passenger transport services on the one hand (28% of total), and freight transport services on the other (27% of total). Inland waterways, maritime transport and air transport together made up less than 7% of total jobs in the sector, while storage and support services were close to 20%, as were postal and mail services. (SOeS, 2013e)

The following statistics further illustrate transport's contribution to the national economy from the employment perspective: passenger and freight transport services, exclusive of storage and supporting services and exclusive of postal and mail services, generated 63 billion EUR in gross remunerations in 2011, 83% of which in land transport (56% for road, 15% for railways, and 12% in urban public transport and scheduled coaches), 12% in air transport, and 5% in inland waterways and maritime transport. (SOeS, 2013a)

To conclude our comments on the contribution of the transport industry to the economy from both the output and the employment perspectives, we can compare the figures in Tables 1.1 and 1.4 and note that the share of transport in national employment is smaller than its share in national output. This observation holds for the whole transport industry and for each of its subsectors as well, with the notable exception of motor vehicle trade and repair services (they make up around 1% of national production and around 1.5% of national employment). This is in line with the observations made by Redding and Turner (2014) for the USA,[5] and by the European Commission for the EU:[6] labour productivity (as measured by the ratio of output value to employee headcount) for virtually all the activities in the transport industry, be they manufacturing or services, is above average.

[5] Redding and Turner (2014) base their analysis on the for-hire transportation sector in the USA.

[6] See: http://ec.europa.eu/transport/strategies/facts-and-figures/transport-matters/index_en.htm.

| Activity branch | Wage employment (1) (2) on Dec. 31 (000) | | | | | |
|---|---|---|---|---|---|---|
| | 1970 | 1980 | 1990 | 2000 | 2010 | 2013 |
| **Manufacturing** (3) | | | | | | |
| Automotive | 558 | 614 | 309 | 293 | 229 | 211 |
| Other transport equipment | | | 172 | 137 | 132 | 147 |
| **Services** (4) | | | | | | |
| Motor veh. trade & repair (5) (6) | 281 | 328 | 340 | 381 | 378 | 363 |
| Transport and storage - all (7) | 985 | 1,104 | 1,186 | 1,339 | 1,349 | 1,345 |
| **Transport industry total** | **1,825** | **2,046** | **2,007** | **2,150** | **2,089** | **2,066** |
| ***as a % of all jobs in France*** (8) (9) | ***8.5%*** | ***9.0%*** | ***8.6%*** | ***8.6%*** | ***8.0%*** | ***n.a.*** |

*Notes: 1. Data are for metropolitan France only: French Overseas Departments are not included. 2. Self-employment in the considered activity branches represented between 140,000 and 150,000 in 1970, 1980 and 1990 (INSEE, 2007). Due to discontinued data series after 1990, self-employment could not be included in the total for transport employment. 3. Sources: INSEE (2014a) for 1970 and 1980; INSEE (2014b) for 1990 onwards. 4. Including trade and repair activities for vehicle motors (activity code 45.20 under NAF-2008), as well as transport and storage services (section H of NAF-2008, activoty codes 49 to 53). 5. Including wholesale and retail trade, as well as repair and maintenance, of motor vehicles and motorcycles. 6. Sources: INSEE (2007) for 1970 and 1980; INSEE (2014b) for 1990 onwards. 7. Source: INSEE (2014a). 8. Including wage employment as well as self-employment. 9. Source: INSEE (2014c) for total employment in France.*

**Table 1.4: Wage employment in the transport industry (INSEE)**

| Services in the transport and storage sector (1) | Wage employment on December 31, 2011 | |
|---|---|---|
| | 000 units | *as a % of total headcount in the sector* |
| Land and pipeline transport | 740 | *55%* |
| *incl. Passeng. transport* | *381* | *28%* |
| *incl. Freight transport* | *360* | *27%* |
| Waterways transport | 17 | *1%* |
| Air transport | 71 | *5%* |
| Storage & supporting services | 261 | *19%* |
| Postal & mail services | 263 | *19%* |
| **All transport services** | **1,352** | ***100%*** |

*Note: 1. Including all activities under section H of NAF-2008, but excluding trade and repair of motor vehicles and motorcycles.*

**Table 1.5: Wage employment in the transport and storage sector (SOeS, 2013e)**

## 1.3 Monitoring the negative impacts of mobility

Notwithstanding the significant positive contributions of the transport industry to the French economy, we consider that the overall sustainability of the French transport system should be examined. The European Union's 2006 renewed sustainable development strategy defines a sustainable transport system as one that '*meets society's economic, social and environmental needs whilst minimising its undesirable impacts on the economy, society and the environment*' (European Council, 2006, p. 10).

Our purpose here is not to discuss the challenges of, and academic debates about, the methods used to evaluate the costs associated with transport 'externalities' (also known as the 'external costs' of transport[7]). For in-depth discussions of these methods and associated issues, we refer our reader to the rich literature dealing with the topic: *i)* from a welfare economics research perspective (see, for instance: Verhoef, 1994; Lakshmanan *et al.*, 2001; Schipper *et al.*, 2001; Kopp and Prud'homme, 2007; Parry *et al.*, 2007; Proost, 2011; Lakshmanan, 2011; Quinet, 2013); and *ii)* from an operational policy-making perspective (see, for instance, the policy recommendations based on meta-analyses of third-party studies and research into public investment cost-benefit analyses and transport project appraisal, by: CGP, 2001; CE Delft, 2008; CGSP, 2013a and 2013b; Ricardo-AEA, 2014).

Instead, we focus on the five major sources of external transport costs as identified in recent research on transport externalities in Europe and the USA (Friedrich and Quinet, 2011; Delucchi and McCubbin, 2011) – namely: oil dependency, emissions of local pollutants, emissions of greenhouse gases, accidents and congestion[8] – and we offer some practical insights into the massive challenges posed to French public policy-makers by transport's '*undesirable impacts on the economy, society and the environment*' (European Council, 2006).

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[7] Proost (2011).

[8] Noise emissions have not been included in this analysis because their effects on human health are complex, very dependent on site location, and still not precisely assessed. For further insights into the effects of noise emissions on human health, see: WHO (2011), and ANSES (2012).

### 1.3.1 Massive fuel consumption that burdens the trade balance

After following an upward trend from 1985 to 2002 (+2.4% per year on average), final energy use by the transport sector in France has been slowly decreasing ever since (-0.1% per year on average from 2003 to 2012). (SOeS, 2013i)

The transport sector was responsible for a stable 29.6% share of total final energy consumption in France in 2010, 2011 and 2012, up from 17.9% in 1973 and 26.6% in 1990 (SOeS, 2013a). Over the long term, its share of final consumption of oil products for energy purposes has increased mechanically in parallel with the decrease in the use of oil products in other activities (whether agricultural, industrial, tertiary or residential): it was approximately 70% in 2012, as compared with about 50% in 1990 (SOeS, 2013a).

**The reign of oil, the diesel takeover**

As illustrated in Table 1.6, the energy mix in the transport sector has remained *heavily dominated by oil*, which still constituted 93% of final energy use in the sector in 2011 (as compared with 98% in 1990).[9] Renewable energies – mainly biofuels – emerged as an alternative source of energy for the sector following the European regulations that set mandatory targets for their use in transport (for the record: 10% by 2020 in all European Member States).[10] Yet, they were still a minority in the sector's energy mix in 2011, with a 5% share. Moreover, it appears that enhanced targets for the use of renewable sources of energy in transport are unlikely to be introduced before an agreement is reached among European regulatory bodies to tighten sustainability criteria for biofuels.[11] Beyond biofuels, the hopes for energy diversification in the transport sector rest on electricity and natural gas. Although on a rising trend, use of these two energy sources was still minimal in 2011 (respectively 2.0% and 0.2% of final national energy use in the sector). (SOeS, 2013i)

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[9] The transport sector's heavy dependency on oil is not specific to France. Refined petroleum products represent the same proportion of final energy demand in transport at EU level: 93% (EC, 2013b).

[10] EC (2009a), Art.3-4: '*Each Member State shall ensure that the share of energy from renewable sources in all forms of transport in 2020 is at least 10% of the final consumption of energy in transport in that Member State.*'

[11] EC (2012b).

| Final energy type | Transport final energy use (in million toe - *as a % of total*) | | | |
|---|---|---|---|---|
| | 1990 | | 2011 | |
| Oil | 40.1 | *98 %* | 46.0 | *93 %* |
| Renewables (1) | 0.0 | *0%* | 2.4 | *5 %* |
| Electricity | 0.7 | *2 %* | 1.0 | *2 %* |
| Gas | 0.0 | *0%* | 0.1 | *0%* |
| **All energy types** | **40.8** | ***100 %*** | **49.6** | ***100 %*** |
| ***as a % of total energy use*** | ***26.6%*** | | ***29.6%*** | |

*toe: tonne of oil equivalent*
*Note: 1. Mainly biofuels; the percentage of biofuels in blends has been stable from 2010 to 2012: 7% for diesel, 5.65% for petrol. (Source: SOeS, 2013i)*

**Table 1.6: Final energy use in transport (SOeS, 2013i)**

Table 1.7 highlights the relative proportions of the different transport activities in the sector's total energy use for traction purposes. Passenger cars consumed 45.9% (23.41 million tonnes of oil equivalent – toe) of transport's total traction energy in France in 2011. Freight road transport was responsible for another 30.3% (15.45 million toe). (SOeS, 2013a)

Looking at the trends over two decades, we observe that traction energy use by public transport increased by 36% (or 7.11 million toe) from 1990 to 2011, with air transport, urban passenger transport and passenger road transport (coaches) recording the highest growth rates (respectively 71%, 61% and 47% over the period), while freight road transport alone was responsible for half of the overall increase (+30% or +3.6 million toe). Comparatively, individual transport recorded much slower growth (+10% or +2.09 million toe from 1990 to 2011), with motorcycles recording a noteworthy 174% increase (0.33 million toe), while passenger cars still made up 85% of the overall increase in absolute terms (1.77 million toe). (SOeS, 2013a)

Besides the significant amounts of energy involved, and the rate at which they are growing, another interesting feature is the progressive *loss in energy diversity* that transport has experienced in recent decades, with diesel capturing an increasing share in both public and individual transport. The only two transport segments in which diesel has been losing ground to other energy sources are: *i)* railways (electricity reached 80% of the traction energy in this segment in 2011); and *ii)* urban passenger transport (the contribution of natural gas rose from 0% to 18% of the traction energy in this segment between 1990 and 2011). In all other transport segments, diesel has been rapidly reinforcing its market position as an energy source for traction in transport. The shift has been particularly spectacular in the road freight transport segment, where diesel represented 98% of the traction energy in 2011, up from 86% in 1990 (following a twofold increase in diesel use by the light commercial vehicle fleet,[12] from 3.23 million toe to 6.80 million toe), and above all in the passenger car segment, where diesel accounted for 69% of the traction energy used in 2011, up from 20% in 1990 (following an almost fourfold increase in diesel use by passenger cars, from 4.40 million toe to 16.04 million toe, in a little more than 20 years).[13] (SOeS, 2013a)

Thus, the recent trends in transport energy demand in France can be summarised as follows: *i)* a burdensome dependency on oil (though slightly decreasing, due to the introduction of biofuels); *ii)* a loss in energy diversity following the massive shift to diesel in most road transport segments.

**The effects of oil dependency on the national trade balance**

Drawing on the analyses provided by the French Directorate General of Customs and Excise (DGDDI, 2012), we can highlight two mechanisms by which massive fuel consumption in the transport sector in France has increasingly contributed to the national trade deficit in recent years. Firstly, a *price* effect is at work that has led to sharp increases in the value of crude oil and refined oil products imports: between 2002 and 2010, the national trade deficit increased by EUR 11.1 billion because of crude oil (although import volumes fell by 15.9 million toe), and by EUR 7.2 billion because of refined oil products (with import volumes increasing by 8.4 million toe while export volumes increased by 3.7 million toe). Secondly, an effect of *supply-demand mismatch* is at work as far as refined oil products are concerned. Indeed, with the rising share of diesel in new passenger-car sales in France (73% of the market in 2012, as compared with 19% in 1990), the demand for diesel had increased to 79% of the total on-road fuel consumption in 2012 (SOeS, 2013d and 2013i). Due to rather inelastic refinery processes, this significant increase in the demand for diesel mechanically led to a rise in diesel imports (CFE, 2014a).[14]

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[12] Commercial vehicles with an Authorised Gross Weight under 3.5 tonnes (see Chapter 3 for detailed definitions and classifications of vehicles).

[13] Chapter 7 offers a historical perspective on preferential tax treatment of diesel over petrol through excise taxation, and on its influence on the share of diesel drivetrains in new vehicle sales in France.

[14] There can be only slight differences in the amounts of diesel and petrol products that can be refined from 1 tonne of crude oil, from one refining process to another. If the demand for the two fuels is not balanced in the same proportions as the refining process allows, the refinery throughput cannot meet the excess in demand for one fuel compared to the other.

The trade deficit for diesel alone in France reached EUR 8.9 billion in 2010, thus contributing more than 17% to the country's total trade deficit (DGDDI, 2012). Altogether, the trade deficit for oil products (70% of which are used for transport purposes) amounted to EUR 54.7 billion in 2012, which made up 80% of France's energy trade deficit in 2012 or 2.7% of national GDP that same year. The energy trade deficit had not impacted so heavily on the national trade balance since the time of the second oil shock in the 1980s (SOeS, 2013i).

| Transport sector segment | Traction energy use (1) (in million toe) | |
|---|---|---|
| | 1990 | 2011 |
| **Public transport services** | **19.98** | **27.09** |
| Railways - SNCF | 0.9 | 0.83 |
| *Share of diesel* | *41%* | *20%* |
| Freight road transport | 11.85 | 15.45 |
| *Share of diesel* | *86%* | *98%* |
| Passenger road transport | 0.43 | 0.63 |
| *Share of diesel* | *100%* | *100%* |
| Passenger urban transport | 0.28 | 0.45 |
| *Share of diesel* | *71%* | *62%* |
| Waterways transport (2) | 2.54 | 2.94 |
| *Share of diesel (3)* | *n.a.* | *90%* |
| Air transport (4) | 3.95 | 6.77 |
| **Individual transports** | **21.84** | **23.93** |
| 2-wheelers | 0.19 | 0.52 |
| Passenger cars (5) | 21.64 | 23.41 |
| *Share of diesel* | *20%* | *69%* |
| **All transports** | **41.82** | **51.02** |
| ***Share of diesel*** | ***43%*** | ***68%*** |

*toe: tonne of oil equivalent; SNCF: Société Nationale des Chemins de fer Français (French national railway company)*

*Notes: 1. The scope for traction energy data differs from the scope for final energy use data (international marine and aviation bunkers are included; parts of the energy use of the transport system are excluded; ...). 2. Data for recreational boating (petrol) were not available for 1990; they repsented 0.29 million toe in 2011. 3. Including heavy fuel oil for maritime transport. 4. Including aviation jet fuel (kerosene) and aviation petrol; no diesel. 5. Including taxis and foreign light commercial vehicles.*

**Table 1.7: Traction energy use by segment of the transport sector (SOeS, 2013a)**

### 1.3.2 A major source of local and global emission

Besides the concerns about energy security, and the associated economic burden on the national trade balance, caused by the dependence on foreign oil, the transport sector also stands out for its significant negative effects on human health and the environment, whether on a local or global scale.

As we will show later, public policies targeting the transport sector for its negative effects on the environment usually address either local effects (air pollution, biodiversity, etc.) or global effects (climate changes induced by the greenhouse effect), but hardly ever take a coordinated approach to the two scales of impact. Yet some of the local air pollutants emitted by transport are acknowledged to contribute directly or indirectly to the greenhouse effect (e.g. nitrogen oxides, carbon monoxide, or non-methane volatile organic compounds) (IPCC, 2013: p.174). Reciprocally, climate changes induced by the emission of greenhouse gases from human activities are likely to result in local feedback loops, although the overall direction of air pollution response to climate changes is uncertain (positive or negative) because of competing effects (IPCC, 2013: p.999-1000; EEA, 2012: p.36-39).

Table 1.8 inventories the most significant contributions by transport to total emissions of local air pollutants and greenhouse gases in France in 2011. While bearing in mind the above-mentioned interactions between the local and the global effects of transport, we focus in this section on the main cause for concern usually associated with each category of emission.

| Emission category (1) | Transport emissions 1990 | | Transport emissions 2011 | | Main sources of emission in transport in 2011 (2) |
|---|---|---|---|---|---|
| **Emissions with a role in acidification, eutrophication and photochemical pollution (000 tonnes - *as a % of total*)** | | | | | |
| NOx | 1,201 | *65%* | 612 | *61%* | Diesel LGVs (23%), diesel pass. cars (20%), diesel LCVs (9%) |
| NMVOC | 1,143 | *44%* | 130 | *18%* | Inland nav. (5%), petrol pass. cars (5%), 2-wheelers (3%) |
| CO | 6,615 | *60%* | 685 | *19%* | Petrol pass. cars (7%), inland nav. (4%), 2-wheelers (3%) |
| **Greenhouse gases (000 tonnes $CO_2$ eq. - *as a % of total*)** | | | | | |
| $CO_2$ (3) | 118,000 | *30%* | 127,000 | *36%* | Diesel pass. cars (14%), diesel LGVs (8%), diesel LCVs (6%) |
| HFC | 0 | *0%* | 3,716 | *24%* | Diesel pass. cars (7%), diesel LGVs (5%), domestic air tr. (6%) |
| GWP (4) | 119 | *22%* | 132 | *28%* | Diesel pass. cars (10%), diesel LGVs (6%), diesel LCVs (4%) |
| **Heavy metals (tonnes - *as a % of total*)** | | | | | |
| As | 1.0 | *6%* | 1.3 | *21%* | Diesel pass.cars (8%), dies. LGVs (5%), petrol pass.cars (3%) |
| Cd | 0.6 | *3%* | 0.4 | *18%* | Diesel pass.cars (8%), petrol pass.cars (3%), dies. LCVs (3%) |
| Cu | 175 | *74%* | 208 | *92%* | Diesel pass. cars (28%), rail transp. (24%), diesel LGVs (14%) |
| Pb | 3,962 | *92%* | 65 | *50%* | Diesel pass. cars (23%), dies. LCVs (10%), petr. pass.cars (9%) |
| Zn | 277 | *13%* | 281 | *64%* | Diesel pass. cars (30%), dies. LCVs (12%), petr. pass. cars (11%) |
| **Persistent Organic Pollutants (tonnes - *as a % of total*)** | | | | | |
| PAH | 3.1 | *8%* | 5.8 | *30%* | Diesel pass. cars (20%), diesel LCVs (6%), diesel LGVs (3%) |
| HCB | 3.6 | *0%* | 9.1 | *58%* | Diesel pass. cars (41%), diesel LCVs (12%), diesel LGVs (4%) |
| **Suspended particulate matter (000 tonnes - *as a % of total*)** | | | | | |
| $PM_{10}$ | 77 | *14%* | 45 | *17%* | Diesel pass. cars (8%), diesel LCVs (3%), diesel LGVs (2%) |
| $PM_{2.5}$ | 69 | *17%* | 36 | *21%* | Diesel pass. cars (10%), diesel LCVs (5%), diesel LGVs (2%) |
| $PM_{1.0}$ | 55 | *16%* | 25 | *19%* | Diesel pass. cars (11%), diesel LCVs (6%), diesel LGVs (1%) |

*NOx: Nitrogen Oxide; NMVOC: Non-Methane Volatile Organic Compound; CO: Carbone monoxide; $CO_2$: Carbone dioxide; HFC: HydroFluoroCarbon; GWP: Global Warming Potential; As: Arsenic; Cd: Cadmium; Cu: Copper; Pb: Lead; Zn: Zinc; PAH: Polycyclic Aromatic Hydrocarbon; HCB: Hexachlorobenzene; PM: Particulate Matter; LCV: Light Commercial Vehicle; LGV: Large Goods Vehicle*

*Notes: 1. Emissions presented here are those for which transport contributed 10% of more in 2011. 2. The three most significant emission sources are listed for each emission category. 3. $CO_2$ emissions do not include emission from the LULUCF sector (land use, land-use change and forestry). 4. The Global Warming Potential provides a simplified, aggregated assessment of the potential future impacts of greenhouse gases upon the climate system.*

**Table 1.8: Air pollutants and greenhouse gas emissions from transport (CITEPA, 2013)**

**Local pollutants and their complex impacts**

On the basis of the work of WHO (2013 and 2014), EEA (2012 and 2013) and CITEPA (2012 and 2013), we note the following facts about emissions that are primarily (but not exclusively) monitored for their local effects on human health and the environment, and for which transport ranks among the main emitters in France:

1) *Nitrogen oxides (NOx)*: They act as precursors for tropospheric ozone (i.e. ozone at ground level), with effects on health (irritation of the respiratory system, aggravation of asthma, reduced lung function, etc.) and on the environment (indirect greenhouse gas effect). 61% of total NOx emissions in France in 2011 derived from transport sources. The role of transport in the emission of other pollutants with similar effects (such as Non-Methane Volatile Organic Compounds, NMVOCs, or Carbon monoxide, CO) considerably decreased during the 1990s and 2000s, both in absolute terms (almost by a factor of 10) and in relative terms. This was at least partly the result of the introduction of catalytic converters, which were increasingly used in automobiles, trucks, buses and motorcycles from the 1990s onwards.
2) *Heavy metals:* They can enter plant, animal and human tissues via air inhalation (but also via diet or direct contact), and have various detrimental effects. Arsenic emissions (e.g. from road wear or from abrasion of tyres and brakes) are associated with higher risks of diabetes and cancer. Cadmium emissions (also from road wear and abrasion of tyres and brakes, as well as from the partial combustion of engine oils) are associated with higher risks of lung, bones and kidney deficiencies. Copper emissions (mainly from brake wear in road transport, or from catenary wear in rail transport) can induce respiratory irritation and gastrointestinal disorders. Lead emissions (which significantly decreased following the ban on leaded petrol from 1 January 2000[15] but persist as a result of the partial combustion of engine oils and of road, brake and tyre wear) can cause serious gastrointestinal, neuromuscular, and neurological disorders. Zinc emissions (from the partial combustion of engine oils, and from the abrasion of roads, tyres and brakes) have

[15] *Arrêté du 23 décembre 1999 relatif aux caractéristiques du gazole et du gazole grand froid*. Available from: http://www.legifrance.gouv.fr/affichTexte.do?cidTexte=JORFTEXT000000399334&dateTexte=&categorieLien=id.

This government order was adopted by France in accordance with Directive 98/70/EC (EC, 1998b).

limited yet detrimental effects on the gastrointestinal tract and they can trigger copper deficiency. Transport is accountable for a growing share of all of the abovementioned emissions of heavy metals except for lead emissions. In absolute terms however, the only emissions still on an upward trend are those of arsenic and copper (+30% and +18% from 1990 to 2011); zinc emissions are stable; emissions of lead and, to a lesser extent, cadmium, are declining (-98% and -30% from 1990 to 2011).

3) *Persistent organic pollutants (POPs)*: PAH emissions (from fuel combustion) are carcinogenic and mutagenic, and they can impair the immune system. HCB emissions (from fuel combustion) are carcinogenic to humans, and they show high toxicity to aquatic organisms. Transport is accountable for increasing amounts of PAH and HCB emissions (+87% and +152% from 1990 to 2011).
4) *Suspended particulate matter (PM):* Particles with a diameter of 10 microns or less ($PM_{10}$, $PM_{2.5}$, and $PM_{1.0}$) are reported to be the deadliest form of air pollution, for they can penetrate and lodge deep inside the lungs. They are associated with aggravated risks of cardiovascular diseases, respiratory diseases and lung cancer. In France in 2011, transport was accountable for 17%, 21% and 19% of $PM_{10}$, $PM_{2.5}$, and $PM_{1.0}$ emissions respectively. The share of transport in overall PM emissions increased over the period 1990-2011 although emissions decreased in absolute terms (-42%, -48%, and -55% over the period for $PM_{10}$, $PM_{2.5}$, and $PM_{1.0}$ emissions respectively).

As regards PM emissions, analyses by Airparif show that, in an urban environment, transport can be accountable for a much larger share of total $PM_{10}$, $PM_{2.5}$ and $PM_{1.0}$ emissions: respectively 61, 60%, and 64% for the City of Paris in 2010; and respectively 29%, 34%, and 36% for the Paris region that same year. Road transport alone was responsible for 25% of total $PM_{10}$ emissions, 30% of $PM_{2.5}$ emissions, and 34% of $PM_{1.0}$ emissions in the Paris region in 2010. (Airparif, 2013: p. 26)

As regards CO emissions, analyses by Airparif show that transport is accountable for a much larger share of CO emissions in an urban environment than observed at the national level: 89% for the City of Paris, and 58% for the Paris region. (Airparif, 2013: p. 6)

For other local air pollutants however, the differences between densely populated urban areas and national averages are not as significant as they are for particulate matters or carbon monoxide. As an illustration, observations by Airparif show that transport is accountable for 66% of NOx emissions and 28% of NMVOCs emissions in the City of Paris, and for 62% of NOx emissions and 17% of NMVOCs emissions in the Paris region. (Airparif, 2013: p. 6)

### The heavy toll of transport-related air pollution on human health

Diesel engine exhaust and petrol engine exhaust were classified by the World Health Organisation respectively as '*probably carcinogenic to humans*' (Group 2A of WHO classification) and '*possibly carcinogenic to humans*' (Group 2B of WHO classification) following the first evaluation by WHO of the carcinogenicity in humans of engine exhaust in 1989 (WHO, 1989). In 2013, a new evaluation by WHO, which included a wider range of data and studies, resulted in the classification of diesel engine exhaust as '*carcinogenic to humans*' (Group 1 of WHO classification), while petrol engine exhaust remained in Group 2B (WHO, 2013).

Research conducted for the WHO in 1999 (Sommer *et al.*, 1999; Künzli *et al.*, 2000) on the basis of data for Austria, France and Switzerland, found that air pollution by $PM_{10}$ caused 6% of total mortality or more than 40,600 attributable cases in 1996 in these three countries. It further found that about half of all mortality (chronic and acute) caused by air pollution could be attributed to motorised traffic (20,200 deaths), which also accounted for more than 25,000 new cases of chronic bronchitis in adults, more than 290,000 episodes of bronchitis in children, more than 0.5 million asthma attacks, and more than 16 million person-days of restricted activities. For France alone, air pollution caused by motorised traffic was found to be accountable for 17,600 deaths, 20,400 cases of chronic bronchitis in adults, 250,000 episodes of bronchitis in children, 450,000 asthma attacks, and close to 14 million person-days of restricted activities in 1996. On the basis of a willingness-to-pay approach, the health costs of road traffic-related air pollution in France in 1996 were assessed in the range of 11.1 billion EUR to 32.5 billion EUR (with a central estimate of 21.6 billion EUR): 9.6 billion EUR to 22.2 billion EUR (with a central estimate of 15.9 billion EUR) for the costs of mortality, and an additional 1.5 billion EUR to 10.3 billion EUR (with a central estimate of 5.7 billion EUR) for the costs of morbidity. Thus, the per capita health costs due to road traffic-related air pollution in France in 1996 were assessed in the range of 190 EUR to 560 EUR (with a central estimate of 370 EUR)[16].

A recent meta-analysis by AFSSET (2009a) showed that long-term reduction in average PM emissions would bring greater health benefits than strategies aiming to avoid peak PM pollution episodes. Discussing available methodologies

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[16] Considering the per capita health costs due to road traffic-related air pollution, the assessment showed very small differences between the countries, with a range from 180 EUR to 540 EUR for Austria (central value of 360 EUR), 190 EUR to 560 EUR for France (central value of 370 EUR) and 160 EUR to 70 EUR for Switzerland (central value of 304 EUR) (Sommer *et al.*, 1999: p.2).

for assessing the said health benefits, Rabl (2003) suggested that public policies should shift from a focus on short-term studies on the number of deaths attributable to local air pollution to a focus on the long-term assessment of loss of life expectancy. He showed that a permanent reduction in $PM_{10}$ concentrations of 15 μg/m³ would likely increase average life expectancy by about 4.5 months. As a comparison, average $PM_{10}$ concentrations for the roadside agglomeration in the Paris region in 2013 were estimated at 51 μg/m³ (Airparif, 2014), which exceeds by 11 μg/m³ the annual limit set by European regulation[17].

The Aphekom project studied air pollution and its harmful effects on human health in 25 European cities totalling nearly 39 million inhabitants in 12 different countries over 3 years, from 20008 to 2011, with a view to providing new information and tools that would enable decision-makers to set more effective policies to mitigate the effects of air pollution on health (Aphekom, 2011). Combining both impact assessment methodologies (i.e. based on the number of deaths attributable to air pollution and based on loss of life expectancy), the project reached the following conclusions: *i)* a reduction in long-term exposure to $PM_{2.5}$ fine particles down to 10 μg/m³ (in compliance with WHO's annual air-quality guidelines) could increase the life expectancy of persons aged 30 or more by up to 22 months, depending on the city and its average level of $PM_{2.5}$ concentrations; and *ii)* the impact on mortality caused by $PM_{2.5}$ concentrations in excess of WHO air-quality guidelines amounts to nearly 19,000 deaths per annum, more than 15,000 of which are caused by cardiovascular diseases.

Achievable average gains in life expectancy were assessed for nine French cities included in the project.[18] They amounted to 3.6 months for the city of Toulouse (down from an observed average annual level of $PM_{2.5}$ of 14.2 μg/m³),

[17] Directive 2008/50/EC on ambient air quality and cleaner air for Europe requires Member States to limit the exposure of citizens to the tiny particles known as $PM_{10}$. The legislation sets limit values for exposure covering both an annual concentration value (40 μg/m³), and a daily concentration value (50 μg/m³) that must not be exceeded more than 35 times in a calendar year (EC, 2008a). In 2011, the European Commission decided to take France to the EU Court of Justice on the grounds of repeated exceedances of limit values in 15 air quality zones (EC, 2011a). See Annex A for further information on the European legislative framework for action against local air pollution caused by motor vehicles.

[18] Average gains in life expectancy are calculated for adults aged 30 years or more, and for a reduction in average annual levels of $PM_{2.5}$ down to 10 μg/m³.

4.2 months for the city of Le Havre (14.5 µg/m³), 4.6 months for the city of Rouen (15.3 µg/m³), 5.0 months for the city of Bordeaux (15.7 µg/m³), 5.7 months for the city of Lyon (16.5 µg/m³); 5.7 months for the city of Strasbourg (16.6 µg/m³), 5.8 months for the city of Paris (16.4 µg/m³), 5.8 months for the city of Lille (16.6 µg/m³), and 7.0 months for the city of Marseille (18.5 µg/m³)).

### Fast-rising greenhouse gas emissions

Transport is also of great concern to public decision-makers because of its contribution to anthropogenic greenhouse gas emissions, and their subsequent role in global climate changes.

Of the various greenhouse gases emitted by human activities,[19] transport is mainly involved in emissions of carbon dioxide ($CO_2$, which is produced as a result of fuel combustion)[20] and of hydro-fluorocarbons (HFCs, one of the three groups of fluorinated gases covered under the Kyoto Protocol, which are commonly used as refrigerants in refrigeration, air-conditioning and heat pump equipment, as blowing agents for foams, as solvents, and in fire extinguishers and aerosols).

As illustrated in Table 1.8, 36% of total $CO_2$ emissions in France in 2011 derived from transport sources (127 million tonnes). Transport has been the lead contributor to $CO_2$ emissions in France since the mid-1990s. All other sectors reduced their $CO_2$ emissions over the period 1990-2011 (by 23% for energy conversion, 26% for manufacturing, 9% for residential and tertiary), except for agriculture (+3%) and transport (+8%). The rise in $CO_2$ emissions from fossil fuel combustion in road transport over the period 1990-2011 (from 111 million tonnes to 121 million tonnes) has more than offset the slight decrease in $CO_2$ emissions from other transport modes (from 6.9 million tonnes to 6.2 million tonnes)[21]. (CITEPA, 2013; SOeS, 2014a)

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[19] Worldwide anthropogenic greenhouse gas emissions in 2010 amounted to 49 Gigatonnes of $CO_2$-equivalent. They consisted of: carbon dioxide ($CO_2$) from the burning of fossil fuel and industrial processes (65% of total tonnes of $CO_2$-equivalent emitted), $CO_2$ from forestry, land use and land-use change (11% of total), methane ($CH_4$) (16% of total), nitrous oxide ($N_2O$) (6.2% of total), and fluorinated gases (F-gases) covered under the Kyoto Protocol (2.0% of total) (IPCC, 2014a).

[20] $CO_2$ emissions can have detrimental effects on health (headaches, asphyxiation, cardiac arrhythmia, blood pressure disorders) (CITEPA, 2012), but they are mainly combated for their contribution to the greenhouse effect.

[21] In accordance with the accounting rules of the Kyoto Protocol, greenhouse gas emissions from international aviation and maritime bunkers are not included in national inventories by CITEPA. The decrease in $CO_2$ emissions from transport other than road

In addition, with emissions of 3.7 million tonnes $CO_2$-equivalent, transport was responsible for 24% of total Hydro-fluorocarbon (HFC) gas emissions in France in 2011, third behind only the residential/tertiary (46%) and manufacturing (29%) sectors. The tremendous rise in HFC emissions from transport sources between 1990 and 2011 (from 0 to 3.7 million tonnes $CO_2$-equivalent) is the result of the following two trends: *i)* HFCs replaced CFCs in refrigerating applications following the signature of the Montreal Protocol in 1987[22]; *ii)* air-conditioning has been increasingly used throughout the transport industry, and is now offered across the entire range of vehicles. (CITEPA, 2013)

| Mode of transport | GHG emissions by mode of transport in France (1) (in million tonnes $CO_2$-eq.) | | | | |
|---|---|---|---|---|---|
| | 1990 | 2000 | 2005 | 2010 | 2011 |
| Civil aviation (2) | 4.3 | 6.2 | 5.0 | 4.5 | 4.8 |
| Road transport | 114.5 | 131.2 | 133.8 | 125.4 | 125.0 |
| Railways | 1.1 | 0.8 | 0.6 | 0.5 | 0.5 |
| Navigation (3) | 1.1 | 1.2 | 1.3 | 1.2 | 1.2 |
| Other | 0.2 | 0.5 | 0.9 | 0.5 | 0.5 |
| **All transport modes** | **121.2** | **140.0** | **141.7** | **132.2** | **132.0** |
| ***as a % of all GHG emissions* (4)** | ***22%*** | ***25%*** | ***26%*** | ***26%*** | ***28%*** |

*Notes: 1. Data are France and French Overseas Departments. 2. Emissions from international aviation are not included. 3. Emissions from international maritime bunkers are not included. 4. Total GHG emissions do not include emissions from the LULUCF sector (land use, land-use change, and forestry).*

**Table 1.9: Greenhouse gas emissions by transport mode (CITEPA, 2013; SOeS, 2013j)**

Taking all greenhouse gases into account, transport ranked first among all emitting sectors in France in 2011 (with 28% of national GHG emissions); at EU level, however, transport ranked second behind the energy industry (22% as compared with 33%) in 2011.[23] Table 1.9 illustrates the trends in GHG emissions

mainly results from the fall in emissions from railways and maritime transport over the period 1990-2011.

[22] The manufacture of CFCs has been phased-out under the 1987 Montreal Protocol on substances that deplete the ozone layer.

[23] In France, the energy industry is a rather low emitter (12% of national GHG emissions), because the primary source of energy is nuclear power production. (SOeS, 2013j)

from the different transport modes in France between 1990 and 2011. (SOeS, 2013j)

Looking at GHG emissions from transport in greater detail, it appears that passenger cars alone accounted for 54% of total GHG emissions from transport in Metropolitan France in 2011. Behind them were large goods vehicles, with 22% of transport GHG emissions, then light commercial vehicles, with 17%, and two-wheelers with a little more than 1%. All other transport means (i.e. domestic aviation, domestic navigation and railways) together accounted for the remaining 5%. (SOeS, 2013j)

Going beyond its obligations under the Kyoto Protocol[24] and under the European Climate and Energy Package,[25] France officially supports the goal of cutting global greenhouse gas emissions by half (from 1990 levels) by 2050, and by at least 75% in developed countries by 2050 (this commitment is known as the 'Factor 4' policy).[26] As part of this policy, in the aftermath of the 'Grenelle Environment Round Tables' held in October 2007, the First Grenelle Act set a target of cutting back greenhouse gas emissions from transport to 1990 levels by 2020.[27]

### 1.3.3 Safety in transport

Although transport is considered an essential for the well-being of society and of each individual, it has increasingly been perceived as a potential source of danger. At the very end of the 20th century, European public opinion was shaken by a series of serious rail accidents (101 killed in the Eschede train disaster in Germany on 3rd June 1998, 31 killed in the Ladbroke Grove rail crash in England on 5th October 1999), the accident in the Mont-Blanc Tunnel (24th March 1999,

[24] Under the Kyoto Protocol, France committed to reduce its greenhouse gas emissions by 8% below 1990 levels in the commitment period 2008 to 2012 (UN, 1998).

[25] Under Decision 406/2009/EC, France has committed to reduce its greenhouse gas emissions by 14% below 2005 levels by 2020, as part of the European Community's independent commitment to achieve at least a 20% reduction in greenhouse gas emissions by 2020 compared to 1990 (EC, 2009e).

[26] *Loi n°2005-781 du 13 juillet 2005 de programme fixant les orientations de la politique énergétique* (also known as 'Loi POPE'). Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000000813253.

[27] *Loi n°2009-967 du 3 août 2009 de programmation relative à la mise en œuvre du Grenelle de l'environnement*, Art.10. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000020949548.

39 killed), the Concorde crash (25th July 2000, 113 killed) and the wreck of the Erika (12th December 1999, 18,000 tonnes of fuel oil released), which all contributed to raising awareness of, and aversion to, the safety risks associated with transport.

**Road safety: A heavy toll**

However, none of the abovementioned risks can compare with road travel risk. Road safety has been steadily moving up the political agenda of transport decision-makers in France ever since the post-World War II era. The first safety-related regulations were enacted in 1954 (first, a decree setting speed limits in urban traffic; then, an act authorising police forces to measure the blood-alcohol level of a driver involved in a serious accident). However, the first official public road safety policies did not emerge until the early 1970s, when the number of annual road fatalities moved above the 15,000 level (in 1970) to reach a record 16,500 in 1972 (for a detailed historical perspective on public road-safety policies in France, see: Hamelin and Spenlehaeur, 2008).[28]

Table 1.10 displays French national statistics for road safety, showing that improvements in road safety have had the same range of impact on: *i)* the number of accidents involving injury (-63% from 162,573 in 1990 to 60,437 in 2012), *ii)* the number of fatalities (-64% from 10,289 in 1990 to 3,653 in 2012), and *iii)* the number of injured (-66% from 225,860 in 1990 to 75,851 in 2012). Yet from 1990 to 2012, the proportion of accidents occurring in urban traffic remained stable at around 70%. (INSEE, 2013c)

Differences appear, however, in the categories of people benefiting from such improvements in road safety: the greatest decrease in fatalities (-70%) and injuries (-75%) over the period was amongst car drivers and passengers, whereas drivers and passengers of motorised and non-motorised two-wheelers lag behind (respectively -47% and -59% fatalities, and respectively -50% and -53% injuries over the period 1990-2012), as well as the drivers and passengers of other vehicles – including light commercial vehicles, large goods vehicles, buses and coaches (-53% fatalities and -54% injuries). Pedestrians were essentially in the average range of reductions (-65% fatalities, and -58% injuries). (INSEE, 2013c)

[28] At European level, road safety first appeared on the political agenda in the late 1990s, because the Commission lacked legal authority to deal with road safetyissues before then (EC, 1997 and 2001d).

| Safety indicator | Road traffic safety statistics in France | | |
|---|---|---|---|
| | 1990 | 2012 | 2012/1990 (%) |
| **Number of injury accidents** | **162,573** | **60,437** | **-63%** |
| ***% of accidents in urban traffic*** | ***71%*** | ***70%*** | - |
| **Number of fatalities** | **10,289** | **3,653** | **-64%** |
| ***% of fatalities in urban traffic*** | ***35%*** | ***28%*** | - |
| Pedestrians | 1,407 | 489 | -65% |
| Non-motorised 2-wheelers: drivers and passengers | 401 | 164 | -59% |
| Motorised 2-wheelers: drivers and passengers | 1,603 | 843 | -47% |
| Passenger cars: drivers and passengers (1) | 6,295 | 1,882 | -70% |
| Other vehicles: drivers and passengers (2) | 583 | 275 | -53% |
| **Number of injured** | **225,860** | **75,851** | **-66%** |
| ***% of injured in urban traffic*** | ***67%*** | ***67%*** | - |
| Pedestrians | 26,666 | 11,247 | -58% |
| Non-motorised 2-wheelers: drivers and passengers | 8,257 | 3,911 | -53% |
| Motorised 2-wheelers: drivers and passengers | 46,556 | 23,236 | -50% |
| Passenger cars: drivers and passengers (1) | 135,173 | 33,263 | -75% |
| Other vehicles: drivers and passengers (2) | 9,208 | 4,194 | -54% |

*Notes: 1. Taxis, ambulances, caravans and trailers are classified with passenger cars. 2. Other vehicles include light-commercial vehicles, large goods vehicles, tractors, buses and coaches.*

**Table 1.10: Road accidents, injuries and fatalities (INSEE, 2013c)**

At European level, total road fatalities in the EU-27 decreased by 45% between 2000 and 2010, from 56,427 to 31,030 fatalities (EC, 2013b).

According to European statistics, France had the second highest number of road fatalities (3,992) in the EU-27 in 2010 – right behind Italy (4,090) – thus accounting for nearly 13% of total EU-27 road fatalities. However, France ranked tenth for the ratio of road fatalities to total traffic (54 road fatalities per billion passenger-km, as compared with the EU-27 average of 64), twelfth for the ratio of road fatalities to total population (63 road fatalities per million inhabitants, just above the EU-27 average of 62), and thirteenth for the ratio of road fatalities to the total passenger car fleet (127 road fatalities per million passenger cars, close to the EU-27 average of 131). Furthermore, France was among the member states to record the greatest fall in road fatalities between 2000 and 2010 (-51%, as compared with the EU-27 average of -45%). (EC, 2012c and 2013b)

As for rail fatalities, France accounted for 2 out of the 62 fatalities in the EU-27 in 2010, and 7 out of 38 in 2011. Finally, no fatalities were recorded in European statistics for commercial air transport and business aviation in Europe in 2010, but the years 2011 and 2012 saw 6 and 8 fatalities respectively. (EC, 2012c and 2013b)

### 1.3.4 The costs of congestion

Last of the negative impacts of transport on the economy and society we will analyse in this section, congestion occurs when the quality of the service supplied by an infrastructure (e.g. a transport system) deteriorates as a result of the mutual disturbance of users when infrastructure capacity approaches saturation (Schade *et al.*, 2006).

Congestion is a complex phenomenon, since it can have a number of causes (bottlenecks and capacity shortage, poor physical condition of infrastructure, accidents, weather conditions, etc.), take a variety of forms – recurrent (e.g. due to infrastructure capacity shortage) or non-recurrent (due to sporadic disruptions, such as accidents, technical problems, etc.), psychological (time lost and unpredictable travel times, but also stress and discomfort) or physical (flow congestion or stock congestion) – and exhibit high spatial and temporal variability (Breteau, 2011).

Assessing the costs of congestion in road transport is a tricky assignment. Analysts often refer to the total costs of congestion using a '*naive*' definition based on the sum of time losses incurred by road users as a result of congestion, by comparison with a situation absent congestion or in free-flowing traffic (Prud'homme, 1999: p. 4; Breteau, 2011: p. 91).[29] Under this definition, many European analyses assess congestion costs in road transport at between 1% and 2% of GDP (Quinet, 1994; EC, 1995; EC, 2001d; Nash, 2003; EC, 2011c and 2011d).

However, according to Breteau (2011), this definition is likely to overestimate road congestion costs by an order of magnitude (Prud'homme, 1999; Breteau, 2011: p. 92, p. 167). Indeed, researchers and policy-makers using an economic approach to road congestion costs acknowledge that there is such a thing as an *economically optimal level of congestion*, which changes during the

[29] Since congestion is both generated and suffered by road users, such a definition of road congestion costs is particularly problematic when used for pricing purposes. Indeed, in that case, it is not appropriate to add the total costs of road congestion to the costs to be covered by road users: only the marginal external cost is relevant for pricing. Yet the average cost of congestion may, on certain assumptions, be used as a first approximation to the marginal external cost. (EC, 1995: p. 11 and p. 15; Nash, 2003: p. 3-4 and p. 11)

course of a day in accordance with variations in demand volume (e.g. peak vs. off-peak) and demand elasticity (e.g. leisure vs. commuting) (EC, 1995: p. 14; OECD/ECMT, 2007: p.16, Breteau, 2011: p.92):

> *'Economically optimal levels of congestion take into consideration not only the cost of road provision but also what people are ready to pay in order to use the road. Economically "optimal" levels of traffic not only entail a certain degree of congestion – as the term is commonly understood by roadway managers and users – but this "optimal" level of traffic can also vary* i.e. *it is not related solely to the capacity of the infrastructure under consideration.'*
>
> (OECD/ECMT, 2007: p. 16)

Using a methodology based on 'big data',[30] INRIX estimated that French car users spent on average 35 hours in gridlock in 2013, down by one hour on 2010 levels. The City of Paris (including its surrounding region) was the most congested urban road network in France in 2013, with 55 hours spent in gridlock by every car user, down by 15 hours from 2010 levels. Other highly congested urban road networks were: Lyon (43 hours in 2013, 34 hours in 2010), Grenoble (41 hours in 2013, 33 hours in 2010), Bordeaux (41 hours in 2013, 26 hours in 2010), and Toulouse (39 hours in 2013, less than 25 hours in 2010). Six of the most congested corridors in the Paris region still recorded total delays in excess of 50 hours per car user in 2013.

Notwithstanding the above-mentioned reservations about such methodologies for assessing congestion costs to society, CEBR (2013) analysed the amount of time spent idling in traffic jams by commuters, business travellers and freight vehicles in the UK, France and Germany using data from INRIX, and developed a methodology to assess the *aggregated costs to households* of road traffic congestion, adding up: *i)* the *direct* impacts of congestion in terms of increased fuel costs from time spent idling and the value of lost work hours; and *ii)* the *indirect* costs to households stemming from higher costs to businesses (leading to increases in overall production costs, and subsequent increases in consumer prices) as a result of congestion. Direct costs for the period from June 2012 to June 2013 were assessed at around 4.1 billion EUR (0.6 billion EUR in extra fuel costs and 3.5 billion EUR in time costs), whereas indirect costs were

[30] In 2012, INRIX claimed to be the world's largest traffic information platform; they crowd source real-time data from approximately 100 million vehicles (including taxis, airport shuttles, light commercial vehicles, heavy duty vehicles and private cars) and devices to deliver traffic and driving-related insight, as well as sophisticated analytical tools and services, across five industries in 35 countries. (Sources for this section are: http://www.inrix.com/pressrelease.asp?ID=106; http://www.inrix.com/pressrelease.asp?ID=159; and http://www.inrix.com/scorecard/keyfindings.asp).

assessed at around 1.8 billion EUR, for a total of 5.9 billion EUR in aggregated costs of congestion to French households. Considering only car-commuting households, the aggregated annual costs of idling amounted to an average 677 EUR per household in France (around 7.8 million car-commuting households), and up to an average 997 EUR per household in the Paris region (around 2.4 million car-commuting households) over the period from June 2012 to June 2013. The total $CO_2$ emissions caused by the excess consumption of 221 million litres of fuel by idling vehicles in France amounted to 0.572 million tonnes of $CO_2$-equivalent.

Congestion costs in rail and air transport have been little researched. In scheduled transport systems such as air and rail transport, congestion costs can take the form of infrastructure scarcity costs (which could be interpreted as the value of creating or taking up a path or slot in a capacity-constrained network) or the form of delay costs (which become increasingly frequent when service frequency is high and infrastructure capacity is approaching saturation) (Quinet, 1994: p. 23; Nash, 2003: p. 2, p. 11 and p. 16). The few available assessments on air and rail congestion costs tend to show that they are one (or two) order(s) of magnitude lower than road congestion costs (EC, 1995: p. 14).

# 1.4 Balancing the funding equation

Transport systems in Western Europe have historically relied on public budgets to fund the provision of transport infrastructure or public transit services. However, in the aftermath of the 2008 economic and financial crisis, the need has become more acute to cautiously monitor public expenditure with a view to absorbing serious deficits in the public finances.[31]

## 1.4.1 The need for pragmatism in new transport infrastructure developments

### Ambitious plans for already large networks

[31] At the end of 2013, France's public debt (calculated according to the rules of the 1992 Maastricht Treaty) reached 1,925.3 billion EUR, and accounted for 93.5% of GDP. 79% of the debt lay with the State, another 11% with social security funds, another 9% with local governments, and less than 1% with central agencies (INSEE, 2014f). At the end of 2008 however, French public debt stood at 1,318.6 billion EUR, amounting to 68.2% of GDP. Between the fourth quarter of 2008 and the fourth quarter of 2013, the state's debt had increased by 46%, and local government debt by 25% (INSEE, 2014g). For the record, the limit set under the Maastricht Treaty for the ratio of public debt to GDP is 60%. France has been in violation of this limit since 2003.

France has an extensive road network (1,065,600 km in 2012, including 11,500 km of motorways),[32] an extensive railway network (29,800 km in 2012,[33] including 2,200 km of high-speed railways),[34] and an extensive inland waterway network (8,500 km, of which 5,100 km are in use)[35] (SOeS, 2014b; EC, 2013b). The costs of maintaining, refurbishing, upgrading, replacing and extending the associated infrastructure are accordingly heavy.

In recent decades, the governance (and funding) of transport infrastructure in France has changed with the influence of two policy trends: *i)* decentralisation (following the decentralisation acts of 1982-1983,[36] 2003-2004,[37] and 2014[38]), and *ii)* privatisation. Whereas most of the railway network and most of the inland waterway network have remained under state

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[32] France ranks third, behind only Spain and Germany, for the length of the motorway network in the EU-27.

[33] Second only to the German railway network in the EU-27.

[34] Second only to the Spanish high-speed rail network in the EU-27.

[35] Fourth in the EU-27, behind Finland, the Netherlands, and Germany.

[36] *Loi n°82-213 du 2 mars 1982 relative aux droits et libertés des communes, des départements et des régions*. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000000880039;
*Loi n°83-8 du 7 janvier 1983 relative à la répartition de compétences entre les communes, les départements, les départements, les régions et l'Etat*. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000000320197;
*Loi n°83-663 du 22 juillet 1983 complétant la loi 83-8 du 07-01-1983 relative à la répartition des compétences entre les communes, les départements, les régions et l'Etat*. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000000320195.

[37] *Loi constitutionnelle n°2003-276 du 28 mars 2003 relative à l'organisation décentralisée de la République*. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000000601882;
*Loi n°2004-809 du 13 août 2004 relative aux libertés et responsabilités locales*. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000000804607.

[38] *Loi n°2014-58 du 27 janvier 2014 de modernisation de l'action publique territoriale et d'affirmation des métropoles*. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000028526298.

management (through wholly state-owned companies),[39] part of the road network has been shifted to local government management (decentralisation through property transfer), or to management by private or partially state-owned companies (through concessions or outright property transfer), as have airports and marine ports. (SOeS, 2013f)

France has a long history of subsidising transport infrastructure and public transport services. Total public expenditure on transport by central and local government was assessed at 39 billion EUR in 2010: 17 billion EUR in investment costs (with a 20/80 distribution between the state and local government) and 22 billion EUR in operating costs (with a 30/70 distribution between the state and local government) (Cercle des Transports, 2012).

In the aftermath of the 'Grenelle Environment Round Tables' held in October 2007, the First Grenelle Act[40] laid the groundwork for the development of a National Transport Infrastructure Scheme (SNIT). The original plan for this scheme was presented in October 2011. It provided for 245 billion EUR in investment over a 25-year period, including 90 billion EUR from the state budget and an additional 56 billion EUR from local authority budgets (MEDDTL, 2011).

Because the original SNIT plan was deemed incompatible with the objective of restoring the public finances, an *ad hoc* committee was set up by the Minister in charge of transport matters in October 2012 to assess the scheme and suggest amendments. This committee is known as 'Mobilité 21'.

### The need for prioritisation

Mobilité 21 established different priority levels among the new-infrastructure investment programmes listed in the original SNIT project, and argued that the maintenance and modernisation of existing infrastructure, in particular the road and railway networks, was of paramount importance (Mobilité 21, 2013).

The recommendations are in line with the analyses by Crist *et al.* (2013) on the use of asset management for infrastructure funding. Studying current transport infrastructure management approaches around the world, they recommend applying life-cycle asset-management approaches to transport infrastructure, underlining the importance of: *i)* preparing multi-annual programmes and budgets for surface transport infrastructure based on data

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[39] In the form of a State EPIC (Public Industrial and Commercial Establishment) or EPA (Public Administrative Establishment).

[40] *Loi n°2009-967 du 3 août 2009 de programmation relative à la mise en œuvre du Grenelle de l'environnement*, Art.16&17. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000020949548.

relating to objective needs rather than historical trends;[41] and *ii)* prioritising maintenance decisions under budget constraints. They argue that deferring maintenance (in particular routine and preventive maintenance that extend infrastructure life by slowing down the deterioration process) can increase the vulnerability of assets and networks to extreme meteorological conditions (resulting in congestion, traffic disruptions, etc.).

### 1.4.2 The necessary diversification of funding sources

In the light of the abovementioned challenges relating to public budget deficits, it comes as no surprise that the search for new (private) sources of funding for transport infrastructure and services has been on the agenda of many a public authority over the past few decades. Public-private partnerships (PPPs) have aroused much interest from public decision-makers, even though they have produced mixed results so far (OECD/ITF 2007; Ugarte *et al.*, 2012; Crist *et al.*, 2013). Performance contracts are another option for both infrastructure operation and service operation. They allow commercial risks to be shared between the public and private sectors (Crist *et al.*, 2013; Faivre d'Arcier, 2013). Pension funds have recently emerged as potentially significant players in the sector: they have been attracted by transport infrastructure assets because of their special investment characteristics, such as low competition and stable, predictable cash flows over the long-term (Ugarte *et al.*, 2012; Sharma, 2013).

The funding mechanisms for transport infrastructure and services in France have some unique historical features. In a historical perspective on the matter, Faivre d'Arcier (2012 and 2013) shows how, ever since the 1970s, the '*Versement Transport*' (VT) tax scheme has provided France's regional urban transport authorities with secure, long-term funding to develop public transport infrastructure, services and maintenance.[42] This specific tax revenue contributes close to half the total funding for regional urban transport authorities outside the Paris region, and close to 40% in the Paris region.[43] Faivre d'Arcier argues,

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[41] They define objective needs as objectives that derive from the gap between the conditions and performances of existing assets on the one hand, and the desired levels of service on the other hand.

[42] The '*Versement transport*' is levied by regional urban transport authorities in France on companies with more than 9 employees; it is based on the total payroll. For further information on this tax scheme, see Chapter 2.

[43] The regional transport authority in the Paris region has been known as STIF (*Syndicat des Transports d'Île-de-France*) since 2000: *Loi n°2000-1208 du 13 décembre 2000 relative à la solidarité et au renouvellement urbain* (also known as 'Loi SRU'), Art.122.

however, that the availability of this massive source of revenue may have had undesirable effects on: *i)* the efficiency of pricing policies (commercial revenues from the sale of public transport tickets and passes covered less than 30% of the total funding of regional urban transport authorities outside the Paris region in 2010); and *ii)* the effectiveness of transport networks (this might stem from the priority given to urban policy concerns over concerns relating to service attractiveness or network performance).

In France and elsewhere, additional funding for transport could be derived from more efficient pricing schemes that would pass on the social costs of road congestion to road users (e.g. urban tolls), for instance, or else capture a proportion of the added value to adjacent properties resulting from improved transit accessibility (for an extended review of the literature on land-value capture, see: Smith and Gihring, 2006 and 2014). It should, however, be noted that changes to pricing schemes tend to raise a great deal of public concern; they are tricky, challenging and potentially conflictual processes, to the extent that they require the right balance between economic performance, social efficiency and public acceptance (much research has been dedicated to these issues, including: Schlag and Schade, 2000; Raux and Souche, 2001 and 2004; PROGRESS, 2004; Jaensirisak *et al.*, 2005; Walker, 2011; De Palma, 2012; Bradley and Kenworthy, 2012).

### 1.4.3 The sensitive issue of transport affordability

From the social standpoint, transport enables access to jobs, education, healthcare and leisure amenities, as well as visits to friends and relatives. So the (geographical and physical) accessibility of transport networks and the affordability of transport services are two major drivers of social integration.

In France, the 'right to transport' was first established by a 1982 act[44] for users of domestic transport networks. That same act also provided the framework for a gradual implementation of the right to travel '*under reasonable conditions of access, quality and price, and at a reasonable cost to the community*'. The role of transport in social equity issues has been high on the political agenda of urban planners in France since the late 1980s (CAE, 2004).

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Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000000207538. The oldest predecessor of STIF was created by presidential decree in 1938: *Décret-loi du 12 novembre 1938 instaurant un comité des transports parisiens*, Art.2. Available from: http://gallica.bnf.fr/ark:/12148/bpt6k65549805/f58.image.

[44] *Loi n°82-1153 du 30 décembre 1982 d'orientation des transports intérieurs* (also know as 'LOTI'), Art.1. Available from: http://legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000000319738.

Building on previous research, CGSP (2013a) highlights the crucial role transport services can play in desegregating pockets of deprivation and 'sensitive areas', particularly in the metropolitan suburbs (on the same issue, see also: Thisse, Wasmer and Zenou, 2004). Indeed, such 'sensitive areas' are characterised by low revenues and a limited social mix, but also by blatant spatial isolation, which is partly due to poor transport access. Moreover, CGSP (2013a) adds that public transit can play a much greater role (provided appropriate services and prices) than road infrastructure (on the historical social function of public transport networks, see also: Faivre d'Arcier, 2012: p.24). Yet it should be noted that, wherever the benefits of public transport are extended to economically disadvantaged areas, the effective use of public transport services is often conditional upon the existence of 'social default tariffs' for vulnerable groups, which many cities in France have now implemented (CAE, 2004: p.72; Faivre d'Arcier, 2013: p.299).

**Transport share in household budgets**

The share of transport in the average French household budget rose from 10.6% in 1960 to 15.0% in 1980, then fluctuated around 15% over the next 20 years, and finally returned to levels in the range of 13% to 14%. Transport was the second highest household expense in 2010 (13.6% of total), after housing (25.9%), but before food (13.1%). In addition, since the 1960s, car-related expenses have accounted for more than 80% of total household transport costs, peaking at 88% in 1995. As a comparison, urban and suburban transport services did not exceed 3% of French household transport expenses in 2010, air transport was approaching 6%, and rail transport was slightly over 3%. (INSEE, 2014d)

Analysing the composition of the transport expenses of French households over more than 40 years (1960-2004), on the basis of national accounting statistics, Arthaut (2005) showed that household fuel and lubricant budgets overtook their budgets for new-car purchase in 1997 (reverting to the situation before the oil price collapse in 1986),[45] but also that the gross expenses for used-car purchase[46] overtook the expenses for new-car purchase in 2000 and have maintained that lead ever since.

Interestingly, after the 2008 economic and financial crisis, all car-related expenses started to decline simultaneously: household expenses on new-car

[45] For a historical perspective on oil shocks since the nineteenth century, and on the economic downturns that followed each of the major post-World-War-II oil shocks, see: Hamilton (2011).

[46] Gross expenses on used-car purchase include sales of vehicles between households.

purchase fell by 2.6% per year on average between 2008 and 2013[47] (notwithstanding the 2009 peak in new-car purchase expenses triggered by the national scrappage incentive scheme).[48] In addition, household expenditure on used-car purchase, spare parts, maintenance and repair services, and fuel and lubricants, also contracted, respectively by 1.9% per year, 2.6% per year, 3.1% per year, and 1.7% per year. Altogether, car-related expenses in 2013 were back to their pre-1998 levels.[49] (INSEE, 2014d and 2014e)

It would therefore seem that, in the post-2008 crisis period, households not only sought to reduce their expenditure on car purchase: they also started to cut back on car running costs, and more noticeably, on maintenance and repair.

It is worth noting that, at the same time, the transport services that grew fastest between 2008 and 2013 in terms of their proportion of household expenditure were: *i)* urban and suburban public transit[50] (+1.8% per year[51]); and *ii)* scheduled coaches and road shuttles (+2.4% per year[52]).

This highlights how sensitive household transport spending is to economic conditions, both in their total amount and in their composition. In all likelihood, in times of economic crisis, vulnerable households might be willing to cut back on car-related spending by: *i)* postponing, or even foregoing, part of it (first of all, maintenance and repair expenses); and/or *ii)* switching to

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[47] In constant 2010 Euros.

[48] The French scrappage incentive scheme was introduced in December 2007. It applied to almost 605,000 new-car sales over the first two years of implementation, 89% of which were sold in the year 2009 alone. Indeed, following the rise in incentives granted in 2009 as part of the French economic recovery plan, the scheme benefited more than one third of total new-car sales in France that year (SOeS, 2010). See Chapter 7 for further information on the scrappage incentive scheme.

[49] In constant 2010 Euros.

[50] Including: buses, subways, urban and suburban railways, tramways, trolleybuses; excluding: coaches, taxis, and cable cars.

[51] This observation should not conceal the fact that this average annual growth rate is lower than the 2.4% average annual growth rate previously recorded by urban and sub-urban transport services over each of the periods: 1980-1990, 1990-2000, and 2000-2008.

[52] This average annual growth rate however masks contrasted performances: after expanding by 6.1% per year between 2000 and 2010, household expenses on scheduled coaches and road shuttles services contracted by 1.9% per year between 2010 and 2013.

alternative modes when they are effective, accessible and affordable (hence the relative resilience of spending on services such as urban and suburban public transit, and scheduled coaches and shuttles); and/or *iii)* foregoing part of their mobility needs.

# 1.5 Innovating towards sustainability

> *'The history of the productive apparatus is a history of revolutions. So is the history of transportation from the mailcoach to the airplane. (…) This process of Creative Destruction is the essential fact about capitalism.'*
>
> Schumpeter (1942)

> *'Growth and technological change in the transport sector follow regular, structured evolutionary paths, resulting in a characteristic pattern of change. This pattern consists of a sequence of replacements of older forms of transportation by new ones. We also showed that the basic elements of the technology life-cycle, birth, growth, saturation, and eventual decline, characterize the long-term development of individual transport technologies and infrastructures not only in different market economies, but also in planned economies. The pattern of temporal changes over time and between countries is marked by a high degree of regularity and a quest for higher speed and productivity.'*
>
> Grübler (1990)

One of the key features of the transport system is its high technological content. Indeed, virtually all the elements of the system rely, to a greater or lesser extent, on value-added technology: vehicles; infrastructure, both 'hard' (e.g. transport networks, including roads, rails, ports, airports, warehouses), and 'soft' (e.g. information systems, air navigation control systems); services (e.g. payment systems for tolls and parking, geolocation systems, embedded communication systems); and energy carriers (e.g. petroleum products, biofuels, electric storage devices).

Grübler (1990) showed that the history of the transport system conforms to the Schumpeterian process of Creative Destruction (Schumpeter, 1942), thereby establishing that regular renewal of the technological content of the transport system is inherent to its evolutionary pattern.

At a time when transport systems are being urged to achieve greater sustainability while undergoing the pressure of increasingly strained budgets, public policy-makers have come to rely on innovation in general, and technological progress in particular, to tackle the challenges ahead.

## 1.5.1 The promotion of innovation from the top down

At the European level, strategies and action plans for transport assume that innovative technologies, in combination with innovations in the organisational, economic and social fields, will help tackle future transport challenges through their contribution to optimised network use, improved safety, reduced emissions, reduced oil dependency, greater comfort, etc. (EC, 2001d, 2005a, 2008b, 2009c, 2009d, 2011c, 2012d). The European Commission fosters RTD expenditure in innovative transport technologies through such programmes as the European Green Cars Initiative (5 billion EUR in EU funds, as part of the 2008 EU Economic Recovery Plan[53]) or the Clean Sky Joint Technology Initiative (1.76 billion EUR in EU funds for 2008-2017).

### Technological innovation as a national priority

In France, innovative technologies for the transport system are integral to national industrial policy as much as to national transport policy. Indeed, France ranks among the world leaders in many fields of the transport industry, including the building of infrastructure, the manufacture of transport equipment and the operation of transport services. In a context of increasing global competition, keeping and enhancing this leadership in transport technologies is seen as a key factor in preserving the competitiveness of the French economy.

In 2008, the automotive industry and the space and aircraft manufacturing industry ranked first and third for their contributions to domestic spending on RTD by businesses, with respectively 4.31 billion EUR (16.7% of domestic expenditure on RTD by businesses, 10.2% of total domestic expenditure on RTD by businesses and administrations), and 2.74 billion EUR (10.6% of domestic expenditure on RTD by businesses, 6.5% of total domestic expenditure on RTD by businesses and administrations). (INSEE, 2011a)

In March 2010,[54] the Government enacted the implementation of the 'Investments for the Future' programme (in French: '*Programme d'Investissements d'Avenir*') with a view to funding projects with high potential for the economy (these projects are co-financed by the state, to the tune of 35 billion EUR, by other public players, and by the private sector). Altogether, the three main actions concerned with research in the transport manufacturing industries have a budget of 2.92 billion EUR: 1.5 billion EUR for 'Research in

[53] EC (2008b).

[54] *Loi n°2010-237 du 9 mars 2010 de finances rectificative pour 2010*. Available from: http://www.legifrance.gouv.fr/affichTexte.do?cidTexte=JORFTEXT000021943745&categorieLien=id. See RF (2013) for an update on the 'Investments for the Future' programme.

aeronautics', 0.92 billion EUR for 'Vehicle of the future' and 0.5 billion EUR for 'Research in the space industry' (RF, 2013).[55]

In September 2013, the National Council for Industry (in French: '*Conseil National de l'Industrie*') set 34 industrial policy priorities for France (MRP, 2013b). Among these 34 priorities, the following 10 are dedicated to transport: *i)* conventional cars with a fuel consumption of no more than 2 litres per 100 km; *ii)* electric charging stations for electric transport; *iii)* battery life and power (for the automotive, aviation and shipbuilding manufacturing industries); *iv)* driverless vehicles; *v)* electric planes and next-generation aircraft; *vi)* heavy-lift airships; *vii)* embedded software and systems (e.g. automatic aviation pilot, vehicle traction control); *viii)* electric-propulsion satellites; *ix)* high-speed train of the future; and *x)* environment-friendly ships. In addition, several priorities not exclusively focused on the transport system still have strong connections with it, e.g. green chemicals and biofuels, or smart grids.

**Will technological innovation save the automotive industry?**

According to the EU's Industrial RTD Scoreboard (JRC/IPTS, 2013), the automotive and parts industry was the leading contributor to RTD spending by businesses in Europe in 2012 (38 billion EUR, or 25% of the total), whereas the aerospace and defence industry ranked fourth (6% of total), behind pharmaceuticals and biotechnology and electronic and electrical equipment. The intensity of RTD (defined as the ratio of RTD spending to total net sales) in these two sectors was 5.1% for the automotive and parts industry, and 6.0% for the aerospace and defence industry.

European industry players see innovation as key to tackling the main challenges of the automotive industry (CARS 21, 2012). According to a recent assessment (Cambridge Econometrics *et al.*, 2013), innovation could create 660,000 to 1.1 million net additional jobs in the automotive sector by 2030, it could reduce vehicle fuel consumption and therefore curb dependence on foreign oil (with estimated savings of 58 to 83 billion EUR a year by 2030 for the EU economy), and it could cut direct $CO_2$ emissions from cars and vans by 64% to 93% by 2050.

In the aftermath of the 2008 economic and financial crisis, French public policy-makers have developed similar expectations towards innovation in the automotive industry. On 20 January 2009, the French government organised the '*Etats Généraux de l'Automobile*' (round table conference between the government and representatives of the automotive industry), which resulted in

[55] On top of these actions targeting industrial research, the 'City of tomorrow' programme was designed to support projects in the field of sustainable transport and urban planning, with a total budget of 850 million EUR (RF, 2013).

the Automotive Pact (*Pacte Automobile*).[56] One of the six priorities of the Automotive Pact was research and development on low-carbon vehicles in France. In the aftermath of the 'Grenelle Environment Round Tables' held in October 2007, the First Grenelle Act (August 2009)[57] confirmed that priority and announced the forthcoming implementation of '*a research programme for the industrial development of clean and energy-efficient vehicles*'. And indeed, in October 2009, the French Government released a 14-point national plan for the development of electric and plug-in hybrid-electric vehicles (*Plan national pour le développement des véhicules électriques et hybrides rechargeables*) (MEEDDM, 2009a and 2010a), based on the expectation that research and development on low-emission vehicles would create net additional economic output of 15 billion EUR by 2030 and would contribute to maintaining employment in the automotive manufacturing industry. Three years later, in July 2012, the governmental Automotive Plan (in French: '*Plan automobile*') intensified the support for innovation in the automotive industry (MRP and MTEFD, 2012; MRP, 2013a). The government increased its backing for low-emission vehicles in particular, through a diverse set of measures on both the demand side (through increased purchase incentives and public procurement) and the supply side (through financial support for RTD activities and infrastructure deployment).

Thus, French policy-makers have chosen to rely on innovation in general, and low-carbon vehicles in particular, to help the automotive manufacturing industry recover from the massive loss of jobs in the period 1990-2010 and from the further demand shock that followed the 2008 economic crisis. How successful this industrial strategy will be remains a matter for conjecture. Yet, the measures taken to foster innovation in the automotive manufacturing industry could make a significant contribution to an integrated policy framework designed to tackle some of the most pressing challenges of the transport industry in France.

### 1.5.2 Innovation in transport at the local level

**Growing political support for innovative mobility services at the local level**

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[56] Source: http://archives.entreprises.gouv.fr/2012/www.industrie.gouv.fr/enjeux/auto/auto-pacte.html. [Accessed: 14th December 2014]

[57] *Loi n°2009-967 du 3 août 2009 de programmation relative à la mise en œuvre du Grenelle de l'environnement*, Art.54. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000020949548.

In addition to political support for technological innovation in the transport system at national level, many large cities in France have endeavoured to support the introduction of service innovations into their portfolio of urban mobility solutions, through the deployment of shared public modes, e.g. public bike-sharing (i.e. 'the shared use of a bicycle fleet by the public'[58]) or public car-sharing[59] (in French: '*auto-partage*').

The city of Rennes was the first to test modern (i.e. IT-based) bike-sharing in France, in 1998, but bike-sharing schemes did not really take off until the city of Lyon launched the Velov' system in 2005 (GART, 2009; DeMaio, 2009; Shaheen *et al.*, 2014). With close to 23,000 bikes in operation, the Vélib' system, established in Paris in 2007, was still the largest of the 35 bike-sharing schemes established in French cities as of January 2012 (CERTU, 2012).

Local governments in France have also supported the development of public car-sharing services, many of them based on battery-electric vehicles. After a few experiments in the 1970s, car-sharing services started to develop in France in the late 1990s. In 1999, the City of La Rochelle's Lisélec system became the first successful car-sharing service (with approximately 50 battery-electric vehicles). Yet, as of 2008, there were only 9,400 subscribers to car-sharing services (public and private) in France, 60% of them in the Paris region (CERTU, 2008). In the aftermath of the 'Grenelle Environment Round Tables' held in October 2007, the First Grenelle Act[60] laid down an official definition for car-sharing, as '*the pooling of a fleet of road motor vehicles to the benefit of subscription users. Each subscriber can access a vehicle without a driver for the trip of his/her choice and for a limited period of time.*' This act also created a car-sharing label, allowing access to designated parking spaces for car-sharing

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[58] Shaheen *et al.* (2014).

[59] We will use this term, which corresponds to the term 'car club' in British usage, to refer to the practice of sharing vehicles between a number of different users, who may use them at *different* times. This practice should not be confused with 'ridesharing' or 'carpooling' (in French: '*covoiturage*'), which in North American parlance refer to the shared use of vehicles at the *same* time (also labelled 'car-sharing' in British English) (TCRP, 2005: p.2-1). TCRP defines car-sharing as '*a membership programme intended to offer an alternative to car ownership under which persons or entities that become members are permitted to use vehicles from a fleet on an hourly basis*' (TCRP, 2005: p.2-2).

[60] *Loi n°2009-967 du 3 août 2009 de programmation relative à la mise en œuvre du Grenelle de l'environnement*, Art.54. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000020949548.

vehicles. The Second Grenelle Act[61] confirmed the willingness of French public authorities to promote car-sharing through urban mobility plans (in French: PDU, for '*Plan de Déplacements Urbains*').[62] As a matter of fact, car-sharing services did not really take off until the Paris region launched the EV-based Autolib' system in December 2011. Three years later, this system had 3,000 vehicles and 70,000 annual subscribers.[63] It remains, as of this day, the largest car-sharing service in France.

**Local governments deploying recharge infrastructure for electric vehicles**

On top of their support to the deployment of bike- and car-sharing services, local governments in France have also endeavoured to foster the spread of electric vehicles in their jurisdictions by deploying a public charging infrastructure. With the financial support of the French Environment and Energy Management Agency (a special call for project was launched in January 2013, with a total budget 50 million EUR, as part of the 'Vehicle of the Future' action under the 'Investments for the Future' programme), 22 projects for local charging infrastructure networks had been initiated by February 2015 (3 at regional level, 15 at district level, 4 at municipality or inter-municipality level).[64] Other local governments, such as the City of Paris, have also deployed charging infrastructure networks of their own (250 publicly-accessible charging stations in standard charging mode[65] and 60 charging stations on dedicated loading/unloading parking bays in standard and semi-fast charging modes[66]).

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[61] *Loi n°2010-788 du 12 juillet 2010 portant engagement national pour l'environnement*, Art.13. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORF TEXT000022470434; and:
*Décret n° 2011-829 du 11 juillet 2011 relatif au bilan des émissions de gaz à effet de serre et au plan climat-énergie territorial*. Available from: http://www.legifrance. gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000024353784.

[62] See Chapter 2 for further detail on urban mobility plans.

[63] Source: http://www.autolib.eu [Accessed: 25th February 2015]

[64] Source: http://avem.fr/actualite-assises-irve-2015-point-sur-le-financement-ademe-5570.html. [Accessed: 10th May 2015]

[65] Source: http://www.paris.fr/pratique/voitures-deux-roues-motorises/bornes-de-recharge-pour-vehicules-electriques/p5775. [Accessed: 10th May 2015]

[66] Sources: http://www.avem.fr/actualite-paris-60-nouvelles-bornes-de-recharge-en-voirie-pour-debut-2015-5169.html. [Accessed: 10th May 2015]

# 1.6 Conclusion

By reviewing the main direct effects, both positive and negative, of transport activities on the French economy and society, and on the environment, we have highlighted the complexity, diversity and magnitude of the challenges facing the transport system, which in our view require an integrated, level-headed approach on the part of policy-makers.

On the one hand, the transport industry (including transport-related manufacturing and service activities) accounts for close to 10% of France's national output and 8% of France's total wage employment in France. Yet, employment in this industry has been fragile and the growth in jobs in transport services could not compensate for the loss of 120,000 jobs in transport manufacturing industries between 1990 and 2010.

On the other hand, transport activities are accountable for several negative externalities with major undesirable impacts on the economy, society and the environment. First, they are responsible for 70% of the end consumption of oil products for energy purposes in France. Their heavy dependency on oil, which covers 93% of their energy needs, has decreased only slightly following the introduction of biofuels (5% of total energy consumption). Electricity and natural gas, although on the rise, have remained minor contributors. On top of their onerous dependency on oil, the energy mix in transport activities has been increasingly focused on diesel, following the massive shift to diesel in most segments of road transport. The combination of these two trends has had an increasingly negative impact on France's national trade deficit.

In addition, transport is a major source of local pollutants and greenhouse gas emissions in France. Air pollution by suspended particulate matter and its adverse effects on human health are of increasing concern to policy-makers, especially in urban areas, where transport can account for a large portion of emissions (beyond 60% in the City of Paris). Transport is also the leading source of $CO_2$ emissions (with 36% of total emissions) and the third source of HFC emissions (24%) in France. In the light of recent trends, significant breakthroughs would be needed to achieve the governmental objective of cutting back transport greenhouse gas emissions to their 1990 levels by 2020.

Alongside these externalities, transport is also increasingly a trigger for congestion problems, especially in urban areas, and remains a major cause of fatalities (3,600 in 2012), although very substantial improvements have been achieved in recent decades.

Another challenge to policy-makers is the economic balance of the transport system. The French transport system has historically relied on public budgets to fund the provision of transport infrastructure or public transit services. Public budget cuts induced by the 2008 economic and financial crisis have therefore put great pressure on transport funding and operations. Because the accessibility and affordability of transport services are sensitive issues from the social perspective (transport is the second highest household expense), the transport system may need to rely increasingly on alternative (i.e. private) sources of funding.

Under pressure to achieve greater sustainability while subject to increasingly tough budget constraints, public policy-makers in France, and more generally in Europe, have developed a set of policies to foster innovation in the transport system. Indeed, one of the key features of the transport system is its high technological content (including in vehicles, info- and infrastructure, services and energy carriers), which goes hand in hand with high RTD intensity and rapid technological renewal (mostly through incremental change). Public policy-makers have therefore endeavoured to provide massive support for innovation in the transport system, with a view to maintaining employment in the manufacturing industries, while simultaneously enhancing the system's environmental performance, e.g. in terms of greenhouse gases or local air pollution in urban areas.

In keeping with this '*technology-push*' philosophy, and in the wake of the 2008 economic and financial crisis, special support has been provided for clean and energy-efficient vehicles in France through purchase incentives, public procurement, financial support for RTD activities and infrastructure deployment, etc. The extent to which this industrial strategy will be successful remains a matter for conjecture. Its success will depend on a wide range of factors, from the implementation of complementary support policies at the local level, to the design of innovative products that actually meet customer needs. Yet, in keeping with the original intent of the First Grenelle Act in 2009, the measures taken to foster innovation in the automotive manufacturing industry may make a significant contribution to an *integrated policy framework* that could (and should) be devised in the coming 5 years to tackle some of the most pressing challenges of the transport system in France.

# Chapter 2
# Corporate mobility: The physical and financial flows at stake, the management tools at hand

## 2.1 Introduction

### 2.1.1 Background

The concept of 'travel demand management' (TDM) originated in the US in the 1970s and 1980s in a context of growing concern about society's ever-increasing reliance on the private car and the associated costs in terms of energy consumption, congestion, pollution and safety (FHWA, 2004a and 2004b).

In Europe, policy-makers developed a similar concept, termed 'mobility management' (MM). This shift in terminology stemmed from a broader perspective on demand-oriented approaches aiming to encourage changes towards more sustainable transport attitudes and behaviours in passenger mobility and freight transport (for a detailed discussion of the differences between TDM and MM, see: Enoch, 2012). For the sake of clarity and consistency, we will thereafter stick with the 'mobility management' concept although we acknowledge that TDM could be equally suitable.[1]

Mobility management aroused great interest amongst European public policy-makers from the 1990s onwards. In order to help clarify the concept of mobility management and to foster better understanding of the potential benefits of its implementation, the EU funded several research programmes, under the labels MOSAIC (Mobility Management Applications in the Community, 1996-1998), MOMENTUM (Mobility Management for the Urban Environment, 1996-1999,), MOST (Mobility Management Strategies for the Next Decades, 2000–2002), and MAX (Successful Travel Awareness Campaigns and Mobility Management Strategies, 2006-2009).[2] The European Conference on Mobility Management (ECOMM) was initiated in 1997, in the wake of the MOMENTUM research project, and two years later gave birth to the European Platform on Mobility Management (EPOMM), a network of European governments engaged in mobility management.[3]

Mobility management has been defined in many different ways, but EPOMM endorsed the following definition, which was developed by the MAX project (MAX, 2007) and which we choose to adopt for the purposes of our analysis:

> *'Mobility Management (MM) is a concept to promote sustainable transport and manage the demand for car use by changing travellers' attitudes and behaviour. At the core of Mobility Management are "soft" measures like information and communication, organising services and coordinating activities of different partners. "Soft" measures most often enhance the effectiveness of "hard" measures within urban transport (e.g., new tram lines, new roads and new bike lanes). Mobility Management measures (in comparison to "hard" measures) do not necessarily require large financial investments and may have a high benefit-cost ratio.'*
>
> (EPOMM/MAX, 2009)

[1] In our personal view, however, if the concept of 'management' applied to transport and mobility is to be understood as being about providing people with 'smart' choices, then we prefer the concept of 'mobility management' over the concept of 'transport demand management', because the smart choice might not always involve using transport networks and/or services (e.g. walking, teleworking).

[2] See Annex C for further detail on these programmes.

[3] EPOMM had 11 members among European countries in 2014, and 15 additional partner countries as part of the EPOMM-Plus project (2009-2012). See Annex C for further detail.

As highlighted by OECD/ITF (2010), mobility management traditionally focused on individual and household travel, on the assumption that households were the relevant perimeter where most transport decisions were made. However, the focus of mobility management was broadened by public authorities from policies targeting individuals and households alone, to policies targeting major traffic generators, such as companies or workplaces. Companies[4] were first officially involved in mobility management in the USA when Southern California introduced the concept of (workplace-based) TDM in the Clean Air Act, Regulation XV, in 1988 (Van Malderen *et al.*, 2012). In Europe, company mobility plans have been a part of Netherlands' transport policy since 1989 (Rye, 1999a), and a part of UK's transport policy since 1998 (Coleman, 2000).[5] So for almost 25 years now, companies (or corporations) have been identified by policy-makers as potential players in the targeted shift towards more sustainable mobility.

In Chapter 1, we provided an analysis of the French transport system in which the main stakeholders considered were: *i)* policy-makers, *ii)* companies on the supply side of the mobility system, and iii) users on the demand side of the mobility system. Thus, the only companies we have *explicitly* considered so far are companies in the transport industry: around 93,000 in the transport and storage sector, 84,000 in the motor vehicle trade and repair sector, and 3,000 in the transport equipment manufacturing sector, for a total of 180,000 companies (INSEE, 2013c). As already discussed, the role of these companies in the supply of transport equipment and services has been researched, analysed and taken into account in transport policy-making processes insofar as transport is their core business, their *raison d'être*.

However, it is our view that companies are also major stakeholders on the *demand* side of the mobility system. Indeed, across all activity sectors, there are around 3,380,000 companies in France, for 95% of which (3,200,000 companies), transport is *not* the core activity, but rather a means to an end, an auxiliary input to their production, or else a by-product of their main activity. All of these companies, to a greater or lesser extent, whether directly or indirectly, contribute to the demand for mobility.

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[4] Unless otherwise specified, we will use 'corporations' and 'companies' as meaning: all juridical persons (i.e. legal persons which are not natural persons), whether public or private, whether large or small. See Chapter 3 for more detail.

[5] Through the Government's White Paper on the Future of Transport (DETR, 1998).

### 2.1.2 Statement of the problem

Public policies in Europe and the USA consider corporations as potential key players in the wider challenge of mobility management. Yet the perimeter of mobility influenced by corporations has never been very well identified and there are only partial assessments of the volume of demand (or traffic) generated by the various forms of mobility relating to corporate activities. Moreover, we lack a clear understanding of how corporations factor mobility issues into their strategic decision-making processes, which necessarily hampers the design of adequate incentives for corporate mobility management.

In France, corporations are considered as major beneficiaries of the mobility system and, in return, are required to contribute to its funding well beyond their direct mobility expenditure. Yet again, we lack an overview of the various expenses incurred by corporations on account (or on the pretext) of mobility.

As well as being unsatisfactory from an academic standpoint, this inadequate understanding of the various roles corporations play in the physical and financial flows involved in the daily operations of the mobility system, poses a significant risk to the effectiveness of public policies built on the premise that corporations are potential agents of change towards greater sustainability in the mobility system. A review of the framework for such policies in France, and of the literature on the tools available to corporations engaged in mobility management, is needed to acquire a better grasp of the challenges ahead.

### 2.1.3 Purpose of the chapter

The objective of the analysis presented in this chapter is twofold. On the one hand, it is intended to synthesise available knowledge about the different roles companies play in the mobility system in France, both on the funding front and on the demand front.

On the other hand, it reviews the degree of familiarity with – and implementation of – the concept of mobility management at company level. This will provide useful context for our subsequent analyses of the policy framework and company processes relating to the management of corporate car fleets.

### 2.1.4 Method

When discussing the contributions of companies to the mobility system in terms of *physical* flows, we will develop an analytical framework based on a wide-ranging literature review. Our intention is to deal with the broadest possible range of facets relating to corporate mobility, including all kinds of mobility patterns (local or long-distance, domestic or international, daily or occasional); all methods of transport (privately or publicly owned, with individual or shared ownership, purchased, leased over the long-term, or rented on a one-off basis);

all services (on own account or for hire; by road, rail, air, inland waterways or the high seas); and all relevant trip purposes (commuting, customer visits, inter-site travel, carriage of raw materials for use in a factory, transport of equipment to a worksite, customer delivery, etc.).

On the other hand, when dealing with *financial* flows, we will focus on the French policy framework and analyse the very specific conditions under which companies provide funding for France's mobility system.

We will then focus on 'corporate mobility management' in an attempt to review the different possible approaches to such a concept, as well as the different tools available to corporations endeavouring to implement mobility management at their level. We will then provide further insights into the French context for the enforcement of – or support for – corporate mobility management through policy means.

It should be noted that our analysis does not cover the notion of 'career mobility' (also called 'occupational mobility' or 'job mobility') whereby an employee changes jobs, within the same company or from one company to another, either vertically (to a job with higher or lower socioeconomic status) or laterally (within a class of jobs similar in status) (Long and Ferrie, 2003).

### 2.1.5 Outline of the chapter

The chapter is structured into three main parts and a conclusion. First, we analyse the many facets of company-related mobility and provide insights into how companies factor mobility into their strategic decisions (Section 2.2). Second, we present the various channels through which companies in France contribute to the wider funding of mobility outside their own activity, together with the amounts entailed (Section 2.3). Then, we provide an overview of the rationale for mobility management at company level, the policy framework in France, and the tools available to companies engaged in mobility management (Section 2.4). In the final section (2.5), we offer some concluding remarks.

## 2.2 Corporate mobility in the literature

There is no readily available indicator of the contribution of companies to overall transport demand in France. Indeed, companies do not fall within the scope of the National Transport and Travel Survey (ENTD)[6] and there is no equivalent of such surveys for corporate travel patterns. Furthermore, there is

[6] ENTD focuses on the travel habits of French households, and their use of various modes of transport (both public and private). See Chapter 4 for further information on the national and local household transport and travel surveys available in France.

no indication of how national statistics on transport output (whether measured in passenger- or tonne-kilometres) can be broken down into distinct categories of household-related demand and company-related demand. What follows constitutes an attempt to provide an overview of the insights into corporate mobility gained from the literature.

### 2.2.1 Cataloguing company-related mobility patterns: From daily commute to long-distance business travel

Scientists do not agree on the boundaries of 'company-related mobility' (we could also use the expressions 'work-related mobility' or 'corporate mobility', to focus respectively on the employee viewpoint or on the firm viewpoint),[7] let alone on its contribution to the overall demand for mobility. Indeed, company-related mobility may cover very different kinds of mobility patterns (local or long-distance, domestic or international, daily or occasional), using various transport means (privately or publicly owned, or yet again shared, purchased, long-term leases or one-off rentals) and/or services (on own account or for hire or reward, by road, rail, air, inland waterways or the high seas), with a diverse set of purposes (home-to-work travel, visits to clients or partners, inter-site travel, carriage of raw material for use in a factory, transport of equipment to a worksite, customer delivery, etc.).

Among these many facets of company-related mobility, some have been better documented than others, in particular: *i)* employees' daily commuting (for France, see: François, 2010; Orfeuil, 2010b; Datar, 2013; for international comparisons, see: Jones *et al.*, 2008; Redding and Turner, 2014); *ii)* urban freight transport and logistics (for historical perspectives on research agendas and results in France, see: Routhier, 2002; Routhier and Gonzalez-Feliu, 2013; for European comparisons, see: EC, 1998c and 2006c; MDS Transmodal, 2012; Patier and Toilier, 2012; OPSTE, 2014); and, to a lesser extent, *iii)* long-distance business travel (see: Gustafson, 2012; Aguiléra, 2008 and 2014). These are the facets that we will discuss first, in order to assess, as far as possible, their contribution to the overall demand for mobility in France.

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[7] In order to avoid any possible confusion, we will refrain from using the expression 'professional mobility' in this section because it is equally used to describe: *i)* travel for professional purposes (in the transport literature), *ii)* the geographic mobility of labour (in the economic or geographic literature), and *iii)* the career mobility of employees (in the human resources literature). In line with the OECD/ITF (2010), we also use the expression 'corporate mobility' although we acknowledge that, in the EU context, it can refer to situations when companies move their establishments from one State to another.

### Daily commuting

From a legal standpoint, the daily commuting enjoys a hybrid status in France, between corporate mobility and private mobility. For instance, on the one hand, the costs of daily commuting by car are considered as private costs and therefore not to be covered by employers (see Section 2.3 for exceptions), and any contribution by the employer could be taxed as a benefit in kind (i.e. subject to personal income tax *and* to employer's and employee's social security contributions). On the other hand, accidents occurring during the daily commute can, under certain conditions, be considered as 'accidents at work', and employers could be held liable for accidents if there were substantiated evidence of safety failures on their part (e.g. excessive working hours). The same ambiguity prevails in most of the literature about the status of the daily commute. Notwithstanding its hybrid status, the daily commuting is one of the best documented categories of company-related mobility patterns in France, thanks in particular to household travel surveys and general population censuses.

Analysing the 2008 French National Transport and Travel Survey (ENTD), François (2010) showed that work accounted for 27% of the reasons for travel in local trips (up to 80 km) made by households during the working week in France, including 20% for daily commuting alone.[8] The average one-way, daily commute was 14.7 km and 22.6 minutes long (up from 9.0 km and 20.5 minutes in 1982). Approximately one in two trips were longer than 10 km in 2008, as compared with one in three trips in 1982. The share of 'long' trips rose sharply from 1982 to 2008: for instance, those between 20 and 40 km rose from 10% to 20% of all commuting trips over this period of time. Conversely, commuting trips of less than 5 km fell from 50% of all commuting trips in 1982 to just 28% in 2008. The massive use of the car as the main commuting mode was responsible for the somewhat smaller rise in commuting time than in commuting distance.

Car use clearly dominated the daily commute in 2008, with a modal share of 72.3% (as compared with 54.6% in 1982), way ahead of public transport (13.3% in 2008, as compared with 18.5% in 1982).[9] The growth in car use as the main mode of transport for daily commuting was a consistent trend over the period 1982-2008, although it was less marked over the period 1994-2008 (+3.7 percentage points) than over the period 1982-1994 (+14.0 percentage points).

[8] 'Daily commuting' is taken here to mean regular trips (at least three times a week in an average working week) to a fixed place of work.

[9] Modal shares are here calculated as the number of trips using a particular mode relative to the total number of trips.

Remarkably, the City of Paris and the Paris region were the only exceptions to this rise in car use for daily commuting between 1982 and 2008. The combined modal share of walking, cycling and motorised two-wheelers remained stable (around 15%) over the period 1994-2008.

The following are usually acknowledged as determinants of the transport mode choice for the daily commute: commuting distance, transport supply, household car ownership, household size, parking availability (both at home and close to the office), cost, etc. Interestingly, François (2010) pointed out that the use of car as the main commuting mode was higher when working hours are flexible: in 2008, it ranged from 71.9% for commuters with regular working hours fixed by the employer, to 78.1% for commuters with variable working hours chosen on a day-to-day basis.

Analysing the daily commute of the French working population based on the 2009 National Population Census, Datar (2013) showed that the average one-way daily commute was close to 22 minutes long in France in 2009. It reached 25 minutes in the largest urban areas (200,000 inhabitants or more),[10] whereas it was close to 17 minutes in small urban areas (50,000 inhabitants or less) and around 20 minutes outside urban areas. Approximately one in three workers worked and lived in the same municipality, both inside and outside urban areas. This ratio was, however, in the range of 40% to 45% in: *i)* small urban areas (50,000 inhabitants or less), *ii)* urban clusters,[11] and *iii)* isolated municipalities.[12]

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[10] According to INSEE's glossary (http://www.insee.fr/en/methodes/default.asp?page=definitions/aire-urbaine.htm), '*an urban area or a "large urban area" is a group of touching [contiguous] municipalities, without pockets of clear land, consisting of an urban centre (urban unit) providing at least 10,000 jobs, and of rural districts or urban units (urban periphery) of which at least 40% of the employed resident population works in the centre or in the municipalities attracted by this centre.*

*The 2010 zoning of urban areas also distinguishes:*

*- "Average areas", a group of municipalities, without pockets of clear land, consisting of a centre providing 5,000 to 10,000 jobs, and of rural districts or urban units among which at least 40% of the employed resident population works in the centre or in the municipalities attracted by this centre.*

*- "Small areas", a group of municipalities, without pockets of clear land, constituted by a centre from 1 500 to 5 000 jobs, and by rural districts or urban units among which at least 40% of the employed resident population works in the centre or in the municipalities attracted by this centre.*'

[11] According to INSEE's glossary (http://www.insee.fr/en/methodes/default.asp?page=definitions/pole-urbain.htm), '*an urban cluster is an urban unit offering at least 10,000 jobs and not situated in the suburban rim of another urban cluster. Also visible: "average*

Datar further observed that significant disparities existed among rural areas. In particular, in regions with robust economic growth, workers tended to live farther and farther away from urban clusters. On the other hand, commuting journeys also lengthened in the areas most affected by unemployment, where job opportunities were scarce.

Analysing 'long' duration commuting (60 minutes and above each way) in the Paris region on the basis of surveys using household travel diaries,[13] Jones *et al.* (2008) (see also: Orfeuil, 2010b) showed that 21% of all commuters were long duration commuters in 2001. Their average commute was 75 minutes and 27.3 km long (approximately twice the values for all commuters in the Paris region: 38 minutes and 13.4 km on average). Furthermore, 25% of long duration commuters travelled by car: indeed, the survey revealed a tendency for long duration commuters to use public transport modes whereas short duration commuters (30 minutes or less one-way) were more likely to use private transport modes. The morning departure time profile of long duration commuters was 30 minutes earlier than the same time profile for short duration commuters: the first quartile value was 06:58 (vs. 07:30 for short commuters), the median value was 07:37 (vs. 08:00), and the third quartile value was 08:12 (vs. 08:45). Long duration commuters spent on average about 100 minutes less per day at home than short duration commuters (731 minutes vs. 832 minutes).

These researchers also carried out a statistical regression analysis. It showed that, all else being equal, long duration commuters were more likely to be male, to belong to intermediate or higher socio-professional categories, to belong to households with two or more people working, and to have children present in the household. However, the differences regarding these factors were not huge. On the other hand, the regression showed that, all else being equal, long duration commuters were three times more frequent in the outer suburbs of Paris (*Grande Couronne*) than in Paris *intra muros*, and two times less frequent in households with more than one car than in households with no car. Other

*cluster" - urban units from 5,000 to 10,000 jobs; and "small cluster" - urban units from 1,500 to 5,000 jobs.*'

[12] According to INSEE's glossary (http://www.insee.fr/en/methodes/default.asp?page=definitions/commune-isole-hors-influence-pol.htm), isolated municipalities outside the influence of urban hubs are '*all the municipalities situated outside the big urban areas, the average areas and the small areas and which are not multi-centric.*'

[13] This research used the 2001 EGT survey (Paris region's household transport survey). The survey records all trips made on one weekday for all individuals above 6 years old in a household; a subset of households completed a similar record for one weekend day.

car-related factors seem to be significant, though to a lesser extent: not holding a driving licence and not having access to preferential car parking at the work place.

Finally, analysing long-distance journeys[14] based on the National Transport and Travel Surveys (ENTD), Grimal (2010) noted that long-distance commuting journeys (5 million journeys) accounted for 7% of all households' long-distance journeys in France in 2008, following average annual growth of 2.1% between 1994 and 2008. He noted that 163,000 individuals in France were characterised by long-distance commuting patterns of this kind in 2008. He also noted that, as far as the active, employed population was concerned, long-distance commuting was the main factor driving the increase in the frequency of long-distance journeys, reflecting the growing disconnect between residential locations and workplace locations. As illustrated in Figure 2.1, long-distance commuting journeys accounted for close to 29% of all long-distance journeys by rail in 2008 (as compared to less than 3% for long-distance journeys by car).

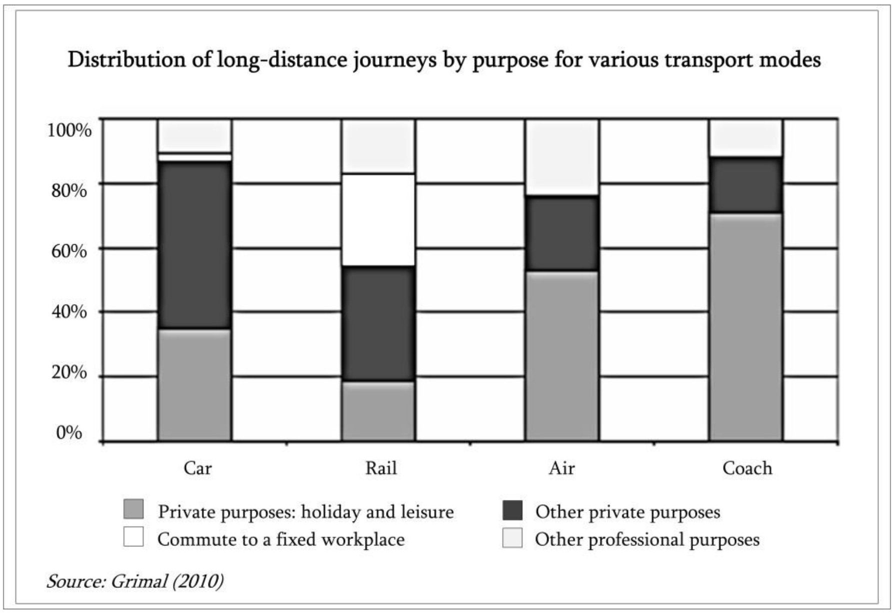


**Figure 2.1: Long-distance journeys for commuting purposes by mode (Grimal, 2010)**

[14] This analysis by Grimal (2010) is discussed further later in this section. A long-distance journey includes at least 2 long-distance trips (80 km or over each), and sometimes some additional intermediate trips (long-distance or otherwise), with an initial trip originating at home and a final trip terminating at home. Long-distance commuting journeys might not be completed within the day.

### Urban freight transport and logistics

Drawing on existing TMV surveys,[15] Gérardin, Patier, Routhier and Ségalou (2000) suggested the following classification of urban goods movements into three main categories: *i) establishment-supply movements* (deliveries and pick-ups), which relate to freight distribution between companies;[16] *ii) end-consumer commodity movements*, which relate to private household shopping trips where the purchased goods are collected and transported by the purchaser; and *iii) other urban goods movements*, which include movements relating to urban management (e.g. waste collection and processing, network management, and the supply of goods to construction sites, public works sites, public administrations), home deliveries, removals (corporate or household), postal services (excluding universal service, including express mail, parcel services, etc.).[17]

Taking the PCE.km as a unit of measure of traffic flows,[18] Routhier, Ségalou and Durand (2001) noted that the above-mentioned three types of movement of urban goods respectively accounted for 40%, 50% and 10% of total traffic in urban goods transport. The first category of movement would seem to fit the definition we set for 'company-related mobility'. The second category of movements, however, is outside our scope, because end-consumer commodity movements are conducted by private households, usually for private purposes. Finally, the third category would appear to have some components that fit our definition of 'company-related mobility' (e.g. the supply of construction sites),

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[15] TMV surveys (*Enquêtes Transport de Marchandises en Ville)* are urban freight surveys conducted in three major cities (Bordeaux, Marseille and Dijon) between 1994 and 1996, as part of the French national programme '*Marchandises en ville*', launched in 1993 by the Ministry in charge of transport matters.

[16] Both sender and recipient are firms, neither households nor public administrations.

[17] These three types of goods movement do not cover all urban goods transport. Indeed, this definition excludes: the transport of water, electricity and gas by urban networks, the universal postal services, the transport of personal effects, and the transport of tools (professional trips for technical maintenance or repair purposes are excluded unless equipment or parts are transported to be repaired off-site).

[18] Passenger Car Equivalent (PCE) is used as a metric to assess the impact that a mode of transport has on traffic flows compared to a single passenger car (reference value of 1). Typical values of PCE are: bus or heavy goods vehicle: 2.0 to 2.5; light commercial vehicles: 1.5; motorcycle: 0.5; bicycle: 0.2. PCE*km is used as a metric or road occupancy whereby PCE is weighted by the mileage.

and others that would not (e.g. household removals). So 'company-related mobility' could account for between 40% and 50% of total urban goods movement.

Overall, Routhier, Ségalou and Durand (2001) showed that, on an average weekday, goods transport accounted for 9% to 13% of total motorised trips, 13% to 20% of total vehicle.kms, and 15% to 25% of total PCE.kms in urban areas. 'Company-related mobility' as we take it here would account for 40% to 50% of those.

Analysing establishment-supply movements more closely, Gérardin, Patier, Routhier and Ségalou (2000) showed that the ratio between pick-ups/deliveries and jobs was greatly dependent on activity type and establishment size: it ranged from 0.2 (for some non-market services) pick-ups and deliveries per job and per week, to more than 10 (for wholesale trade), with an average value of 1, all activities included. Moreover, transport on own account prevailed, especially in large cities, over transport for hire or reward (or 'professional transport'), and close to half of pick-ups and deliveries were conducted by wholesale and retail trade and department stores. Three out of four deliveries were conducted in one-way runs (as opposed to round trips), but they represented no more than one out of four pick-ups and deliveries: round trips made up the remaining three out of four pick-ups and deliveries. Finally, more than half of pick-ups and deliveries used light commercial vehicles.

### Long-distance business travel

Reviewing the emerging literature on corporate travel management, Gustafson (2012) highlighted that business travel has been growing substantially for several decades, under the combined influences of: *i)* globalisation, with the geographical expansion of the markets and productive structure of firms; *ii)* new organisational trends such as networking, outsourcing and work in project teams; and *iii)* improved mobility infrastructure. According to the World Travel & Tourism Council (WTTC, 2011), global expenditure on business travel exceeded USD 850 billion in 2011.

Aguiléra (2008) highlighted the predominance of organisational aspects over other factors such as activity sector or company size, in the formation of business travel demand in a given company. Relevant internal organisational factors would include: the existence of multiple units, their number and geographical distribution, the organisation of production among units, the performance of the communication system used, the remodelling of work organisation around multi-site project teams, etc. Other external factors would also be involved, such as the number of partners or interlocutors, their geographical locations, their relationship with clients, etc.

Analysing the French National Transport and Travel Surveys (ENTD), Grimal (2010) showed that household members made 71.5 million long-distance journeys[19] for professional purposes[20] in 2008 (up from 58.3 million in 1994), each including 1.0 night away from home on average (down from 1.8 nights in 1994). The average mileage travelled during long-distance professional journeys was 788 km in 2008 (down from 808 km in 1994). In 2008, as in 1994, professional purposes accounted for 20% of total long-distance journeys (13% for meetings, conferences, training sessions, etc.; 7% for long-distance commuting), and close to 17% of the overall mileage of households' long-distance journeys. Grimal also showed that 66% of long-distance journeys for professional purposes were completed within the day, up from 59% in 1994. On the other hand, long-distance professional journeys entailing 4 nights or more away from home contracted from 10.5 million (18%) in 1994 to 6.7 million (9%) in 2008. In 2008, 50% of long-distance professional journeys were by car (59% in 1994), 40% by rail (27% in 1994), 7% by air (9% in 1994), the remainder by coach.[21]

Differences according to professional status were already significant in 1994 and became more marked between 1994 and 2008: executives and liberal professions made 45% of all long-distance professional journeys in 2008, as compared with 28% in 1994. Not unrelatedly, long-distance professional journeys were three times more frequent for men than for women in 2008 (1.93 journey per year for men, as compared with 0.66 for women), even though women had begun to catch up (from 0.34 journey per year in 1994). Both long-distance commuting and business travel contributed to this gap between genders, which reflects differences in employment rates, as much as in access to high-end jobs, between men and women.

Grimal (2010) further noted that 26% of the long-distance professional journeys of households living in the Paris region were international (as compared with 8% for the national average), thereby illustrating the international integration of this particular region of France. The most frequent, and most dynamic, destinations for international business journeys were

[19] A long-distance trip is at least 80 km long. A journey is a sequence of trips including an initial trip originating at home and a final trip terminating at home. A long-distance journey includes 2 long-distance trips at least, and sometimes some additional intermediate trips (long-distance or otherwise).

[20] Here, professional purposes cover both the commute to work and other business purposes such as meetings, conferences, etc. However, statistics provided by the paper seldom discriminated between these two categories.

[21] However, as already suggested above, the increase in rail use for long-distance journeys is closely associated with commuter travel rather than other business purposes.

Western European countries (from 4.3 million journeys in 1994 to 5.3 million journeys in 2008). The increase in the number of journeys to these destinations between 1994 and 2008 was entirely attributable to high-speed rail traffic to the Netherlands, Belgium and the UK.

For the record, focusing on business purposes other than commuting, Figure 2.1 illustrated that long-distance business journeys accounted for around 10% of all long-distance journeys by car and coach, 18% of all long-distance journeys by rail, and 23% of all long-distance journeys by air. Incidentally, Bouffard-Savary (2010) showed that the average distance flown for professional purposes was 1,830 km in 2008, up 24% from the 1994 value, but still lower than the average distance flown for private purposes (2,631 km in 2008). The increased competition from high-speed rail on short-haul routes (e.g. neighbouring European States: see above) could explain part of the upward trend in the average distance flown for professional purposes, along with globalisation (cause of an increasing number of long-haul flights) and the use of ICT as a substitute for the least 'useful' trips (which, according to the author, might have been short-haul rather than long-haul).

**Identifying and describing the blind spots**

Following this non-exhaustive review of literature on the best-documented categories of 'company-related mobility' (for the record: daily commuting, urban freight transport and logistics and, to a lesser extent, long-distance business travel), it appears that many other categories have been left aside, such as long-distance freight transport or local business travel (other than commuting). Under the label 'service-related traffic', Hebes *et al.* (2013) provide one of the rare analyses of motor vehicle traffic '*that is generated by the provision of services of economic entities or professional activities to the exclusion of freight transport*' and of the relative influence of various company-related factors (internal and external) on its volume and patterns. However, they leave out of the scope of their analysis all categories of mobility that do not use company-owned motor vehicles (e.g. public transport, taxis, cycling).

Other blind spots in the literature on mobility also include categories of mobility patterns *in the private sphere* that are not directly generated by companies, but are nevertheless connected with them. This would include, in particular, private trips using means that are fully or partially paid for by the company, such as holiday trips combined with a business trip abroad, or local private trips using a public transport pass paid for by the employer, or again private weekend trips using a company car. For further reference, we suggest that these particular categories should be labelled 'company-*enabled* mobility'. We believe that there might be other mobility patterns which do not fall into one of the above-mentioned categories, but are nonetheless influenced by companies. These would include, for instance, private international travel to countries which aroused the interest of the business traveller on previous business trips (Aguiléra, 2014). However, we consider that the connection between this last category of mobility and the corporate sphere is too remote for the purposes of our analysis.

Figure 2.2 presents a draft typology of company-related mobility patterns based on our previous observations, taking into account *i)* mobility patterns that are *decided* or *initiated* by the company (i.e. explicit corporate mobility), and *ii)* those outside the strictly corporate context that are nonetheless (fully or partially) *paid for* by the company (i.e. company-enabled mobility). Daily commuting here is considered a hybrid type of mobility, between corporate and private mobility.

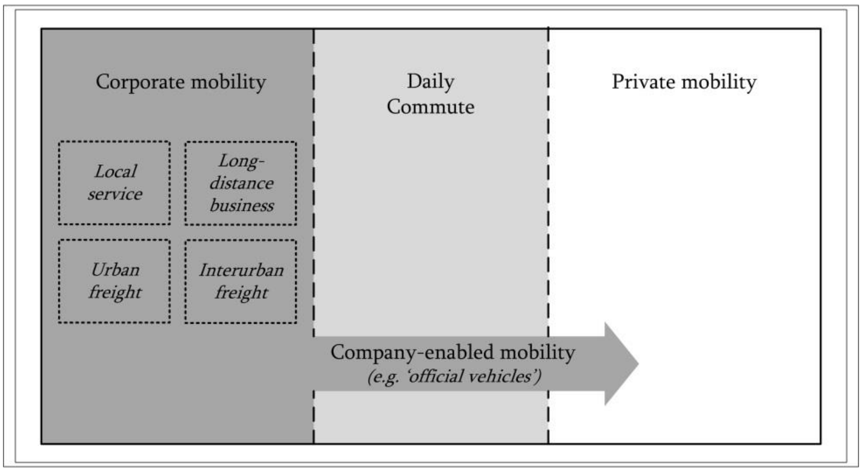


**Figure 2.2: Identifying and categorising corporate mobility patterns**

### 2.2.2 Insights into how companies factor mobility into their strategic decisions

To the best of our knowledge, there is no specific current of literature dealing with how common companies (i.e. other than transport service providers) perceive their relationship with the wider mobility system, or include mobility considerations in their strategic decision-making (e.g. when they choose to relocate) (Aguiléra, 2008). However, from a preliminary analysis, we anticipated that two specific fields of research and/or policy could provide insight into how mobility might be factored, explicitly or implicitly, into the strategic decisions of companies: on the one hand, research concerned with agglomeration effects (including dimensions such as accessibility and productivity); on the other hand, research concerned with corporate social responsibility and/or sustainable development strategies for companies.

**Mobility as a factor of accessibility and productivity**

As noted by Duranton and Turner (2007), a large part of the literature relating to agglomeration effects overlooks the effects of public infrastructure in general, and transport in particular, on the productivity of companies. Yet part of the new economic geography literature (Krugman, 1991; Duranton, 1997; Redding and Turner, 2014) discusses the role of transport networks as one of the factors of company production. Indeed, to put it in quite prosaic terms, it can be shown that transport networks matter to companies not only because efficient transport systems help to lower the costs of their production inputs and outputs, but more generally because they facilitate their access to potential customers (market) and employees (labour pool), as well as partners and suppliers (set of production inputs). The new economic geography literature further highlights that transport networks can improve productivity in other factors of production (e.g. labour, by reducing employee travel time). Although these two effects – direct and indirect – of transport networks on companies' productivity cannot always be separated out, many analyses concur that transport networks facilitate the concentration of activities, which results in changes in job densities, which in turn affects the productivity of the companies concerned (Breteau, 2011: p.38-39; CGSP, 2013b: p.18).[22]

On the other hand, as noted by OECM/ECMT (2007) and Prager and Quinet (2013), several factors might offset the trend towards a concentration of activities. Congestion is one such factor, which might trigger a negative feedback loop that reduces the benefits of agglomeration for companies, and might cause some of them to relocate their activities. OECD/ECMT (2007: p.156-158) identified four types of impact that congestion may have on business productivity, namely: *i)* additional direct 'on-road' costs (e.g. marginal labour and vehicle operating costs, including fuel and maintenance); *ii)* logistics-related and business process-related productivity impacts (e.g. increased on-site inventory holdings to tackle unplanned delays in 'just-in-time' processes, re-scheduling costs for missing the delivery 'slot' to a shipper); *iii)* market scale and accessibility impacts (companies face trade-offs between positive economies of scale as triggered by agglomeration and increased transport costs as triggered by congestion);[23] and *iv)* business costs of worker commuting (upwards adjustment

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[22] Following a review of international research on agglomeration effects, CGSP chose to use a 0.015-0.05 range for the elasticity of productivity with respect to job density (CGSP, 2013a: p.193).

[23] '*Not all firms face the same decision – whereas some firms may move out of congested areas relatively quickly because of their particular business activity (e.g. industrial production activities), others may be much more resilient in the face of increased*

of wages to retain workers who might otherwise make a trade-off between commuting time and wages). To this last type of impact, we might add the costs in decreased quality and productivity from employees with a long, stressful or risky commute (including both the effects of physical tiredness and potential accidents) (Cox *et al.*, 2006). Prager and Quinet (2013) see another negative feedback on the agglomeration of companies in the increased operating costs companies incur as a result of higher land and building costs, and/or in the higher wage levels of the local labour pool in dense urban areas.

**Mobility as a sustainability issue?**

On top of accessibility and productivity considerations, we anticipated that companies might also factor mobility into their strategic decisions relating to sustainability issues. We therefore checked the literature relating to corporate social responsibility (CSR) and/or sustainable development (SD) strategies in companies, for further insights into this issue.

Conceptual developments in CSR matured progressively in the US from the mid-1970s onwards, but CSR received no theoretical development until the 1990s (for extensive reviews of the literature on CSR, see: Wood, 1991; McWilliams, Siegel and Wright, 2006). Here we feel the need to discuss CSR and SD as company strategies which, as noted by Ebner and Baumgartner (2006), lack a precise definition. Following an extensive review of the use of the concepts of both CSR and SD in the literature, Ebner and Baumgartner suggested that CSR should be construed as the social dimension of corporate sustainability, which in turn should be conceived as the application at corporate level of the macro-level, ethical concept of SD (as defined by Brundtland,[24] based on the three pillars of economic, social and environmental concern). They noted, however, that '*a large number of scientists describe CSR as stakeholder-oriented, social pillar of SD, slightly more, though, tend to replace the term SD by CSR without restrictions which then pictures CSR as a three-dimensional concept of sustainability. It is impossible to say if CSR is more likely to be used as a synonym for SD in future or if it is rather seen as the new stakeholder approach or as the social dimension of SD.*' (Ebner and Baumgartner, 2006: p.11-

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*congestion (such as firms that are dependent on a professional workforce that values high density urban living).*' (OECD/ECMT, 2007: p.158)

[24] In: *Our Common Future*, also known as the Brundtland Report, from the United Nations World Commission on Environment and Development (UN, 1987). The 'classical' definition of sustainable development laid down in this report is: '*Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.*' (p.43)

12). In our view, their preferred definitions to some extent reflect a USA-centric approach to the concepts of CSR and SD, whereas – as will be emphasised below – the literature and policies in Europe seem to have opted to treat these concepts as synonyms.

Chiroleu-Assouline (2006) suggested that the definition of SD at corporate level should be construed as the result of an implicit negotiation among all the economic and social players with a view to achieving mutual recognition of their divergent objectives (namely: the quest for profit, as far as the firm and its shareholders are concerned; social responsibility and respect for the environment, as far as NGOs, employees, consumers or local governments are concerned). In such a view of corporate strategy, the standard profit-maximising principle is therefore circumscribed by the voluntary internalisation (whether brought about by internal or external pressures, or by economic incentives) of some of the externalities of the firm's activities that affect the environment and stakeholders, *beyond* national and international legal and regulatory requirements. However, according to Chiroleu-Assouline, a range of motives may prompt companies to internalise such constraints: *i)* public acceptance of the activity, *ii)* cost reduction, *iii)* anticipation of regulatory changes, *iv)* new market and profit opportunities, *v)* image and reputation management, and *vi)* financial attractiveness (through improved risk management and long-term sustainability planning).[25]

Although we expected to gain further insights into how companies factor mobility into their CSR-related decisions from the above-listed literature, after taking a closer look we found that mobility and mobility-related impacts have not been acknowledged as a core dimension of CSR so far.

We then turned to the European policy framework to check for a mobility-related dimension of CSR. The European Commission, in its 2001 Green Paper promoting a European framework for CSR, clearly presented CSR as the application of sustainable development principles to companies (EC, 2001h). The Green Paper identified two dimensions of CSR: *i)* an internal dimension (relating to issues such as human resources management, health and safety at work, adaptation to change, and management of environmental impacts and natural resources), and *ii)* an external dimension (relating to issues such as local

[25] McWilliams, Siegel and Wright (2006) introduced an additional restriction to the definition of CSR as 'situations where the firm goes beyond compliance and engages in actions that appear to further some social good, *beyond the interests of the firm* and that which is required by law'. With Chiroleu-Assouline, we think that expected gains in terms of brand image or public acceptance of the activity are motives well *within the scope* of the interests of the firm.

communities, business partners, suppliers and consumers, human rights, and global environmental concerns). 'Environmental problems associated with transport' explicitly appeared among the externalities for which companies could be held accountable. The European Commission proposed a renewed strategy for CSR in 2011 (EC, 2011e), and a new definition for CSR as 'the responsibility of enterprises for their impacts on society', thereby covering the following issues: human rights, labour and employment practices (e.g. training, diversity, gender equality and employee health and well-being), environmental issues (e.g. biodiversity, climate change, resource efficiency, life-cycle assessment and pollution prevention), combating bribery and corruption, community involvement and development, the integration of people with disabilities, and consumer interests (including privacy). So transport-related externalities were no longer explicitly listed in the 2011 Communication.

In France, environmental and social reporting has been mandatory for French companies listed on a regulated market since 2002.[26] Such reporting should include information on the organisation of working time, health and safety conditions for workers, resource consumption (water, raw materials and energy), release of pollutants into water, soil and air, etc. To the best of our knowledge, there is no literature that discusses the status of mobility in mandatory sustainability reports.

Finally, building on the proposals of the 'Grenelle Environment Round Tables' operational committee on CSR (MEEDDAT, 2008), the Second Grenelle Act[27] made it compulsory for companies with 500 employees or more to report on their greenhouse gas emissions (such reporting is often known as a carbon audit, or in French: '*Bilan Carbone*'®). Under this legislation, companies have to

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[26] *Loi n° 2001-420 du 15 mai 2001 relative aux nouvelles régulations économiques.* Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000000223114; and:
*Décret n° 2002-221 du 20 février 2002 pris pour l'application de l'article L. 225-102-1 du code de commerce et modifiant le décret n° 67-236 du 23 mars 1967 sur les sociétés commerciales.* Available from: http://legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000000775209.

[27] *Loi n°2010-788 du 12 juillet 2010 portant engagement national pour l'environnement.* Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000022470434; and:
*Décret n° 2011-829 du 11 juillet 2011 relatif au bilan des émissions de gaz à effet de serre et au plan climat-énergie territorial.* Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000024353784.

report on direct greenhouse gas emissions (including direct emissions from mobile sources with heat engines) and on indirect greenhouse gas emissions due to energy consumption (electricity, water vapour, heat or cooling energy). Reporting on other indirect emissions is however optional, including upstream and downstream transport of freight and other goods, transport of staff by means of transport not belonging to the company (e.g. business travel), transport of visitors (customers, partners or others), commuting and teleworking by employees (MEDDTL, 2012: p.17-18). Yet again, as of 2014, we could find no evidence in the literature that mobility had become a key element of carbon audits following the 2010 act.

## 2.3 Companies and the funding of mobility other than their own

According to national accounting statistics (see: SOeS, 2013a), the total transport expenditure of companies *outside* the 'transport and storage' activity sector (see Section 1.2 for more information on the scope of this sector), was 124 billion EUR in 2011 (including 38 billion EUR on own account). This would cover the expenditure of companies for both the transport of people (mainly their staff) and the transport of freight and other goods (e.g. raw materials, equipment, manufactured products). Road transport accounted for 76% of the total expenditure, maritime transport for 10%, air transport for 6%, urban public transport for 5%, and rail transport for 3%.

Yet, in addition to paying these direct costs, companies in France are also expected to contribute to the *funding* of the transport and mobility system, which they do through various channels. First, they directly contribute to the funding of urban public transport through a specific tax scheme, known as the '*Versement Transport*' (VT). Second, they contribute, whether on a mandatory or voluntary basis, to the costs incurred by their employees for commuting and, in some cases, for personal transport. Finally, they also contribute to the general public budget through various taxes and duties.

### 2.3.1 Companies and the funding of urban public transport through the VT tax scheme

#### The VT tax scheme

As mentioned in Chapter 1, France has a specific tax scheme, the '*Versement Transport*' (VT), which was set up in the 1970s to raise capital for investment in local public transport infrastructure and to cover its operating losses.

VT is a hypothecated local tax levied on companies with nine or more employees. The money is directed to the regional urban transport authority (in French: AOT, for '*Autorité Organisatrice des Transports*'), which is responsible for organising public transport in a given urban transport zone (in French: PTU, for '*Périmètre de Transport Urbain*'). The tax is based on the total gross salaries of employees, and the maximum tax rate varies depending on the size of the population resident in the PTU. It is therefore unconnected with the actual use of the public transport system by companies and their employees (SOeS, 2013a).

Faivre d'Arcier (2012) shows how the VT tax scheme was originally designed with a view to devolving tax revenues from the central government to the AOTs, in return for the latter taking on responsibility for reviving the public transport networks and services. The 1960s had seen the passenger car become the preferred mode of transport for a rapidly-increasing number of households. However, this development model revealed its limitations in the early 1970s, when congestion, noise and pollution first emerged as major challenges in urban centres, together with the growing burden on municipal budgets of investment in road and parking infrastructures.

This scheme was first set up in the Paris region in 1971,[28] with a maximum rate of 2% of the gross wage bill. It was expanded in 1973[29] to communities of more than 300,000 inhabitants, with a maximum rate of 1.5% (in the case of a heavy infrastructure newly built and partly funded by state subsidy; 1% otherwise). It was expanded again in 1974,[30] 1982,[31] 1992[32] and 2000:[33] the

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[28] *Loi n°71-559 du 12 juillet 1971 relative à l'assujettissement de certains employeurs de Paris et des départements limitrophes à un versement destiné aux transports en commun de la région parisienne.* Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000000322075.

[29] *Loi n°73-640 du 11 juillet 1973 autorisant certaines communes et établissements publics à instituer un versement destiné aux transports en commun*. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000000334814.

[30] *Décret n°74-933 du 7 novembre 1974 étendant aux communes et établissements publics de plus de 100 000 habitants les dispositions de la loi n°73-640 du 11 juillet 1973, autorisant certaines communes et établissements publics à instituer un versement destiné aux transports en commun*. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000000306566.

[31] *Loi n°82-684 du 4 août 1982 relative à la participation des employeurs au financement des transports publics urbains*. http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000000880224.

[32] *Loi d'orientation n°92-125 du 6 février 1992 relative à l'administration territoriale de la République*. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000000722113.

population threshold was successively lowered to 100,000, 30,000, 20,000, then 10,000 inhabitants, thereby allowing an increasing number of urban areas, large and medium-sized, to invest in transport projects such as subway and tram networks. Faivre d'Arcier (2012) argues that the steady expansion of VT tax schemes might have been the cause of the re-emergence of tramways in French cities in the 1980s. Figure 2.3 illustrates the growing number of AOTs that introduced VT tax schemes to fund public transport in their zones from 1973 to 2012.

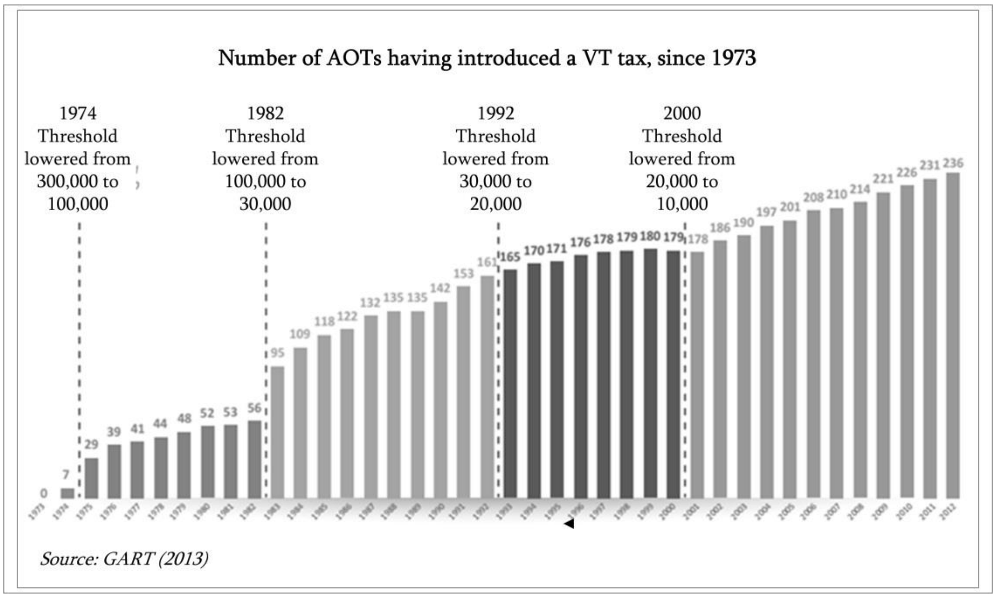


**Figure 2.3: Impact of decreasing population thresholds for VT schemes on the actual introduction of VT taxes by AOTs (GART, 2014)**

It is worth noting that the structure of the VT tax scheme outside the Paris region is now very complex. Indeed, different maximum tax rates have been set for different categories of urban area: altogether, there are 16 categories of urban area eligible to introduce a VT tax scheme outside the Paris region, and 12 different maximum rates ranging from 0.55% to 2.00% depending on: *i)* the population size (4 classes); *ii)* the existence of mass rapid transit (MRT) networks with dedicated lanes (in French: TCSP, for '*Transport en Commun en Site Propre*'), such as subways, tramways, or bus rapid transit (BRT); *iii)* the governance of the regional transport authority (whether or not it involves

[33] *Loi n°2000-1208 du 13 décembre 2000 relative à la solidarité et au renouvellement urbains (SRU)*. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000000207538.

cooperation among several municipalities); and *iv)* tourism potential. (GART, 2014)

From 2.0% in 1971, the maximum VT rate for the City of Paris went steadily up, reaching 2.7% in 2013. There are 3 different maximum tax rates in the Paris region, ranging from 1.5% to 1.8%. The only municipalities eligible for the 2.7% maximum rate, apart from the City of Paris, are the municipalities of the *Hauts-de-Seine* district, which includes Paris' Central Business District of *La Défense*. (GART, 2014)

**VT tax revenues (almost 7 billion EUR in 2012) provided nearly half the funding of urban public transport in France**

Table 2.1 illustrates the contribution of VT tax revenues to the total resources of AOTs in French provinces (i.e. outside the Paris region). While total AOT resources increased by 56% between 2000 and 2012 (+3.8% per year), VT regularly accounted for 40% to 50% of the total amount throughout the 2000s. However, this table does not provide the total VT tax revenues for French provinces: it is based on a sample of 197 networks outside the Paris region. (GART, 2014)

Total VT tax revenues amounted to 3,643 billion EUR in 2012 in French provinces, and an additional 3,235 billion EUR were collected in the Paris region, thus totalling 6,878 billion EUR in VT tax revenues nationwide in 2012. The VT's contribution to the total costs of public transport in the Paris region has been in the range of 35% to 40% since 2000. The Paris region accounted for approximately 50% of total VT tax revenues in France throughout the last decade, though VT tax revenues in French provinces outside the Paris region have been growing faster than in the French capital. (GART, 2014)

All sources concur that the French-specific VT tax scheme has led companies to become significant contributors to the funding of urban public transport, not only in the Paris region, but also in an increasing number of municipalities, large or medium-sized, in the French provinces. As many municipalities, except for the smaller ones, have already set their VT tax rate to its maximum level (Faivre d'Arcier, 2012), it is an open question how the delicate balancing act of funding resources on the one hand, and investment and operating expenditure on the other hand, will be maintained in the coming years. The tightening of public finance capacities has already triggered a steady decline in public contributions to the funding of urban public transport systems since 2006 (Faivre d'Arcier, 2012).

| Source of funds | Resources [1] of urban public transport in French provinces [2] (EUR 2010, millions - *as a % of total)* | | | | | |
|---|---|---|---|---|---|---|
| | 2000 | | 2010 | | 2012 | |
| **Public** | **1,718** | ***35.0%*** | **1,960** | ***31.8%*** | **2,883** | ***37.5%*** |
| State | 289 | *5.9%* | 92 | *1.5%* | 159 | *2.1%* |
| Local authorities | 1,429 | *29.1%* | 1,868 | *30.4%* | 2,724 | *35.5%* |
| **Other** | **3,190** | ***65.0%*** | **4,194** | ***68.2%*** | **4,800** | ***62.5%*** |
| 'Versement Transport' tax | 2,088 | *42.5%* | 3,000 | *48.7%* | 3,526 | *45.9%* |
| Commercial revenues | 1,102 | *22.4%* | 1,194 | *19.4%* | 1,274 | *16.6%* |
| **All funding sources** | **4,908** | ***100%*** | **6,154** | ***100%*** | **7,683** | ***100%*** |

*Notes: 1. Own resources only, excluding loans. 2. Based on a sample of 197 public transport networks in French provinces; Paris region not included.*

**Table 2.1: Distribution of urban public transport funds by source (GART, 2005 and 2014)**

### 2.3.2 Mandatory and voluntary participations in the costs incurred by employees for their transport

For decades now, it has been a well-established rule in France that employers should pay for the costs incurred by their employees for their *professional* mobility, from taxi, short-term rental and employee car mileage-related expense claims, to long-distance rail and air tickets. Yet in many cases employers in France contribute to the mobility costs of their employees well beyond the strict scope of professional mobility.

**Mandatory contribution to the costs of commuting by public transport**

Starting with Paris in 1983,[34] it has become *mandatory* for employers to contribute *at least 50%* to the costs of public transport season tickets purchased by their employees for daily *public transport commuting* between their home and their regular place of work. Twenty-five years later, in 2008,[35] this

[34] *Loi n°82-684 du 4 août 1982 relative à la participation des employeurs au financement des transports publics urbains*, Art. 5. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000000880224.

[35] *Loi n°2008-1330 du 17 décembre 2008 de financement de la sécurité sociale pour 2009*, Art. 20. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte= JORFTEXT000019942966.

obligation was extended to all employers in France, and was also extended to the costs incurred by employees for subscribing to a public bike-sharing scheme. As regards the tax status of these employee benefits, they are excluded from the employee's personal income tax base, as well as from the company's social security contribution base. Employers can decide to contribute more than 50% to the costs of public transit season tickets; however, contributions above the mandatory 50% threshold are taxable.

Employers' mandatory contributions to the costs incurred by their employees for their public transport commute amounted to 811 million EUR for the Paris region alone in 2012.[36] In other words, combining both this contribution and the VT tax revenues (3.235 billion EUR in 2012), companies provided 47% of the total Paris region transport authority's 8.608 billion EUR operating budget in 2012. By way of comparison, public subsidies contributed close to 20%, passenger ticket sales contributed a little over 30%, and other revenues (from advertising, fines, etc.) contributed close to 3%.

**Voluntary contributions to the costs of employee mobility for *personal* purposes**

The same act in 2008 launched a new incentive scheme, labelled the 'transport allowance' scheme (in French: '*prime transport*'), which made it possible for employers (on a voluntary basis) to contribute to the costs incurred by certain types of employees for their *daily commute by car* between their home and their regular place of work.[37] Only two types of employees are eligible for this second scheme: *i)* employees living outside the Paris region and outside any of the regional urban transport authority zones; and *ii)* employees living in the Paris region or in one of the regional urban transport authority zones, but for whom car use is necessary due either to the lack of a public transit service between their home and their regular place of work, or to particular working hours (e.g. night-shift work, staggered hours). This 'transport allowance' is excluded from the employee's personal income tax base and from the company's social security contribution base, up to a threshold of 200 EUR per year.

Another quite common way for companies to contribute to the costs incurred by their employees for their personal transport, lies in the supply of 'official cars' – also called 'perk cars', i.e. company cars which employees receive as part of their benefits package (or 'perks') and can use for both professional and

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[36] Source: http://www.stif.org/organisation-missions/volet-economique/financement-transports-publics/financement-transports-franciliens-442.html.

[37] This scheme (for car-commuting) and the one previously discussed (for public transit commute) are exclusive of one another.

private purposes,[38] The use of company cars for private purposes is considered a benefit in kind under French law, i.e. a non-wage benefit provided in addition to the employee's normal wage. It is therefore subject to personal income tax and to employer's and employee's social security contributions.[39]

Other forms of voluntary contributions by companies to the costs of their employees' personal mobility may include: *i)* company loans for the purchase of a private car; *ii)* holiday vouchers (in French: '*Chèques-Vacances*'[40]); or else *iii)* employer rebates on cars and transport tickets, for the employees of car manufacturers and transport operators respectively.

### 2.3.3 Companies further contribute to the general public budget through various tax schemes

On top of their abovementioned contributions, companies are subject to: *i)* ordinary duties and taxes on transport equipment and services (e.g. motor vehicle registration tax, motor vehicle insurance premium tax, domestic consumption tax on energy products, civil aviation tax, airport tax);[41] *ii)* a specific annual tax on corporate passenger cars (TVS, for: *Taxe sur les Véhicules de tourisme de Société*).

**How much do companies contribute to the revenues from ordinary taxes on vehicles and transport services?**

The standard taxes listed above represent huge tax revenues for the general public purse (including the respective budgets of the state, local authorities and other public bodies): in 2012, 2.1 billion EUR for the motor vehicle registration tax, 1.0 billion EUR for the motor vehicle insurance premium tax,

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[38] See Chapter 3 for detailed definitions of these terms.

[39] Chapter 3 provides further detail on taxes applicable to company car benefits.

[40] '*Chèques-Vacances*' were created in 1982 with a view to facilitating access to holidays for employees in the lowest-income categories. See: *Ordonnance n°82-283 du 26 mars 1982 portant création des chèques-vacances*. Available from: http://legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000000339926.

[41] VAT is a notable exception as most companies are allowed to deduct the VAT they pay on their purchases (input tax) provided that the goods or services are used for their business activities. Companies that are not obliged to charge VAT on their outputs (e.g. schools, banks, insurance companies, medical activities, small businesses below the VAT threshold) cannot deduct input VAT. (Source: http://ec.europa.eu/taxation_customs/taxation/vat/traders/vat_refunds/index_en.htm)

23.6 billion EUR for the domestic consumption tax on energy products (more prosaically known as the 'fuel tax'), 0.6 billion EUR for the civil aviation tax, and 0.9 billion EUR for the airport tax (SOeS, 2013g). Overall, these ordinary taxes on transport equipment and services generated more than 28 billion EUR in tax revenues in 2012.

However, from the publicly available sources (in particular: SOeS, 2013g), we were not able to isolate the respective contributions of companies and of households to each of these tax revenue categories.

**Almost a billion euros in annual revenues from the TVS tax scheme on corporate passenger cars**

TVS is an annual tax levied on companies for the use of passenger cars (registered in the $M_1$ category under EC Directive 2007/46/CE) and some Sport Utility Vehicles and Multi-Purpose Vehicles.[42]

The TVS tax scheme being exclusively levied on companies, it therefore constitutes an explicit contribution of companies to the general budget of the state. This contribution amounted to 965 million EUR in 2012, up from 644 million EUR in 2000, but down from an all-time high of 1,140 million EUR in 2007, just before the economic and financial crisis (SOeS, 2013g). In 2011 and 2012, TVS tax revenues contributed a little over 2% of the total tax revenues allocated to the compulsory social security pension scheme in France (Sécurité Sociale, 2013).

For all the above-mentioned contributions (both mandatory and voluntary) by companies to the funding of mobility (both their own and general mobility), we could not but be aware that little research has been done to find out how they are perceived by companies, and on what criteria they are optimised.

# 2.4 Corporate mobility management, from theory to practice

## 2.4.1 A brief literature review on corporate mobility management

In their *Mobility Management User Manual*, MOMENTUM/MOSAIC (1999) noted that '*Mobility Management measures are quite diverse and can be organised in different ways according to local conditions. On a question of scale, two levels can be distinguished – the urban/regional level and the site level. Although the objectives for both levels are the same, organisation and*

[42] See Chapter 7 for a detailed account of the TVS tax scheme.

*procedures may differ*'. The site-level approach is closely connected with 'company mobility management'.[43] Indeed, one of the key pillars of such an approach will be the site-based 'company mobility plan',[44] as noted by MOMENTUM/MOSAIC: '*In working with site owners/operators, a comprehensive concept of measures aimed at influencing the need for transport to and from that site can be elaborated in a Mobility Plan*'.

### Company mobility management as policy

Although companies have long been acknowledged by policy-makers as key players in the planned shift towards more sustainable mobility, the literature on company mobility management is far from being as rich as that on mobility management in general.

We could find two main approaches to corporate mobility management in the literature, both mainly focused on a policy perspective, and both in our view open to criticism. When it was not construed as a site-level version of mobility management (MOMENTUM/MOSAIC, 1999), corporate mobility management was sometimes targeted as the main focus of mobility management because of the significant impacts of commuting (EPOMM/MAX, 2009).

*Approach No.1: Corporate mobility management is mobility management at site-level.* This approach is open to criticism because it proposes a top-down approach (from regional, to local, to site level) that is likely to ignore several differences in nature between companies, on the one hand, and regional or local authorities, on the other hand. In particular: *i)* corporations can be multi-located, which can be source of both opportunities (favourable local conditions, benchmark of best practices, feedback on operating experience) and threats (extra costs due to the fragmented location and structure include: lower returns to scale, risk of failing to achieve the critical mass needed to deliver certain services efficiently, transaction costs due to the need to acquire locally relevant information on public policies, etc.), as regards the design and implementation of an effective mobility management policy; *ii)* most corporations are private actors with higher profitability expectations compared with regional and local public authorities, and with more limited (though not null) intrinsic motivation for tackling such 'externalities' as congestion or pollution; *iii)* mobility is usually not the core business of the corporations considered, thereby explaining both the lack of internal skills to deal with the issues at stake, and the low priority of mobility-related projects.

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[43] We also use 'corporate mobility management' (OECD/ITF, 2010) as a synonymous concept.

[44] See the following subsection for further information on this concept.

*Approach No.2: Corporate mobility management is (or should be) the main focus of mobility management*. This approach is open to criticism on two grounds. First, this approach seems incomplete because it places too much emphasis on company-related mobility, and in most cases, on the daily commute alone, as the key targets for a change towards more sustainable mobility attitudes and behaviour. As was previously mentioned, it is true that daily car commuting accounts for close to half the distances travelled by car in France and most of the peak hour congestion. However, other issues should not be overlooked when considering a transition towards a sustainable mobility system: in particular, the rise in car use for shopping purposes (which is still considered to be *private* mobility) should be under close scrutiny by urban planners for the development of large out-of-town shopping centres (see, in particular: Broomberg, 2010). Furthermore, the excessive emphasis on daily commuting entails an excessive focus on *passenger* mobility, which tends to underrate the issues at stake in the transport of freight and other goods.

We would like to acknowledge the efforts of participants in the MoMa.BIZ project in developing an approach to corporate mobility management that remedies many of the failings of the previous approaches:[45]

> *'Company Mobility Management (CMM) is about analysing, improving and monitoring the travel of employees (and transport of goods), in an effort to influence their work related mobility behaviour and reduce the solo-use of cars.*
> *The CMM could easily be extended to an entire Business or Industrial Zone (BIZ), where companies collaborate in order to achieve common targets, with clear benefits: 1) Sharing of the work load; 2) Possibility to implement a greater range of mobility actions; 3) Sharing of the costs; 4) Creation of a critical mass that can attract the attention and obtain the collaboration of local stakeholders, i.e. local authorities.'*
>
> (MoMa.BIZ, 2013a)

[45] MoMa.BIZ (Mobility Management for Business and Industrial Zones) was a European project implemented in small/medium cities in 5 European countries (May 2010 – February 2013, IEE Programme). The main aim of MoMa.BIZ was to contribute towards the promotion and dissemination of sustainable mobility in business and industrial zones across Europe through the creation of: *i)* an innovative methodology for the development of mobility plans in business and industrial zones; *ii)* 'Boxed solutions', which are a set of guidelines for the successful planning and implementation of standard mobility actions in business and industrial zones; and *iii)* a mobility labelling system specifically designed for business and industrial zones. (Source: http://www.moma.biz)

A noteworthy strength of this approach is that, by considering corporate mobility management *from the standpoint of the corporation*, they identify some key issues in the practical implementation of CMM, in particular the *costs* involved and the relevant *scale of action*.

**Company mobility plans**

As already mentioned, company mobility plans are often presented as the main tool for implementing company mobility management (see, for instance: MOMENTUM/MOSAIC, 1999). However, just as we observed for the concepts of 'mobility management' and 'corporate mobility management' and their numerous respective derivatives, there is no agreement in the scientific literature about a specific term for the concept of 'company mobility plan'.

Indeed, in English, none of the following terms has ever truly come into its own: '(company/workplace) mobility plan' (OECD/ITF, 2010), 'green commuter plan' (Coleman, 2000; Rye and McGuigan, 2000), 'green transport plan' (Potter, Rye and Smith, 1999), '(workplace/employer-based) TDM programme' (Modarres, 1993; Rye, 1997; Hendricks and Georggi, 2007), 'employer transport plan' (Rye, 1999a and 1999b; Watts and Stephenson, 2000; Van Malderen *et al.*, 2011), '(company/workplace) travel plan' (Rye, 2002; Enoch and Potter, 2003; Bamberg and Möser, 2007; Möser and Bamberg, 2008; Roby, 2010; Cairns, Newson and Davis, 2010; Enoch, 2012), 'employer mobility plan' (Van Malderen *et al.*, 2010), or 'employer-based mobility programme' (Van Malderen *et al.*, 2012).

In French however, although the concept of 'mobility plan' (in French: '*Plan de mobilité*') is the one originally used by the legislature,[46] the term '*Plan de Déplacements d'Entreprise*' (PDE) has gained wide recognition among practitioners in the last decade. In addition, three variations on the term exist, differing only in the nature of the entity setting up the mobility plan: *i)* PDA (*Plan de Déplacements d'Administration*), when the mobility plan is set up by a public administration; *ii)* PDIE (*Plan de Déplacements Inter-Entreprise*), when the mobility plan is pooled by several companies with closely located sites (e.g. in the same business or industrial zone); and *iii)* PDES (*Plan de Déplacements d'Etablissement Scolaire*), when the mobility plan is set up by an educational institution.

As for the definition of what a company mobility plan is, what it can achieve, and how it can achieve it, we suggest using the following definition from the COMMERCE project:[47]

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[46] See Article 96 of the abovementioned 2000 'loi SRU'.

[47] COMMERCE (Creating Optimal Mobility Measures to Enable Reduced Commuter Emissions) was a European project (October 2007 – October 2010, IEE Programme),

> *'A workplace travel plan is a long-term management strategy employed by an organisation to promote more sustainable transport amongst staff, visitors and deliveries to its site. This can simultaneously bring about a number of benefits such as a reduction in associated $CO_2$ emissions, cost savings, reduced congestion and improved health through active travel so that both employers and employees truly benefit.*
> *A workplace travel plan usually addresses a variety of different travel types to and from a site, namely: 1) Commuter journeys; 2) Visitors; 3) Business travel undertaken by staff; 4) Fleet vehicles operating as a part of company activity; 5) Delivery and contractors.*
> *Where more than one company occupies a site, it's possible to join forces to produce a travel plan with benefits for all.'*
>
> (COMMERCE, 2010b)

Regardless of the scope considered for the portion of company-related mobility to be included in company mobility plans (whether or not limited to the daily commute, whether or not limited to passenger travel, etc.), there are four main approaches to company mobility plans in the scientific literature.

The first approach more or less takes for granted the intrinsic efficiency of company mobility plans and takes the policy-maker's standpoint in analysing the conditions for facilitating the uptake of these mobility management tools by corporations. Research adopting this approach showed that one of the potentially important roles of the public authorities lies in tax reform. In particular, they highlighted the need to tackle the deterrent effects of the distortionary tax treatment of employee benefits such as employer-provided parking or company cars (Potter, Rye and Smith, 1999; Rye, 1999b; Enoch and Potter, 2003; OECD/ITF, 2010). Overall, the scope for potential government action considered in this current of research is fairly wide, from the supply of adequate information and support facilities, to setting appropriate regulatory frameworks in the fields of transport, environment and land use (e.g. through land development authorisation processes or zoning requirements for the provision of parking spaces).[48]

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whose main aim was to increase the number and improve the quality of Mobility Plans developed by small- and medium-sized companies by providing tools and standards based on best practice across Europe. The COMMERCE project envisaged mobility plans as a clear way of reducing $CO_2$ emissions caused by company-related mobility. (Source: http://eaci-projects.eu/iee/page/Page.jsp?op=project_detail&prid=
1492)

[48] On the links between mobility management and parking management, see also: Litman (2013).

Somewhat mirroring this first approach from the perspective of the policy-maker, a second stream of research looks at the attitudes of employers to company mobility plans as a transport policy tool. Moving on from an early stage characterised by much scepticism – and/or wait-and-see attitudes – on the part of employers (Rye, 1999a; Coleman, 2000), more recent literature on the topic suggests an evolution towards more proactive attitudes and the gradual embedding of company mobility plans within organisations (Roby, 2010). Analysing the motivations of corporations for introducing mobility management measures, OECD/ITF (2010) noted that their behaviour was still most influenced by the following two sources of pressure: *i)* external regulations (with regard to transport *per se*, or linked with land development authorisation processes or zoning requirements for the provision of parking spaces, etc.); and *ii)* transport-related costs (e.g. costs relating to the supply of parking for employees and customers).

A third current of research has developed to assess the efficiency and effectiveness of company mobility plans, either from the standpoint of public authorities (Modarres, 1993; Rye, 2002), or from the standpoint of corporations (Rye and McGuigan, 2000; Watts and Stephenson, 2000; Rye, 2002; Hendricks and Georggi, 2007; Bamberg and Möser, 2007; Möser and Bamberg, 2008; Cairns, Newson and Davis, 2010). Some of the papers in this research current focus on the success factors at company level for maximising employees' support of, and participation in, the company mobility plan (OECD, 2002; Vanoutrive *et al.*, 2010; Van Malderen *et al.*, 2011 and 2012). Identified success factors are analysed with a view to pinpointing 'best practices' in the field of corporate mobility management (e.g. financial incentives, information flow, provision of facilities, parking management). Best practices prove to differ from one corporation to another depending on their size, the nature of their business, site characteristics, etc. (Van Malderen *et al.*, 2012).

Drawing on the findings of the three currents of literature described above, a final approach to company mobility plans consists of reports, rather than scientific papers, which offer ready-made, practical advice to companies for the design and implementation of mobility plans. This approach could be labelled as action-research, research that seeks to solve a practical problem facing organisations (namely: the design and implementation of an effective and efficient mobility plan) and to produce guidelines based on best practice (Denscombe, 2010: p.10). More detail on this current of literature can be found in the section that follows.

### 2.4.2 The corporate toolbox for mobility management

**'One-stop' resources for company mobility management**

Many of the research projects and individual research previously mentioned have produced new insights into the potentialities and limitations of a wide range of measures available to corporations for the development of a company mobility plan.

In some cases, research outputs have been collated into 'practical guides' – sometimes labelled 'toolkits' or 'toolboxes' – intended to present the most comprehensive possible information on potentially applicable measures. Such 'exhaustive' guides on company mobility plans include the following in the traditional, 'static' form: *i)* in English: MoMa.BIZ (2013a to 2013j), COMMERCE (2008 and 2010a), VCD (2008); *ii)* in French: OVE (2011b), ADEME (2013), and GoodPlanet.org (undated). In France, similar guides have been developed for company mobility plans pooled among companies located in the same business zone (PDIE), e.g. OREE/ADEME (2010), and for mobility plans set up by public administrations (PDA), e.g. ARENE Île-de-France (2007).

Most of these guides provide both guidelines as to what the structure and content of an effective mobility plan should be and a commented list of measures potentially applicable as part of a mobility plan project.

The most common measures listed in the abovementioned practical guides can be sorted into the following six categories (references to detailed publications focusing on one particular measure will be given as footnotes):

1) *Promotion of 'soft' modes of transport (e.g. walking[49], cycling[50])*: *i)* promotional material (on benefits to health, on safe cycle and walking routes to the premises); *ii)* infrastructure (walkway lighting and maintenance, safe crossings, safe cycle lanes to the site); *iii)* on-site facilities (secure cycle parking, lockers, changing facilities and showers, repair service); *iv)* company bike pool for work-related travel; *v)* financial incentives (interest-free loans by employers, discounts for bicycle purchase); *vi)* cycle mileage allowance (i.e. reimbursement for staff cycling on company business).
2) *Promotion of public transport:[51]* *i)* promotional material (on costs, parking restrictions, stress); *ii)* (real-time) information on public transit services (routes, schedules, costs); *iii)* participation in the costs of public

[49] For further reference, see: MoMa.BIZ (2013c).

[50] For further reference, see: MoMa.BIZ (2013b), ViaNova (2008).

[51] For further reference, see: MoMa.BIZ (2013d).

transit season tickets (or interest-free loans for staff to purchase an annual season ticket); *iv)* shuttle bus (to out-of-town sites).

3) *Promotion of alternative car technologies and uses:*[52] *i)* energy-efficient company car pools for work-related travel; *ii)* review of the company car policy to incentivise low-emission vehicles;[53] *iii)* car-sharing (access to a car club for work-related travel);[54] *iv)* ride-sharing[55] (dynamic information on demand and supply, 'guaranteed ride home' programme for non-driving commuters[56]); *v)* car park management (priority staff parking for electric vehicles or high-occupancy vehicles, reduction in the number of parking spaces to save on company parking costs, introduction of parking charges, shared or pooled parking facilities,[57] parking cash out);[58] *vi)* eco-driving training;[59] *vii)* 'cash or car' (a cash allowance instead of a company car allowance).

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[52] For further reference, see: MoMa.BIZ (2013g).

[53] For further reference, see: RECODRIVE (2010). RECODRIVE (Rewarding and Recognition Schemes for Energy Conserving Driving, Vehicle procurement and maintenance) was a European project (October 2007 – March 2010, IEE Programme) which sought to merge existing eco-driving initiatives with good fleet management and logistics optimisation practices to push fuel saving in fleets beyond 10%. RECODRIVE focused on all processes with human components and supported fleet owners. (Source: http://eaci-projects.eu/iee/page/Page.jsp?op=project_detail&prid=1689)

[54] For further reference, see: MoMa.BIZ (2013f), Vanoutrive *et al.* (2012), MOMO Car-sharing (2009a). MOMO Car-sharing (More options for energy efficient mobility through Car-sharing) was a European project (October 2008 – September 2011, IEE Programme) which aimed to extend the number of car-sharers in Europe and to establish car-sharing in cities where this innovative system did not yet exist. MOMO Car-sharing raised awareness about car-sharing and made recommendations on how to develop and establish new car-sharing schemes. (Source: http://eaci-projects.eu/iee/page/Page.jsp?op=project_detail&prid=1879)

[55] For further reference, see: MoMa.BIZ (2013e), US EPA (2005).

[56] For further reference, see: US DOT (1990).

[57] For further reference, see: CERTU (2010), Litman (2013).

[58] For further reference, see: Shoup (2002).

[59] For further reference, see: RECODRIVE (2010).

4) *New or alternative work practices*: *i)* telecommuting/working (IT support for teleworking at home or from a satellite office); *ii)* flexi-time (flexible working hours to avoid peak-time commuting); *iii)* staggered working hours;[60] *iv)* compressed workweek(or four-day workweek);[61] *v)* videoconferencing and conference calls; *vi)* on-site facilities (e.g. laundry, concierge).
5) *Improvement of goods transport*: *i)* rationalisation of freight deliveries (use of local suppliers, requirements for coordination of deliveries, incentives for pooling logistic facilities);[62] *ii)* sustainability requirements on suppliers and carriers (use of alternative-fuel vehicles, emission criteria).
6) *Qualified personnel: i)* appointment of a mobility manager;[63] *ii)* capacity building among personnel on mobility management issues,[64] at policy level (strategic know-how, background knowledge and competence to act), management level (project management capacity, broad, practice-oriented knowledge and good communication skills), and at user level (good organisational, social and communication skills and customer-oriented thinking).

**Interactive decision-support tools**

On top of the abovementioned traditional, 'static' guides on applicable company mobility management measures, some of the most recent research projects have come with more interactive decision-support tools for companies. Two examples of such interactive, online tools are: *i)* the MaxExplorer tool[65], developed within the framework of the MAX project (supported by the 6th RTD Framework

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[60] For further reference on a specific case study, see: Giuliano and Golob (1990).

[61] For further reference on specific case studies, see: Ho and Stewart (1992), Sundo and Fujii (2005).

[62] For further reference, see: Camman *et al.* (2013).

[63] For further reference, see: Gustafson (2012) on the role of the 'travel manager' (see also: Anderson *et al.* (1999) on the role of the 'corporate travel management department'), Vanoutrive *et al.* (2010) on the role of the 'employee transport coordinator', and MOMENTUM/MOSAIC (1999) on the role of the 'mobility manager'.

[64] For further reference, see: MOMENTUM/MOSAIC (1999).

[65] See: http://epomm.eu/index.php?id=2745.

Programme); and *ii)* the TOOLBOX for mobility management measures by companies (supported by the IEE Programme).[66]

Both online tools are based on decision-support systems designed to customise mobility management measures for the specific needs of a given company on the basis of some of its key features. For instance, the MaxExplorer tool will consider the following company features: *i)* organisation type (company, public transport operator, public authority, school, other public service); *ii)* main target group (for a company: own employees or site visitors); *iii)* location of the main target group (rural, suburban area, urban area); *iv)* size of the main target group (for a company: less than 50 employees, 50 to 99 employees, 100 to 499 employees, more than 500 employees; or: less than 500 visitors/day, more than 500 visitors/day).

Using this preliminary information on the organisation and its target group for mobility management, the MaxExplorer interactive tool with be able to select the most appropriate mobility management measures from a list of more than 20, and will provide a detailed description of each selected measure, existing examples of implementation, and some comments on the likely impacts of the measure in the context considered. The TOOLBOX for company mobility management measures is built on similar principles.

### 2.4.3 The policy framework in France

OECD/ITF (2010) stressed the role of public authorities in facilitating company mobility management policies, through: *i)* regulation (enforcement); and/or *ii)* support (encouragement). The review of existing regulations and initiatives among ITF member countries revealed various combinations of the two kinds of measures.

The French approach to urban mobility plans is mostly conceived and implemented top-down through laws and regulations, although local authorities play the main investor role by planning and financing mobility projects (EPOMM, 2013). Indeed, requirements for urban mobility plans (in French: PDU, for '*Plan de Déplacements Urbains*') were progressively introduced and reinforced as powerful tools for mobility management through three successive acts at national level, in 1982 (guidelines for internal transport organisation),[67] 1996

[66] See: http://www.mobilitymanagement.be/english/index.htm.

[67] *Loi n°82-1153 du 30 décembre 1982 d'orientation des transports intérieurs* (also know as 'LOTI'). Available from: http://legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000000319738.

(air quality and rational energy use act),[68] and 2000 (urban solidarity and renewal act).[69] Since then, all cities with more than 100,000 inhabitants have been required to set up a PDU.

PDUs should provide guidance for traffic, public transport, walking, cycling, car-pooling, awareness raising and mobility management. The sixth and final objective of urban mobility plans listed in Article 14 of the 1996 act was: to *encourage* companies and public administrations to promote the use of public transit and car-pooling (also known as ride-sharing) to their employees. However, following poor progress in company mobility management measures between 1996 and 2000, the 2000 urban solidarity and renewal act reinforced the requirements on local authorities to *encourage and assist* companies in setting up mobility plans (Articles 96 and 113), but still did not force companies to set up such plans. By 2008, therefore, less than 500 company mobility plans had been introduced in France (Duchène and Crépin, 2008).

The legislative framework for company mobility management is more forceful in the Paris region than it is in the rest of France:

1) In 2005, the initial Atmospheric Protection Plan (PPA) for the Paris region provided, as the first of nine regulatory measures, for the *mandatory* implementation of mobility plans by major traffic generators (PPA-IF, 2005). Major traffic generators were defined under the PPA implementing decree of 2008[70] as company sites with more than 700 employees commuting to work by car on a daily basis.[71] Thus, 124 sites

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[68] *Loi n°96-1236 du 30 décembre 1996 sur l'air et l'utilisation rationnelle de l'énergie* (also known as 'Loi LAURE'). Available from: http://legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000000381337.

[69] *Loi n°2000-1208 du 13 décembre 2000 relative à la solidarité et au renouvellement urbains* (also known as 'Loi SRU'). Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000000207538.

[70] *Arrêté inter-préfectoral n°2008-1926-1 relatif à la mise en œuvre du Plan de Protection de l'Atmosphère et à la réduction des émissions de polluants atmosphériques en Île-de-France*. 30th October 2008. Available from: http://www.driee.ile-de-france.developpement-durable.gouv.fr/IMG/pdf/AP_PDE_30oct08_cle564a1c.pdf.

[71] The number of car users among the employees of a given company site is determined by multiplying the actual number of employees by the average modal share of the passenger car in the daily commuting practices of residents of the municipality where the company site is located (relevant data is provided by the national population census).

in the region were identified as subject to the mobility plan mandate under the initial PPA.

2) In 2013, the revised PPA confirmed the mandatory implementation of mobility plans for major traffic generators (PPA-IF, 2013). The revised PPA implementing decree of 2013[72] lowered the threshold for qualification as a major traffic generator from 700 to 500 employees commuting to work by car on a daily basis.[73] 341 sites were identified as subject to the mobility plan mandate under the revised PPA.

Other regions or districts adopted similarly binding approaches to the implementation of company mobility plans within the framework of their respective PPAs. As an illustration, the *Bouches-du-Rhône* district (which includes the City of Marseilles) set a 250-employee threshold in its initial PPA in 2006,[74] which it confirmed in the revised 2013 PPA.[75]

Yet, to the best of our knowledge, little research has been done to assess the effectiveness of the policy framework in developing relevant corporate mobility management measures at company level.

## 2.5 Conclusion

By building an analytical framework for company-related mobility, we were able to identify various categories of mobility patterns on the basis of their relative sensitivity to corporate influence. Our literature review showed that two categories of mobility patterns that are *directly* dictated by corporate activities (i.e., service and business trips), have been fairly well documented, namely: long-haul business travel and urban freight transport. On the other

[72] *Arrêté inter-préfectoral n°2013-084-0002 relatif à la mise en œuvre du Plan de Protection de l'Atmosphère révisé pour l'Île-de-France*. 25th March 2013. Available from: http://www.driee.ile-de-france.developpement-durable.gouv.fr/IMG/pdf/arrete_application_vfinale_cle134e15.pdf.

[73] Using the same calculation rule as previously.

[74] *Arrêté approuvant le Plan de Protection de l'Atmosphère des Bouches-du-Rhône*. 22nd August 2006. Available from: http://www.paca.developpement-durable.gouv.fr/IMG/pdf/ppa_complet_2006_08_11_avec_AP_cle7725f7.pdf.

[75] *Arrêté de mise en œuvre des mesures de police générale du Plan de protection de l'atmosphère révisé pour le département des Bouches-du-Rhône*. 14th May 2014. Available from: http://www.paca.developpement-durable.gouv.fr/IMG/pdf/PPA_13_AP_Police_Generale_14_05_14_cle5881d4.pdf.

hand, long-distance freight transport and local business travel count among the *blind spots* of the literature on company-related mobility. The daily commute, which enjoys a *hybrid* status between corporate and private mobility, is probably the best-documented mobility pattern within the scope of our analysis. While this state of affairs may be a direct consequence of the very substantial effects of daily commuting on the global operation of the mobility system (e.g. because of peak time congestion), we do not consider this to be a sufficient reason for entirely overlooking other mobility patterns and the potential gains to be anticipated from their optimisation. Under the label of 'company-enabled mobility', we highlighted the existence of mobility patterns *in the private sphere* that employ means which are fully or partially paid for by companies, e.g. private local trips using a public transit pass paid for by the employer, or private weekend trips using a company car. By and large, company-enabled mobility patterns are also a blind spot in the literature on mobility.

By examining the literature for insights into how companies factor mobility issues into their *strategic* decision, we found elements in the field of research into *agglomeration effects* to support the assertion that mobility is an essential factor of accessibility (to potential customers and employees, as well as partners and suppliers) and productivity, which companies take into account in their decisions relating to location choice. On the other hand, while we anticipated that we would find complementary elements in the literature looking at corporate social responsibility (CSR) as to how companies factor mobility into their decisions relating to sustainable development, we had to face the fact that mobility is not as yet considered a core dimension of CSR.

Moving on to look at financial flows, we have shown that companies in France are significant contributors to the funding of the wider mobility system. In particular, through a tax scheme that seems to be specific to France (the VT tax scheme), companies play a crucial part in the funding of urban public transport: with close to 7 billion EUR in annual VT tax revenues in 2012, they contributed close to half the total funding of urban public transport in France. In addition, employers in France are also required to make mandatory contributions to the costs incurred by their employees for their daily commute by public transport: they bear 50% of the costs of public transport season tickets and bike-sharing scheme subscriptions. The additional cost to companies of PT season tickets in the Paris region alone was 0.8 billion EUR in 2012. Beyond their mandatory contributions to the costs their employees' daily commute by PT, companies can also contribute on a *voluntary* basis to the costs of employee mobility for *personal* purposes. Such contributions may take various forms, including, but not limited to: *i)* contributions to the costs incurred by employees for their daily commute by car (subject to restrictive conditions on the place of residence and/or working times); and *ii)* the supply of 'official cars', which employees receive as part of their benefit packages and can use for both professional and personal purposes.

On top of their above-mentioned contributions to mobility *per se*, companies further contribute to the general budget through: *i)* ordinary duties and taxes on transport equipment and services, the amount of which we were unable to assess in our preliminary analysis; and *ii)* a specific annual tax on corporate passenger cars (the TVS tax scheme), which generated close to 1 billion EUR in revenues in 2012, or 2.1% of the total tax revenues allocated to the compulsory social security *pension scheme* in France.

In the light of the significant physical and financial flows involved, we went on to analyse the concept of 'corporate mobility management' and found that most of the literature dealing with this general concept failed to address it from the standpoint of the corporation, and therefore overlooked some key issues in the practical implementation of CMM, in particular the costs involved and the relevant scale of action. On the other hand, the rather extensive literature on the 'company mobility plan' provides useful insights into: *i)* the conditions for facilitating the uptake of these mobility management tools by corporations from a public policy standpoint (e.g. through tax reform, supply of adequate information and support facilities, and appropriate regulatory frameworks in the fields of transport, environment and land use); *ii)* the attitudes of employers to company mobility plans and their motives for introducing mobility management measures (mainly influenced by regulations and by transport-related costs); and *iii)* the efficiency and effectiveness of company mobility plans (with different best practices promoted depending on the size, nature of business and site characteristics of companies). In addition, drawing on the insights gained into the potentialities and limitations of a wide range of measures available to corporations for the development of a company mobility plan, researchers have developed 'practical guides' (so-called 'toolkits' or 'toolboxes') intended to present the most comprehensive possible information on potentially applicable measures. Such guides usually provide guidelines as to what the structure and content of an effective mobility plan should be, as well as a list of measures potentially applicable within a mobility plan project. These usually include measures to promote 'soft modes' (e.g. walking, cycling), public transport, alternative car technologies and uses (e.g. low-emission vehicles, eco-driving, car-sharing), alternative work practices (e.g. teleworking, staggered working hours), goods transport optimisation, or capacity building and management in all these fields.

Focusing on the French public policy framework for promoting corporate mobility management, we found that local authorities are responsible for *encouraging and assisting* companies in setting up mobility plans. While some local authorities (e.g. the Paris region) have set mandatory requirements for major traffic generators to implement such mobility plans, we could find no evidence of the effectiveness of corporate mobility management policies, whether mandatory or voluntary.

Altogether, it would appear that, while public policy-makers in Europe and the USA have promoted corporate mobility management based on the assumption that companies could be major agents of change towards a more sustainable mobility system, insufficient research has been done to analyse the issues at stake (including, the physical and financial flows involved, but also, the externalities) or their presence in the strategic decision-making process of corporations. Therefore, the assessment of the *actual benefits* to be obtained from company mobility management, as well as the analysis of the *conditions* needed to maximise these benefits, still depend on the progress of research in that sphere.

# *Part II*

# *The nature and features of corporate car fleets*

# Chapter 3
# Corporate car fleets: Key definitions and issues

## 3.1 Introduction

### 3.1.1 Background

In the literature that looks at companies as components of – and players in – the larger mobility system, two main currents of research in recent decades have investigated the vehicle fleets operated by companies. On the one hand, starting in the late 1970s, researchers in the USA have endeavoured to analyse company vehicles because of their increasing share in new car sales (from 8.9% in 1966 to 23.7% in 1990)[1] (Shonka, 1978; Miaou, 1992). Corporate car fleets in the USA have been investigated through a wide range of censuses and sampling surveys, in order to gain insight into their composition (e.g. fleet size, vehicle types, vehicle makes, vehicle weights), their operating characteristics (e.g. vehicle age, length of ownership, refuelling practices), vehicle use (e.g. annual distance travelled, trip purposes), and their decision-making processes. Following the adoption of purchase mandates to promote the adoption of alternative-fuel vehicles by companies in the USA in the 1990s,[2] researchers have been able to draw upon the gradually accumulated knowledge about company fleets in order

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[1] For fleets defined as '*cars operating in groups of ten or more*' (Shonka, 1978).

[2] The 1992 Energy Policy Act (EP Act) and the 1990 Clean Air Act Amendments (CAAA) both contained provisions requiring fleets throughout the USA to purchase increasing number of alternative fuel or clean fuel vehicles (US Code, 2010a, 2010b and 2010c).

to assess potential demand for alternative-fuel vehicles (see, for instance: US EPA, 1994; Golob *et al.*, 1994; Golob *et al.*, 1997).

On the other hand, the taxation of company-car fringe benefits[3] has recently emerged as a hot topic of research in several European countries (and also Israel, Australia and New-Zealand), on account of rising concerns about the possible distortionary effects of such taxation. Analysing company-car taxation across 19 European Member States, Naess-Schmidt and Winiarczyk (2010) observed that the high proportions of new company cars in total new car sales in Germany, the UK and the Netherlands (respectively 60%, 58%, and 54% in 2008) could stem from taxation being more favourable to company-car fringe benefits than to monetary wages. Yet, some of the characteristics of the vehicles purchased by companies (e.g. high engine horsepower, high emissions) raised concerns about the sustainability of these fleets. Researchers have therefore endeavoured to assess and explore the effects that excessively favourable tax conditions for company-car fringe benefits could have on car ownership and use in the countries considered (see, for instance: Gutiérrez-i-Puigarnau and Van Ommeren, 2011, for a focus on the Netherlands; Shiftan, Albert and Keinan, 2012, for a focus on Israel), or else on social welfare in these countries (for a European analysis, see: Naess-Schmidt and Winiarczyk, 2010; see also: De Borger and Wuyts, 2011). It should however be noted that, at the time these analyses were undertaken, basic knowledge about company fleets in these countries was at best in an early stage of development (see, for Belgium: Cornelis *et al.*, 2007; Cornelis *et al.*, 2009). In most cases, it still remains fragmentary today.

France appears to be in a special position among its European neighbours with regard to fringe-benefit taxation on company cars. Indeed, several sources concur that the fiscal treatment of company-car fringe benefits is not as favourable in France as it is in Belgium, Germany or the UK (see, for instance: Naess-Schmidt and Winiarczyk, 2010; Macharis and De Witte, 2012). Perhaps as a result of this, there has been little research so far on the composition of company fleets in France, their patterns of use, or indeed their management processes. In other words, company fleets are a *blind spot* of research in France, and a blind spot of mobility-related public policy as well.

### 3.1.2 Statement of the problem

The growing scientific literature on company car fleets in Europe has revealed the need for further investigation on their composition, patterns of use and operational management. Many shortcuts and oversimplifications are made, for

[3] I.e. employer-provided vehicles that can be used by the employee for private purposes.

lack of data availability, lack of clear definitions and/or lack of adequate analytical frameworks on the issues involved. In France, even more than in neighbouring countries, an in-depth investigation of corporate car fleets would be needed to address the dire shortage of information, and gain some useful insights into the share of company fleets in the total light-duty vehicle stock, their contribution to the activity of companies, their part in the environmental externalities of the wider mobility system, and ultimately their possible role in its transition towards sustainability.

### 3.1.3 Purpose of the chapter

The objective of the analysis presented in this chapter is to start building a much needed knowledge base on company car fleets in France. The first step in our analysis will consist in 'delineating' our research object. We aim to develop an analytical framework which to comprehend the diversity of company car fleets, and propose clear definitions for the new objects we will uncover, starting with a definition of the 'corporate car fleet' as an entity, and further analysing the various modes of possession of the vehicles, the diversity in their patterns of use, the complexity of their management processes, etc.

The second step in our analysis will consist in 'fleshing out' our research object. We will endeavour to collect information on the basic characteristics of corporate car fleets in France, their share in the overall light-duty vehicle stock, their share in new light-duty vehicle sales, and their share in total light-duty vehicle use.

Last, we aim to shed light on some of the main issues at stake with regard to corporate car fleets in France. In particular, we want to investigate the costs of fleets to corporations, and provide preliminary insights into the main components of the costs incurred by corporations through their ownership and use of light-duty vehicles, and into the influence of taxes on the costs of corporate car fleets in particular. Then, we want to provide some initial insights into the *external* costs of corporate car fleets, focusing on some of the major sustainability challenges facing the wider mobility system, namely safety issues, energy issues, and emissions.

### 3.1.4 Method and sources

Because of the lack of prior research on corporate car fleets in the French context, we identified our research object through examination of multiple sources. Besides academic papers on wider mobility issues, we collected information from ministerial documents, special reports on corporate car fleets by the general press, professional journals and other industry sources. The knowledge retrieved from all these sources, together with an on-going qualitative survey of corporate car fleet decision-making processes we launched in 2012 (see Chapter 6), was instrumental in developing adequate analytical frameworks and definitions for our object.

In particular, we used various publications by *long-term rental industry players* (SNLVLD and OVE sources), which provide valuable insights into the composition and main characteristics of the French corporate light-duty fleet, because of their dominant position on this market. However, we paid special attention to the potential biases introduced in our analysis by the nature of the source.

Many valuable insights into the diversity of use patterns and the complexity of fleet decision-making processes were gained from professional journals (e.g. *Flottes Automobiles*, *L'Automobile&L'Entreprise*), or from special reports on corporate fleets in the general press (e.g. *Le Monde*, *Le Figaro*, *Les Echos*, *La Tribune*, *Le Parisien*), which are usually targeted at an audience of fleet managers.[4]

Industry sources and professional journals were also used to gather information on the costs of fleets to corporations. In particular, we chose to base our analysis of the total costs of ownership (TCO, which include all costs associated with vehicle purchase *and* use) of corporate vehicles on a methodology that OVE has been developing since 2012, which provides TCO simulations for a wide range of vehicle market segments in the passenger car and light commercial vehicle categories (OVE, 2014d).

### 3.1.5 Outline of the chapter

The chapter is structured into four main parts and a conclusion. First, we propose a set of definitions (regarding the ownership, composition, operation and management of corporate car fleets) and we develop an analytical framework for our subsequent investigation of corporate car fleets (Section 3.2). Second, we present some key facts and figures on the size, turnover and total annual mileage of the corporate light-duty vehicle fleet in France (Section 3.3). Then, we provide some insights into the total costs of ownership of corporate vehicles and the relative proportions of various cost components (Section 3.4). Finally, we shed light on some of the main external costs of corporate car fleets, with a threefold focus on safety issues, energy issues and emissions (Section 3.5). In the last section, we discuss the significance of corporate car fleets as a component of the wider mobility system and highlight some of the issues that would require further investigation.

[4] While we tried to give credit when credit was due, we acknowledge that our assiduous reading of these professional sources has inspired our thinking far beyond the limited number of references that we include in this chapter.

# 3.2 Key definitions

To begin this investigation into corporate car fleets, we will first set out a few useful definitions. First of all, as has been highlighted by many researchers before us (Shonka, 1978; Miaou *et al.*, 1992; Nesbitt and Sperling, 2001), there is no widely agreed definition of what a vehicle fleet is. A reason for this may be that vehicle fleets are highly diverse (Nesbitt and Sperling, 2001). Among other things, they are diverse *i)* in their ownership status and holding arrangements (the matter of 'who?'), *ii)* in their size and composition (the matter of 'what?'), *iii)* in their underlying rationales, functions, geographic scope of operation and patterns of use (the matter of 'what for?'), and *iv)* in their management and reporting processes and tools (the matter of 'how?').

Thus, starting from the following definition suggested by Miaou *et al.*, we will dedicate this section to developing a better understanding of vehicle fleets through the basic analytical grid of *i)* who, *ii)* what, *iii)* what for, and *iv)* how, in order eventually to suggest a typology of vehicle fleets that will serve as a basis for our further research:

> *'Ideally, a fleet is defined as a group of vehicles, including cars, vans, station wagons, buses, and trucks, operated under a corporation or an institution (i.e., under a unified control) for non-personal activities. Several important features that may help to distinguish fleet vehicles from non-fleet vehicles (owned by households or individuals) are that (1) these vehicles are typically purchased in bulk, (2) vehicles are used for non-personal use during business hours, and (3) in some instances, such vehicles are engaged in pick-up and delivery activities along a fixed or predictable route and are often operated under frequent stop-and-go conditions.'*
>
> Miaou *et al.* (1992: p.5)

## 3.2.1 The 'who?', 'what?', 'what for?', and 'how?' of fleets

### *Who* owns and *who* holds vehicle fleets?

The definition of vehicle fleets provided by Miaou *et al.* (1992) suggests that they are operated under the '*unified control*' of '*a corporation or an institution*', as opposed to those vehicles which are '*owned by households or individuals*'. Nesbitt and Sperling (2001) further illustrate the diversity of ownership of vehicle fleets in stating that they '*are owned by private companies, public agencies, small neighborhood businesses, and large international corporations*'.

*Corporations and institutions*: Many types of business entities, from sole proprietorships to large multinational enterprises, including cooperatives and small and medium enterprises, operate vehicle fleets for their business needs. Furthermore, many public entities and organisations, such as governments, non-governmental organisations, international organisations, charities, etc., operate vehicle fleets to fulfil their missions. Our objective here is not to choose *a priori* among these types of entity, but rather, if the opportunity arises, to qualify the influence of status and type of business on the overall characteristics and patterns of use of the operated fleet. Therefore, drawing on the generic definition of a corporation as '*a group of people authorized by law to act as a legal personality and having its own powers, duties, and liabilities*',[5] we choose to use the term '*corporate vehicle fleets*' to refer to the vehicle fleets of all juridical persons (i.e. legal entities which are not natural persons), whether public or private, large or small.

*Owning and holding*: A first set of definitions we need to specify here relates to the various possible combinations of ownership status and holding arrangement that can be observed when analysing corporate vehicle fleets. '*Ownership*' of a vehicle will be defined as the *legal right of possession* over this vehicle, usually attested by the vehicle registration document.

In recent decades, some companies have chosen to outsource the ownership of their vehicle fleets, whether for strategic reasons (e.g. to focus on their core business), financial reasons (e.g. to avoid recording the corresponding assets in their balance sheet capital) or else operational reasons (e.g. to achieve greater flexibility in the event of a decline in activity). Long-term rental companies offer their corporate fleet customers this kind of 'ownership outsourcing' service.[6] Long-term lease agreements provide for a separation of the registered ownership (property rights) from the actual operation (rights of access and use) of the vehicle, for a duration and at a price set when the said agreement is signed.[7] Through a long-term lease agreement, a company could therefore '*hold*' a vehicle – in the sense that it would have *full-time access* to, and *exclusive use* of, the vehicle – without actually owning it.

Interestingly, in some instances, companies might neither 'own' nor truly 'hold' the vehicles in their fleet. Indeed, they can assign a particular vehicle to a particular employee and transfer to him/her the benefits of full-time access to, and exclusive use of, that vehicle. In such arrangements, companies retain their share of rights and responsibilities over the vehicle (which differ depending on whether the vehicle is leased or owned). In particular, they still act as decision-

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[5] See *Collins English Dictionary*: http://www.collinsdictionary.com/dictionary/english/corporation. [Accessed: 6th August 2014]

[6] See Section 3.3 for further information on long-term rental companies and their share in the corporate vehicle fleet market in France.

[7] In France, long-term vehicle lease agreements are regulated by Article 1709 and subsequent Articles of the Civil Code.

makers in the acquisition and pattern of use of the vehicle. Yet, under our earlier definition, the employee to whom the vehicle is assigned can be considered to 'hold' it as part of his or her household fleet. In our view however, both conditions of *i)* full-time access, and *ii)* exclusive use, have to be met for a company vehicle to be considered as 'held' by an employee.[8]

At this stage, we want to highlight two specific categories of vehicles owned by juridical persons, which we will nevertheless exclude from our definition: *i)* vehicles owned by car dealerships (because they only own the vehicles until they sell them to the end customer, mostly households);[9] and *ii)* vehicles owned by long-term rental companies and directly leased to households, without the involvement of their employer.

**_What_ are corporate vehicle fleets made of?**

The definition proposed by Miaou *et al.* (1992) highlights the great diversity of vehicles that can be found in fleets and alludes, in its mention of bulk-buying (i.e. '*the purchase at one time, and often at a reduced price, of a large quantity of a particular commodity*'),[10] to the large number of vehicles which can constitute a fleet. Nesbitt and Sperling (2001) further illustrate the diversity in fleet size and composition in stating that '*they might consist of two vehicles or two million vehicles; they might include anything from forklifts to long-haul heavy-duty trucks*'.

*Corporate vehicle fleets exist in all sizes*: Miaou *et al.* (1992) argued in favour of a definition of 'vehicle fleet' with a cut-off at 10 or more vehicles bought within a two-year period, saying this would provide a clear distinction from vehicles bought by households or individuals. This minimum threshold was applied for a long time in the USA, but changed in the 2000s. It now seems more common practice to count as fleet vehicles those that belong to fleets of 15 or more, as well as vehicles in fleets where 5 or more vehicles are purchased annually (Davis *et al.*, 2014).

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[8] See Chapter 4 for more details on the holding and use of corporate vehicles by private households in France.

[9] New-vehicle sales by car manufacturers to their distribution networks are sometimes labelled 'tactical sales', because they can mask the effects of temporary downturns in sales. Ultimately, these vehicles are sold to households (or corporations) by the car dealerships. In 2012, 'tactical sales' accounted for 12% of all new light-duty vehicle sales (including passenger cars and light commercial vehicles) in France (SNLVLD, 2012e).

[10] See *Collins English Dictionary*: http://www.collinsdictionary.com/dictionary/english/bulk-buying. [Accessed: 6th August 2014]

Our objective here is not to choose *a priori* a minimum size threshold, but rather, if the opportunity arises, to highlight differences in the decision and management processes according to the size of fleet. We do acknowledge that these differences can be huge, ranging from the multi-thousand-vehicle fleets operated by utilities, to the one-, two- or three-vehicle fleets run, say, by catering businesses and heating installers. However, our underlying assumption here is that there are more significant differences between the decision and management processes of a single-vehicle fleet and those of a private household, than there are between the decision and management processes of a single-vehicle fleet and those of a ten-vehicle fleet, if for no other reason than that corporate vehicle fleets and household fleets are subject to very different tax regimes.[11] We therefore choose to include in our scope of analysis all corporate vehicles, be they part of a single-unit fleet or of a multi-thousand vehicle fleet.

*Vehicle categories and vehicle body types*: Both statements by Miaou *et al.* (1992) ('*a group of vehicles, including cars, vans, station wagons, buses, and trucks*') and by Nesbitt and Sperling (2001) ('*anything from forklifts to long-haul heavy-duty trucks*') illustrate the diversity of vehicle type that can be found in corporate fleets. For greater clarity, we suggest that vehicles should first be categorised in line with European legislation. We borrow from Annex II of Directive 2007/46/EC establishing a framework for the approval of motor vehicles (EC, 2007b), the following definitions for two broad categories of motor vehicles which we wish to investigate further: *i)* Category M: '*Motor vehicles with at least four wheels designed and constructed for the carriage of passengers*'; and *ii)* Category N: '*Motor vehicles with at least four wheels designed and constructed for the carriage of goods*'. The first restriction imposed by our scope of analysis is based on whether or not the vehicle considered belongs to one of these two categories. We thereby deliberately exclude from our scope of analysis such vehicles as non-motorised vehicles, two- and three-wheelers and quadricycles (Category L), trailers and semi-trailers (Category O), agricultural and forestry tractors (Category T), etc. The Directive further subcategorises vehicles on the basis of the number of seats and maximum mass.[12] For the sake of our analysis, we will leave aside the heaviest vehicles in both M

[11] See Chapter 7 for further information on tax policies targeting corporate vehicle fleets.

[12] Various references for categorising vehicle weights are used for different purposes in different parts of the world. In Europe, Directive 2007/46/EC establishing a framework for the approval of motor vehicles (EC, 2007b) uses the reference to 'maximum mass' (short for 'technically permissible maximum laden mass'), which Eurostat *et al.* (2010) call the 'gross vehicle weight' (or 'legally permissible maximum weight'), and which will be our reference here.

and N categories (i.e. minibuses, buses and coaches for Category M; medium and large goods vehicles for Category N). Our final focus will therefore be on the following two light-vehicle subcategories:

> *'Category $M_1$: Vehicles designed and constructed for the carriage of passengers and comprising no more than eight seats in addition to the driver's seat.*
> *(…)*
> *Category $N_1$: Vehicles designed and constructed for the carriage of goods and having a maximum mass not exceeding 3.5 tonnes.'*
>
> EC (2007b)

Vehicles in category $M_1$ are more commonly known as 'light passenger vehicles', or 'passenger cars' (in French: '*véhicule particulier*', or '*véhicule de tourisme*'); those in category $N_1$ are known as 'light commercial vehicles' (LCVs) (in French: '*véhicule utilitaire léger*').[13] Because of the similarity in their design and purpose, $M_1$ and $N_1$ vehicles in Europe may be subject to very similar – though differentiated – regulations (e.g. on emission standards), or may even share some identical regulations (e.g. on driving licences). Together, they are referred to as 'light passenger and commercial vehicles' (see, for instance: EC, 2012a), or 'light-duty vehicles' (see, for instance: US EPA and US DOT, 2012), or simply 'light vehicles' as a common shorthand.

As we have decided to exclude the heavier vehicles from our investigation of corporate vehicle fleets, it would seem appropriate to hold ourselves to the more accurate term of 'corporate light-duty vehicle fleets'. For the sake of simplicity, we will opt instead for the more common term of 'corporate car fleets', all the while bearing in mind that light commercial vehicles are also included.

Going on with our exploration of the diversity of fleets in terms of vehicle body types, we will simply note for now that corporate car fleets are likely to

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[13] Terms to refer to this category of vehicles vary from one context to another. The European Commission has opted for 'light commercial vehicles' (LCVs), but the same vehicles can also be labelled as 'light goods vehicles' (in the UK, for instance) or 'light-duty trucks' (in the US). On top of these differences in labels, it should be noted that the criteria set to define which vehicles qualify as LCVs also vary from one context to another. As an illustration, the definition by the US federal regulation is as follows: '*Light-duty truck means any motor vehicle rated at 8,500 pounds [A/N: 3,855.5 kg] Gross Vehicle Weight Rating (GVWR) or less which has a vehicle curb weight of 6,000 pounds or less and which has a basic vehicle frontal area of 45 square feet or less, which is: (1) designed primarily for purposes of transportation of property or is a derivation of such a vehicle, or (2) designed primarily for transportation of persons and has a capacity of more than 12 persons, or (3) available with special features enabling off-street or off-highway operation and use.*' (US Code of Federal Regulations, 2013)

include all kinds of passenger car body types, from compact cars to luxury cars, including saloons (also called 'sedans' in the USA), coupés and estate cars (also called 'station wagons', in the USA). Similarly, they are likely to include all kinds of light commercial vehicle body types, such as light vans, light trucks, large vans, pick-up trucks, and four-wheel drive vehicles (CCFA, 2013). One particular light commercial vehicle body type also found in French corporate car fleets is the passenger-car derivative, a product of the conversion of a passenger car body type into a commercial vehicle (in particular, rear seats are prohibited), mainly for tax purposes.[14]

**_What_ are corporate car fleets meant _for_?**

To differentiate fleet vehicles from non-fleet vehicles more easily, Miaou *et al.* (1992) suggest analysing whether or not '*vehicles are used for non-personal use during business hours*'. They further note that '*in some instances, such vehicles are engaged in pick-up and delivery activities along a fixed or predictable route and are often operated under frequent stop-and-go conditions*'. However true those assertions may be, the reality of corporate car fleet use patterns reveal much greater complexity, which we will further explore here.

*Employee benefit-oriented vs. service-oriented: Is there only one kind of corporate car?* It may easily be imagined that significant portions of corporate car fleets would provide specific 'business functions' ('pick-up and delivery', or otherwise) during 'business hours' (whatever these may be), to serve 'business interests' (whatever those may be). These portions of corporate car fleets, which could be described as *primarily service-oriented*, use vehicles just like any other basic working tools in their daily business operations.[15] The primary rationale behind their acquisition (be it through purchase or lease) lies in the service they perform for the corporation. Many of them are fitted with special equipment (drawers, shelves, box-type inserts and trays for vehicles carrying small equipment and tools, roller shutter doors for street vending trucks, etc.). Many of them bear the corporate logo, colours and/or contact information. They might be used in pools (pool vehicles can be used by different employees, according to a programme or on an *ad hoc* basis), or else be assigned to one employee for his/her exclusive use. In this latter case, however, access to the vehicle would generally be limited to business hours (as suggested by Miaou *et al.*, 1992) and

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[14] See Chapter 7 for further information on the tax schemes applicable to light commercial vehicles in corporate car fleets in France, and Chapter 5 for more detail on the French market for passenger-car derivatives.

[15] This description would mirror the description provided for the 'representatives' type of company car user by Macharis and De Witte (2012) in the Belgian context.

for business purposes, with some instances of extension to the daily commute, be it for operational reasons (staggered work schedules, variable work locations, on-call services), financial reasons (savings in vehicle storage costs) or on other grounds (poor public transport access to the company site, etc.). Generally, however, the employee would not be entitled to access the vehicle outside the work context, for instance on holidays and weekends, on free days or during leaves of absence. Furthermore, he/she would generally not be entitled to use the vehicle for purposes other than professional and, in some instances, commuting. In the absence of a unified definition, we suggest labelling those corporate fleet vehicles that meet this archetypal description – which we described as primarily service-oriented – as *service vehicles*.

There is at least one further 'classic' in corporate car fleet vehicles that differs in many ways from this typical service-oriented vehicle. Indeed, in many instances, the rationale behind the acquisition of corporate cars is not immediately related to service considerations, but rather to human resource factors. In particular, some corporate cars can be seen primarily as fringe benefits, i.e. additional advantages provided by the employer to supplement an employee's regular pay[16] (also described as benefits in kind, since they are not pecuniary benefits, or 'perks').[17] Such fringe benefits are subject to personal income tax and to employer's and employee's social security contributions. From a human resource perspective, the main reason given for providing such benefits is their positive influence on the corporation's ability to attract and retain talent (external and internal employer branding) and to foster employee performance and loyalty (through incentive and reward processes, or merely through the supply of a valued status symbol). From a strictly economic perspective, such benefits are deemed to make sense for both the employer and the employee provided that: *i)* the employer is able to supply the fringe benefit at a lower cost than the employee would otherwise achieve (e.g. due to its greater bargaining power *vis-à-vis* car dealers, long-term rental companies, insurance companies and maintenance service suppliers); and/or *ii)* the tax system itself favours in-kind fringe benefits over monetary remuneration (Naess-Schmidt and Winiarczyk, 2010). Other, somewhat secondary reasons are sometimes given for providing corporate car fringe benefits, such as the need for the employee to drive a car of a certain minimum standard (Naess-Schmidt and Winiarczyk, 2010), in order to meet corporate identity standards (in particular for cars used to visit customers), and/or road safety standards (in particular for the cars that

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[16] See *Collins English Dictionary*: http://www.collinsdictionary.com/dictionary/english/fringe-benefit. [Accessed: 7th August 2014]

[17] Short for 'perquisite'.

are used most intensively). Generally, when this kind of employee benefit-oriented rationale prevails in the decision to provide a company car to a particular employee, the benefits of exclusive use and full-time access are extended to private use of the vehicle, in addition to professional uses. Again, in the absence of a unified definition, we would suggest labelling those corporate fleet vehicles that meet this archetypal description – which we described as primarily employee benefit-oriented – as *official vehicles* (or official cars, as most of them happen to be passenger cars).[18]

The two archetypal descriptions provided above, on the one hand for service-oriented corporate vehicle, and on the other hand for employee benefit-oriented corporate vehicles, are deliberately simplified. Indeed, we acknowledge that these two perspectives would most probably be deemed complementary to each other in all decisions on corporate car fleets, whether regarding the acquisition or terms of use of the vehicles. As a matter of fact, as will be illustrated in Chapter 6, the observation of corporate car fleet decision-making processes provides a good illustration of how diverse the strategic rationales behind fleet decisions are.

*The many functions of corporate car fleets*: There are different possible ways of partitioning the functions of corporate car fleets. One fairly common partition actually combines fleet function and the corporation's activity type, by proposing such fleet categories as: emergency services, delivery vehicles, rentals, etc. (Nesbitt and Sperling, 2001). Although we acknowledge that the corporation's activity can help in describing the functions performed by the fleet, we will instead suggest here some partitions that describe fleet functions independently of any information on the corporation's activity.

A first truly functional partition of corporate car fleets might be between vehicles used to transport staff and other people (e.g. visitors, customers), and vehicles used to carry freight and other goods (e.g. small equipment and tools). This first partition can be further refined by considering the nature of the duty performed and/or the stage of production considered, which might differ significantly from one type of activity to another. As an illustration, a manufacturing firm's corporate car fleet could perform the following functions: *i)* visits to suppliers' or partners' facilities, inter-site travel for team meetings, sales visits to clients, etc., on the people carrying side; and *ii)* transport of input materials, equipment and tools to activity sites (e.g. factories, construction worksites), inter-site logistics and mail, delivery of products to customers, etc., on the goods carrying side.

[18] This description would rather mirror the description provided by Macharis and De Witte (2012) for the 'enjoyers' type of company car users in the Belgian context.

Such a partition can be combined with another division, which differentiates ‘own account’ transport from transport ‘for hire or reward’. Own account transport refers to transport operations carried out by the same corporation from which the need arises. Transport for hire or reward, on the other hand, refers to commercial transport operations that are performed by a corporation other than the one from which the need arises, this other corporation usually being a professional transport company.

This preliminary attempt to partition corporate car fleet functions should not however mislead us into considering that these functions are mutually exclusive. Indeed, many fleet vehicles might transport people and goods alternately, and many might also be used both on own account and for hire or reward. Again many, especially pool vehicles, might be used by a sales manager on a commercial visit in the morning (with a sample of products on board, if need be), and by an engineer for a technical visit to a subcontractor’s plant in the afternoon.

*Geographical scope of operation*: Another dimension that needs be explored when analysing the purpose of corporate car fleets, is the geographical range of their business. Our assumption is that, depending on the number and geographical distribution of their sites, and depending on the number and geographical distribution of their external interlocutors (customers, suppliers, partners, etc.), the geographical scope of operations of corporate car fleets could differ greatly from one corporation to another, even in the same sector of activity.

*Patterns of use*: It is worth noting that the use of corporate car fleets can be organised according to very different patterns, in terms of vehicle dispatch, routing, scheduling, mileage, etc.

### *How* are corporate car fleets managed?

The definition for vehicle fleets given by Miaou *et al.* (1992) mentions the ‘*unified control*’ that vehicle fleets are subject to, but says nothing more on the corporate functions and decision processes actually involved in their management, from acquisition to daily operations. Nesbitt and Sperling (2001) provide further insights into these matters:

> *‘Fleet management responsibilities might be assigned to administration, finance, sales, operations, or purchase departments; because each department has different goals and objectives, they will often make very different purchase decisions. Indeed, fleet managers themselves are diverse, representing a wide spectrum of backgrounds, including many promoted from other positions within the organization. Larger organizations dedicate a full-time position to fleet management while others assign the duty to an employee who already has other job responsibilities.’*
>
> Nesbitt and Sperling (2001)

*Complex management processes and their tools*: This passage from Nesbitt and Sperling (2001) raises two interesting points about the stakeholders involved in corporate car fleet management processes. It indeed suggests that: *i)* in a given corporation, they can present very diverse backgrounds, functions and levels of expertise; and *ii)* they might differ significantly from one corporation to another. However, this overlooks an important preliminary to the discussion of corporate car fleet management processes, which is that there is no widely accepted definition of what fleet management is. Indeed, there are ambiguities, both in theory and in practice, in *i)* the scope and focus of fleet management responsibilities, and *ii)* the identity and missions of the fleet manager. In particular, on the scope and focus of fleet management responsibilities, it is unclear whether or not all decisions regarding fleet life, from decisions on acquisition to decisions on daily operations, should be considered relevant to fleet management processes. In addition, as far as 'fleet managers' are concerned, it is unclear whether this term refers to: *i)* a single in-house corporate function or even a single position in the organisation (Nesbitt and Sperling, 2001), or *ii)* different people working in different positions (and/or different departments) in the organisation, or else *iii)* external providers of fleet management services. It is also unclear whether fleet managers, whoever they may be, take charge of all fleet management responsibilities, or if they are merely coordinators of fleet management processes that involve a wide range of functions in the organisation, or else if they have no authority except in decisions about daily operations.[19]

In the rest of this analysis, we choose to give fleet management the widest definition possible, including all decisions involved in the acquisition process (e.g. selection of suppliers, selection of makes and models) as well as in the day-to-day operational management (e.g. reporting and monitoring on vehicle use and running costs) of corporate car fleets. The main rationale for this broad definition lies in the assumption that, in our understanding, decisions relating to both acquisition and day-to-day operations are bound to be increasingly intertwined in the future, because of the increasing use of reporting and other decision-support tools required for life-cycle cost-benefit analysis (see Chapter 6 for further information).

We further choose to distinguish the in-house corporate functions explicitly involved in fleet management, hereafter described as 'fleet managers', from the external providers of fleet management services, hereafter described as 'fleet-

[19] For instance, Nesbitt and Sperling present a rather restricted view of the fleet manager's mission, whereby his/her '*primary responsibility is to keep the vehicles running at a minimum cost*' (Nesbitt and Sperling, 2001: p.300).

management providers'.[20] We further argue that the former category should clearly differentiate between, on the one hand, 'fleet managers' who are involved in the design and/or supervision of fleet management processes, and on the other hand, 'fleet management personnel' whose involvement, however crucial, is restricted to the implementation of existing fleet management processes, the design and supervision of which they have little or no power to influence.

Going back to our initial considerations on the diversity of in-house functions involved in fleet management processes, it is worth noting that different backgrounds, functions and levels of expertise possibly lead to differences in rationales and priorities when dealing with fleet management issues. Basically, financial departments would be likely to focus on costs, while sustainable development departments would instead focus on emissions, and operational departments on technical performance, downtime and ride quality, for instance.

Moreover, the participation of people with different backgrounds, functions and levels of expertise in fleet management processes goes hand in hand with a great diversity in the management and reporting processes and tools involved. For instance, fleet managers use a wide range of reporting tools, from simple spreadsheets to very sophisticated fleet management software, the purpose of which is to store, monitor and report a range of fleet-relevant information on vehicle characteristics, driving licences, running costs (e.g. fuel, maintenance, tyres), maintenance (routine and scheduled), tax and insurance due dates, etc. Logistics or in-house maintenance services, on the other hand, sometimes use Computerised Maintenance Management System (CMMS) software, with a high level of detail and analysis functionalities on maintenance-relevant information. Finance departments commonly use Enterprise Resource Planning tools (ERP) of varying sophistication to collect information on fleet inventory, procurement contracts, orders and invoices, capital expenditure and operating expenses, etc. Other departments may use other tools to report on fleet emissions, safety records, and so on. As well as having different types of inputs and outputs, these tools also have different frequencies of data collection and reporting, and different rules for their verification and audit.

This diversity amongst the in-house stakeholders potentially involved in the fleet management processes of a given corporation also raises the question of how the decision-making processes are coordinated and structured. According to Nesbitt and Sperling (2001), two contextual dimensions are of particular interest in that regard: *i)* formalisation, defined as '*the extent to which rules and*

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[20] Practitioners in France call them '*fleeters*' (*Flottes Automobiles*, 2014), from the English word 'fleet', although this term does not seem to be used as such in English.

*procedures guide the fleet decision process*'; and *ii)* centralisation, which '*has to do with the number of people involved in fleet decisions and their decision-making autonomy*'.[21]

### 3.2.2 Sketching a typology of corporate car fleets to analyse their choices regarding vehicle acquisition and use

On the basis of the analytical framework set out above, we will now go on to recall some of the important definitions on which we will base our work. We also sketch a typology of corporate car fleets for the purpose of analysing their choices regarding the acquisition and use of vehicles.

First, we define a corporate car fleet as a light-duty vehicle or a group of light-duty vehicles (including passenger cars and/or light commercial vehicles), owned or leased by a juridical person (including public administrations, non-profit organisations and associations, as well as companies, public or private, large or small). Fleet vehicles can be used by the corporation to meet service needs (including visits to suppliers' or partners' facilities, inter-site travel for team meetings, commercial visits to clients, transport of input materials, equipment and tools to activity sites, inter-site logistics and mail, delivery of products to customers, etc.), and/or be provided as a benefit in kind to employees, who can use them for their professional and private needs. The following light-duty vehicles, although registered in the name of a juridical person, are excluded from the scope of corporate car fleets: *i)* vehicles owned by manufacturers' distribution network pending sale; and *ii)* vehicles owned by rental companies and leased directly by households. Figure 3.1 illustrates this definition of corporate car fleets.

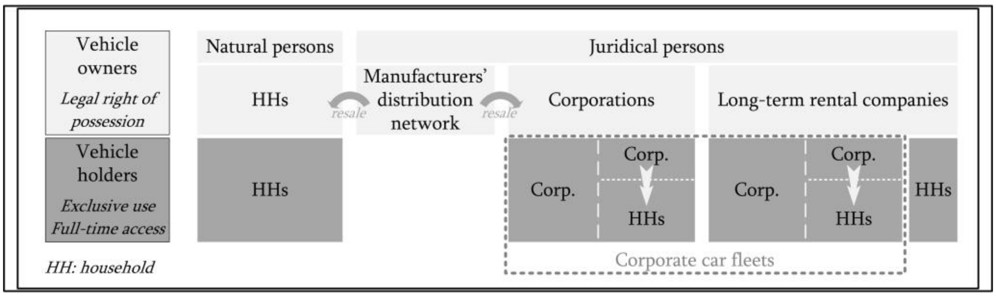


**Figure 3.1: A representation of the ownership and holding of corporate car fleets**

Comparing this perspective – from the corporate car fleet standpoint – with the most common perspective in mobility research, which considers the vehicle stock held by households, it should be noted that they overlap in some instances

[21] See Chapter 6 for further information in this regard.

when households are provided with vehicles by their employers. Indeed, such vehicles, while owned or leased by the employer (and therefore qualifying for our definition of corporate car fleets), will be considered as 'held' by the employee's household to the extent that the latter has exclusive use of, and full-time access to, that vehicle.

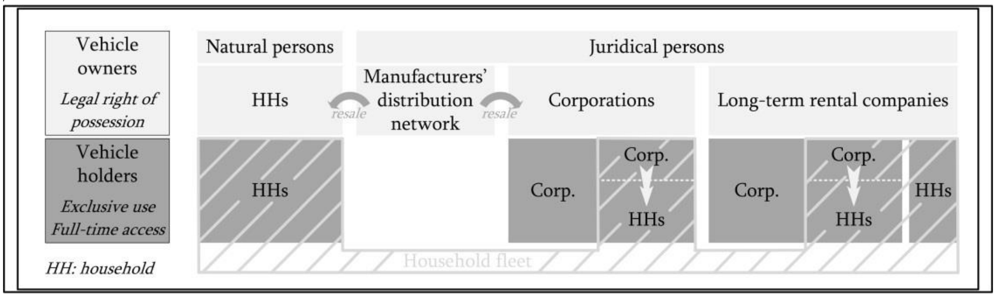


**Figure 3.2: A representation of the ownership and holding of the household vehicle fleet**

Now adopting an employee's perspective on corporate car fleets, we suggest that the reader refer to the diagram in Figure 3.3 in order to clarify the different possible definitions relating to the various levels of 'rights' over a corporate vehicle that can be granted to an employee. In particular, this diagram formulates our underlying assumptions for: *i)* a rather broad definition of what a 'service vehicle' is (i.e. any corporate vehicle unless it meets our definition of an 'official vehicle'), and *ii)* a rather restrictive definition of what an 'official vehicle' is (i.e. a corporate vehicle which a particular employee can use for private as well as professional purposes). Our understanding is that, when analysing the household vehicle stock (e.g. through household travel surveys), we should find in it the following two types of corporate vehicle: *i)* assigned service vehicles for which the employee has supplementary commuting rights (exclusive use of, and full-time access to, the vehicle are granted), and *ii)* official vehicles (maximum rights are granted on the vehicle, including private use rights).

This typology would seem to match fairly well the criteria for describing the corporate vehicle as a fringe benefit, whereby 'private use rights' are the main trigger factor for the application of company-car fringe benefit taxation, whereas 'commuting rights' alone can be construed as a natural extension of professional trips (if the vehicle is otherwise necessary to the employee's activity).[22] However, its validity from the standpoint of corporate car fleet operations will need to be tested against field observations. In addition, its workability in terms of analysis and research will need to be tested against available data.

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[22] See Annex D for further information on the application of company-car fringe benefit taxation.

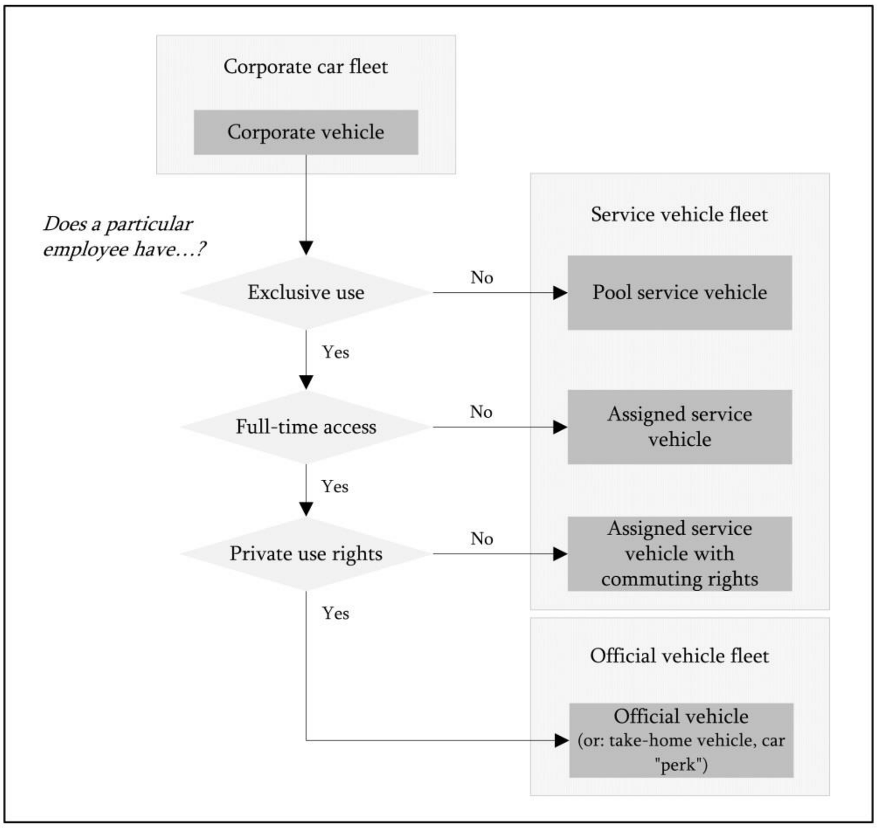


**Figure 3.3: Discriminating official vehicles from service vehicles in corporate car fleets**

Finally, when analysing the functions of corporate car fleets, we choose not to lay down precise, *a priori* definitions. We will, however, assume that own account transport, on the one hand, and transport for hire or reward, on the other hand, are governed by different types of logic.

We will not consider the distinction between goods transport and people transport as being key to our analysis. Instead, we will focus on the two main vehicle types that make up corporate car fleets, namely passenger cars and light commercial vehicles. Indeed, owing to very different tax conditions applicable to these two types of vehicle when held by corporate car fleets in France,[23] we assume that passenger cars and light commercial vehicles may display different market characteristics and different patterns of use. To avoid the possible pitfalls arising from too close an association between goods transport and light commercial vehicles, and/or between people transport and passenger cars, we do not postulate any functional distinction between these two vehicle types *a priori*.

[23] See Chapter 7 for detailed information on the tax schemes applicable to corporate car fleets in France.

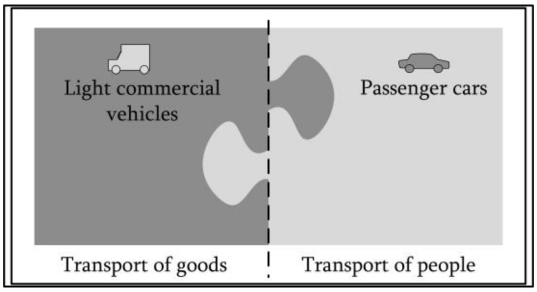


**Figure 3.4: The overlapping functions of light commercial vehicles and passenger cars**

# 3.3 Some facts and figures on corporate car fleets in France

This section aims to present some key facts and figures about corporate car fleets in France, their market and their patterns of use. Only limited references will be made to the situations of corporate car fleets in countries other than France – for instance, in Europe or the USA – because discrepancies in definitions, methods of observation and measurement, and local policy conditions, significantly hinder international comparisons.

Due to very limited data from official or academic sources, most of our references in this section will come from industry sources (e.g. CCFA, OVE, SNLVLD[24]), from professional journals (e.g. *Flottes Automobiles*, *L'Automobile&L'Entreprise*), or from special reports by the general press (e.g. *Le Monde*, *Le Figaro*, *Les Echos*, *La Tribune*, *Le Parisien*).

## 3.3.1 Corporate car fleets in the overall light-vehicle stock

**The new statistical register of road motor vehicles**

As reported by Friez and Dervieux (2013), the French Interior Ministry and the Observation and Statistics Service of the Ministry for Sustainable Development (SOeS) have worked hand in hand to develop a new statistical register of road motor vehicles (RSVERO) based on: *i)* data from the Interior Ministry's

[24] CCFA (*Comité des Constructeurs Français d'Automobiles*) is the French Automobile Manufacturers' Association ; SNLVLD (*Syndicat National des Loueurs Longue Durée*) is the French National Association of Long-Term Car Rental Agencies; OVE (*Observatoire du Véhicule d'Entreprise*) is the French Corporate Vehicle Observatory. Originally created in 2002 by the long-term rental company Arval (a subsidiary of BNP Paribas bank), OVE became an association in 2007.

decision-support information system on vehicle registration certificates (providing information on new-vehicle registrations and on changes in vehicle ownership during the full lifetime of the vehicle, as well as on each vehicle's make, model, body type, engine horsepower, gross weight, fuel type, etc.);[25] *ii)* data collected by the French national technical inspection agency (UTAC-OTC) through the mandatory technical inspections of motor vehicles and motorcycles (providing additional information on mileage, diesel particle filters, fuel consumption, etc.); and *iii)* data collected by the French National Institute of Statistics and Economic Studies (INSEE), such as economic activity codes and business registration numbers for vehicles registered under the name of a juridical person.

This new register has been designed as a tool for monitoring: *i)* the development of the motor vehicle stock in France and of its use, and *ii)* the implementation of public policies in the road transport sector. It started operations in 2009. At the time of writing, the register was, however, still in the testing phase.

Until this advanced register is fully operational, only partial and fragmented information is available on the state of the motor vehicle stock currently in use in France, and in particular on its corporate component. As an illustration, as of 2013, the manager of the register was still in the process of cleaning up the database for destroyed and other unusable vehicles (Friez and Dervieux, 2013): about 15 million vehicles out of the total 57 million (including large goods vehicles, light-duty vehicles and motorcycles) listed in the database were considered old vehicles.[26] Additional data progressively collected from technical inspections should allow for a better understanding of their actual state of use.

### French corporate car fleets could account for 8% of total passenger cars and 59% of total light-duty vehicles in France

Based on preliminary analyses of the new register of road motor vehicles, Breteau and Léglise (2013) report that corporations could own about 8% of the total fleet of passenger cars in France. This figure should, however, be interpreted cautiously for the reasons already stated. On the basis of estimates by the French Commission for National Transport Accounts (CCTN), SOeS (2013d) assessed the overall passenger car stock in France at 31.575 million vehicles in use in 2012. Accordingly, an 8% share of the total passenger car stock would imply an estimated *corporate* passenger car fleet of 2.5 million vehicles in 2012.

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[25] In time, RSVERO is also expected to provide information on vehicle compliance with Euro emission standards.

[26] Older than 10, 15 or 20 years depending on the category of vehicle.

However, these 2.5 million vehicles would likely include all passenger cars owned by juridical persons, in particular the car manufacturers' distribution networks, and therefore be somewhat of an overestimation of the number of vehicles that would strictly match our definition for corporate car fleets.

In addition, as already stated, corporate car fleets are major users of light commercial vehicles. Based on the results of the 2010 French national survey on the use of light commercial vehicles,[27] it was assessed that professional users represented 59% of all light commercial vehicle users in France in 2010 (SOeS, 2012a): out of a total of 5.598 million light commercial vehicles in use in France in 2010, about 3.3 million vehicles would be part of corporate car fleets. On the basis of estimates by the French Commission for National Transport Accounts (CCTN), SOeS (2013d) assessed the overall light commercial vehicle stock in France at 5.911 million vehicles in use in 2012. Accordingly, a 59% share of the total light commercial vehicle stock would imply an estimated *corporate* LCV fleet of close to 3.5 million vehicles in 2012.

Thus, on a first level of analysis and notwithstanding the abovementioned reservations regarding the heterogeneity of the underlying data, the overall corporate car fleet in France could be estimated as close to 6 million vehicles (2.5 million passenger cars and 3.5 million LCVs) in 2012, or 16% of the total light-duty vehicle stock (37.5 million vehicles). This fleet would be distributed as follows: between 40% and 45% would be passenger cars, between 55% and 60% would be light commercial vehicles.

As a complement, industry sources reveal that: *i)* short-term rental companies had a fleet of 282,000 light-duty vehicles in 2008 (223,000 passenger cars and 58,000 light commercial vehicles) (ANFA, 2010), or roughly 5% of the total corporate car fleet (assuming a stable fleet from 2008 to 2012); and *ii)* long-term rental companies had a fleet of 1,161,500 vehicles in 2012 (SNLVLD, 2012e), or roughly 20% of the total corporate car fleet. Thus, corporations outside the vehicle rental business could own up to 75% of the total corporate car fleet in France.

### Corporate car fleets display a high concentration of vehicles

We could not find any official or academic source giving figures for individual corporate car fleets, or for the concentration of vehicles in corporate car fleets in France. Yet, some industry sources provide useful insights in this respect.

[27] For further information on the French LCV surveys, their methodology and results, see Chapter 5.

Based on a survey of 1,060 corporate car fleets in France[28], OVE (2011a) found that one in three fleets surveyed had a vehicle count ranging from 11 to 100 vehicles, and another one in three had a vehicle count ranging from 101 to 700 vehicles.

Corporate car fleets registered by long-term rental companies also display a high concentration of vehicles. An illustration of this was provided by SNLVLD (2005), which revealed that 18% of vehicles in long-term rental by corporate customers were in fleets of only one vehicle, 20% were in fleets of between 2 and 5 vehicles, 13% were in fleets of between 6 and 20, 15% were in fleets having between 21 and 100 vehicles, and finally 34% were in fleets exceeding a hundred vehicles. Unfortunately, follow-up statistics were not provided in subsequent publications by SNLVLD. However, some long-term rental companies occasionally provide their own data, which generally concur with those of SNLVLD: for instance, in 2009, LeasePlan[29] stated that half their vehicles in long-term rental in France were in fleets exceeding 250 vehicles, 25% were in fleets with between 20 and 250 vehicles, and the remaining 25% were in smaller fleets, including the professions (e.g. nurses, solicitors) and a few private households (less than 3% of the market) (*La Tribune*, 2009).

### 3.3.2 Corporate car fleets in the overall market for new-vehicle sales

#### Corporate car fleets account for close to 40% of new light-duty vehicle sales

Statistics provided by SNLVLD allow a detailed breakdown of new vehicle sales among the different types of buyers. They indeed identify four categories of entities responsible for new vehicle registrations: *i)* households; *ii)* demonstration and makers (i.e. the manufacturers' distribution networks); *iii)* enterprises and long-term rental companies; and *iv)* short-term rental companies. To match our definition of the scope of corporate car fleets, it would therefore be necessary to aggregate new vehicle registrations by enterprises and

[28] 80% of corporations in the sample were companies and 20% were public administrations. Altogether, more than one in three corporations surveyed exceeded 1,000 employees, and almost one in two was established in the Paris region.

[29] In 2009, LeasePlan, originally a Dutch company specialising in fleet management, a 50% subsidiary of Volkswagen since 2004, ranked first for long-term rental services in Europe, and third in France (*La Tribune*, 2009) – fifth if the in-house long-term rental services of the two major French automotive manufacturers, Renault and PSA Peugeot-Citroën, are taken into consideration.

long-term rental companies on the one hand, and new vehicle registrations by short-term rental companies on the other hand.

According to this source, enterprises and long-term rental registrations accounted for 30% of new light-duty vehicle sales in 2012 (682,000 units in total): 20% of new passenger car sales and 82% of new light commercial vehicle sales[30]. New vehicle registrations by short-term rental companies added another 9% to the share of corporate car fleets in total light-duty vehicle sales. Thus, based on the scope we defined for corporate car fleets, we can consider that they represented around 39% of new vehicle sales in France in 2012. (SNLVLD, 2012a, 2012b, 2012c, 2012d, and 2012e)

Other sources present consistent data for the share of corporate car fleets in new vehicle sales in France. For instance, according to the professional journal *L'Automobile&L'Entreprise* (2013), corporate car fleets made up 29% of new passenger car sales in France in 2012, and 86% of new light commercial vehicle sales, for an overall share of 39% in all new vehicle sales. In addition, this source provides interesting insights into the fleet of public administrations in France: with 16,400 new vehicles registered in 2012 (9,800 passenger cars and 6,500 light commercial vehicles), they represented 1.9% of the corporate market segment, or 0.7% of the total market for new vehicle sales.

**Steady sales, rising stakes**

Over the last 25 years, corporate car fleets have accounted for an increasing share of new light-vehicle sales in France. With a scope that is wider than the one we defined for the purposes of this analysis because it includes all sales to the manufacturers' distribution networks (or 'tactical sales' as we labelled them), OVE (2014a) notes that the share of corporate buyers in new passenger car sales rose from 26% in 1991 (580,000 passenger cars) to 44% in 2013 (796,000 passenger cars), despite difficult times in the aftermath of the 2008 economic and financial crisis. Sales to corporate entities increased by 1.4% annually on average over this period of time, whereas sales to households decreased by 2.2% annually on average. In particular, sales to corporate buyers have been fairly steady during this century: with close to 790,000 new passenger car sales in 2013, they were exactly at their 2000 level, after experiencing a record high in 2007 with close to 890,000 units sold, and a drop in sales in 2009, down to 730,000 units[31] (OVE, 2014a).

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[30] Light commercial vehicles considered by SNLVLD have a gross vehicle weight not exceeding 5 tonnes, whereas, for the record, we chose for our definition a 3.5-tonne upper limit, in keeping with European legislation.

[31] That same year, in 2009, new passenger car sales to households were significantly boosted by the French government's national scrappage incentive scheme, introduced in

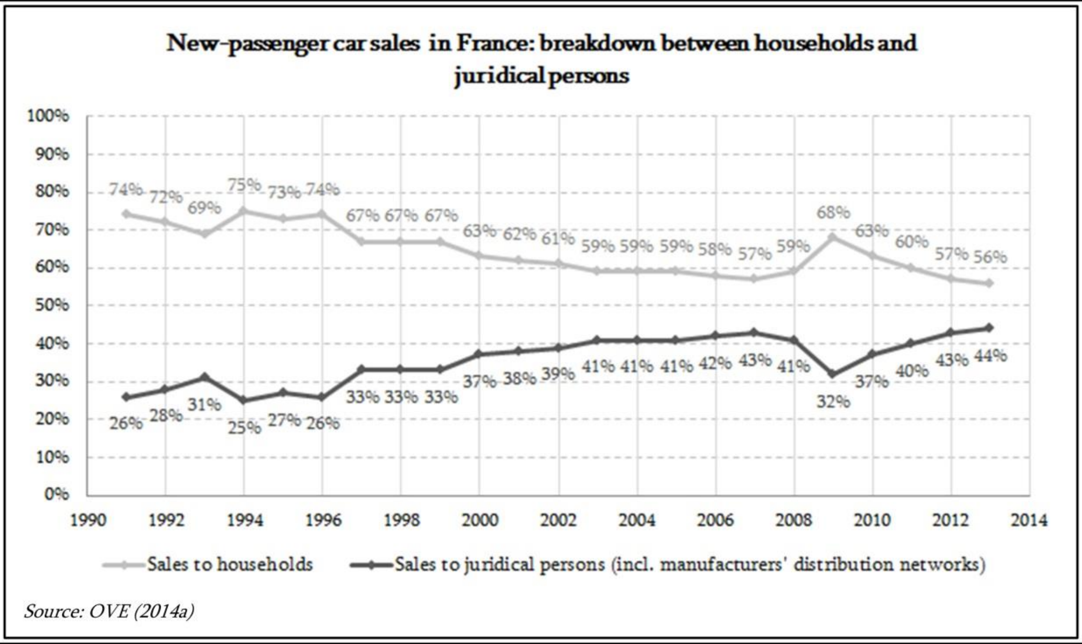


**Figure 3.5: New passenger car sales to households and to juridical persons (OVE, 2014a)**

The good performance of the corporate market segment for new vehicle sales relative to the household segment in recent years has fuelled the interest of market players: this specific market is seen as '*a parallel market as well as a second driver for the activity of manufacturers*' (*Les Echos*, 2013), '*a source of fresh growth for manufacturers*' (*Le Monde*, 2013b), '*the strongest link in the automotive market*' (*Le Monde*, 2013b), or '*a shock absorber*' (*Le Figaro Magazine*, 2014). The same logic seems to prevail in Germany, where manufacturers reportedly consider the corporate market, with 363,000 new passenger car sales in 2012 (up by 1.5% from 2004), as a '*powerful cure for the crisis*' (*Le Monde*, 2013a).

On account of this good performance, manufacturers have been keen to develop targeted 'premium' products for the specific needs of this higher-end,

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December 2007. It concerned close to 605,000 new-car sales over the first two years of implementation, 89% of which were sold in the sole year 2009. Following the rise in incentives granted in 2009 as part of the French economic recovery plan, the scheme benefited more than one third of total new-car sales in France that year. While most corporations (except state fleets) were eligible for this scrappage incentive scheme in 2009, they only accounted for 4% of the beneficiaries (SOeS, 2010), probably because of the small proportion of old vehicles in their fleets. See Chapter 7 for further information on the scrappage incentive scheme.

yet cost-aware, automotive segment (*Le Monde*, 2013b; *Le Parisien*, 2013a and 2013b; *Les Echos*, 2013; *Le Figaro*, 2014). Consequently, French manufacturers, which still retained a 61.8% share of the new vehicle sales to French corporate customers in 2012 (*L'Automobile&L'Entreprise*, 2013), have been faced with increasingly fierce competition from foreign manufacturers specialising in 'premium' segments. Considering just the six German makes of Audi (Volkswagen Group), BMW, Mercedes (Daimler Group), Mini (BMW Group), Porsche and Volkswagen, it appears that their market share in new passenger car sales to corporate car fleets in France reached 22.6% in 2012 (82,000 new registrations), up from 13.8% in 2004 (50,000 registrations) (*Le Monde*, 2013a; *Les Echos*, 2013). Mercedes alone scored 40% of its sales in France with corporate customers in 2013, while for Lexus – the high-end brand of Toyota – the figure was 60%.

Table 3.1 illustrates the relative performance of French and foreign car makers on the corporate market in France in 2011 and 2012 based on statistics provided by the professional journal *L'Automobile&L'Entreprise* (2013). The year 2012 saw a decline in new vehicle registrations by corporate fleets in France (-7.6%, down to 879,700 vehicles from 951,800 vehicles in 2011), though this decline was limited compared to the overall performance of the automotive market that year.[32] French car makers suffered the full force of the market decline: Renault lost 10.0% of its corporate sales, and PSA Peugeot-Citroën 7.8%, between 2011 and 2012.

[32] Even in 2012, the corporate market segment was considered to be more resilient than the household segment: new vehicle sales to private households decreased by 19.4%, from 1,268,500 vehicles (passenger cars and light-duty vehicles included) in 2011 to 1,022,600 vehicles in 2012 (*L'Automobile&L'Entreprise*, 2013).

| Car makers | New light-duty vehicle registrations by corporate car fleets [1] in France in 2011 and 2012 | | | | | | |
|---|---|---|---|---|---|---|---|
| | 2011 | | | 2012 | | | 2012/2011 (yoy) |
| | Pass. cars | LCVs | All LVs | Pass. cars | LCVs | All LVs | All LVs |
| **French car makers** | **337,437** | **258,768** | **596,205** | **309,630** | **234,111** | **543,741** | **-8.8%** |
| PSA Peugeot-Citroën [2] | 197,766 | 130,945 | 328,711 | 185,767 | 117,255 | 303,022 | -7.8% |
| Renault [3] | 139,671 | 127,823 | 267,494 | 123,863 | 116,856 | 240,719 | -10.0% |
| **Foreign car makers (>10,000 new vehicle registrations by corporate car fleets in France)** | | | | | | | |
| Audi | 22,549 | 912 | 23,461 | 22,885 | 759 | 23,644 | 0.8% |
| BMW | 18,309 | 169 | 18,478 | 18,181 | 71 | 18,252 | -1.2% |
| Fiat | 16,361 | 18,643 | 35,004 | 12,456 | 17,130 | 29,586 | -15.5% |
| Ford | 34,801 | 15,915 | 50,716 | 25,907 | 14,645 | 40,552 | -20.0% |
| Iveco | 0 | 12,399 | 12,399 | 0 | 11,027 | 11,027 | -11.1% |
| Mercedes | 15,526 | 17,534 | 33,060 | 17,458 | 16,377 | 33,835 | 2.3% |
| Nissan | 10,599 | 7,244 | 17,843 | 12,584 | 6,846 | 19,430 | 8.9% |
| Opel | 24,745 | 6,640 | 31,385 | 18,154 | 6,331 | 24,485 | -22.0% |
| Toyota | 9,309 | 2,896 | 12,205 | 9,108 | 3,345 | 12,453 | 2.0% |
| Volkswagen | 50,251 | 11,720 | 61,971 | 49,084 | 12,154 | 61,238 | -1.2% |
| **All car makers** | **588,071** | **363,690** | **951,761** | **547,748** | **331,972** | **879,720** | **-7.6%** |

*LCV: Light Commercial Vehicle; LV: Light Vehicle, including passenger cars and LCVs.*
*Notes: 1. Including new registrations by long-term rental companies for corporate customers. 2. Citroën and Peugeot recorded similar performances: -8.0% for the former, -7.7% for the latter. 3. Dacia and Nissan not included. Dacia sold 6,600 new vehicles to French corporate car fleets in 2012 (-14.4% from 2011).*

**Table 3.1: New vehicle registrations by corporate car fleets in France for French and foreign car makers (*L'Automobile&L'Entreprise*, 2013)**

The performance of foreign car makers was much more varied. On the one hand, the 'premium' brands mentioned above performed rather well: BMW and Volkswagen both limited the decline in their corporate sales to 1.2% year on year, whereas Audi and Mercedes achieved an increase in their corporate sales (by 0.8% and 2.3% respectively). The corporate sales of Mini and Porsche in France, though more limited in volume (4,885 and 1,283 vehicles sold respectively in 2012), performed even better still: +18.0% and +7.3% respectively between 2011 and 2012. On the other hand, non-premium foreign car makers generally performed even worse than the overall corporate market: -15.5% for Fiat between 2011 and 2012, -20.0% for Ford, and -22.0% for Opel (General Motors Group). Finally, the performance of Asian car makers is worth noting: both Nissan and Toyota have made of the corporate market segment a commercial priority for France (*Le Monde*, 2013b; *Flottes Automobiles*, 2013d). In particular, Toyota has built on its portfolio of hybrid vehicles to gain a foothold on the French corporate market (*La Tribune*, 2009; *Flottes Automobiles*, 2013d): hybrid vehicles made up 45% of their sales to corporate fleets in France in 2013 (*Le Monde*, 2013; *Le Figaro*, 2014).

**60% new registrations on the corporate car market use long-term rental**

On top of its attraction for 'premium' products, the corporate market segment displays some very specific features compared with the household market segment. A first notable element is the high penetration of long-term rental in new vehicle registrations. According to industry sources (SNLVLD, 2006, 2011, 2012e; OVE, 2014a), long-term rental by corporate car fleets increased more than fivefold in the 1990s, from 104,000 vehicles in 1990 to 590,800 vehicles in 2000, and doubled again in the 2000s, up to 1,120,500 vehicles in 2010. In 2012, long-term rental by corporate car fleets represented 1,161,500 vehicles on the roads. Thus, long-term rental would make up about 20% of the previously estimated vehicle count of corporate car fleets in France.

The share of long-term rental in new vehicle registrations by corporate car fleets has increased tremendously in recent years: it was already 35.2% (381,800 vehicles) in 2005, and reached 61.1% (681,600 vehicles) in 2012. As already mentioned, there are many reasons for the success of long-term rental with corporate car fleets, some strategic (e.g. companies want to focus on their core business) (*Le Parisien*, 2013b), some financial (e.g. companies want to maintain their cash flow, or to avoid capitalising the vehicles in their balance sheets, or to have greater control over their fleet costs through an 'all-inclusive' package of services covering the vehicle and its maintenance, tyres, insurance, etc., for a fixed price) (*La Tribune*, 2009; *Le Parisien*, 2013a; *Les Echos*, 2013; *Flottes Automobiles*, 2013e); and some operational (e.g. companies want greater flexibility in case of a decline in activity, or they need support for handling accidents, managing maintenance schedules and processing fines, or else they want to be relieved of the used-vehicle remarketing process) (*La Tribune*, 2009; *Le Parisien*, 2013a).

Because of this high penetration of long-term rental with corporate customers, statistics gathered by this particular industry provide crucial insights into the corporate car market segment. We will, however, bear in mind that there are many biases implicit in analysing corporate car fleets through the prism of long-term rental.

The first bias, already mentioned above, arises because of the relatively large size of fleets in the customer base of long-term rental companies. Not unrelatedly, another bias might arise from the large size of the corporations themselves. Indeed, OVE (2014a) recently provided an illustration of the size bias of long-term corporate rental customers, recording that 80% of large enterprises, 55% of intermediate-sized enterprises, 25% of SMEs, and only 6% of micro-enterprises had chosen long-term rental for their fleet in 2013.[33]

Another possible bias in the long-term rental customer base could lie in the features of the vehicles offered for rent. Because of the need for the long-term rental companies to achieve good residual values on the vehicles they rent out (*Le Monde*, 2012; *Flottes Automobiles*, 2013i), they will be less keen to address market segments with a need for vehicles with special equipment or design (e.g. vehicles with integrated shelves and drawers) (*Les Echos*, 2013), or vehicles with unusual paint colours (e.g. yellow vehicles for the French postal services). Moreover, long-term rental companies will not necessarily be well positioned for vehicles that cover excessive or insufficient annual mileage, or for vehicles that are intended to be held for a long time (*Flottes Automobiles*, 2013i). Finally, it is unclear whether, in France, long-term rental offers an appealing option for governmental and other public fleets. As a matter of fact, long-term rental was

[33] According to French national statistics, large enterprises are *i)* enterprises employing more than 5,000 people, or *ii)* enterprises with fewer than 5,000 employees but annual turnover greater than 1.5 billion Euros and a balance sheet total of more than 2 billion Euros (Source: http://www.insee.fr/en/methodes/default.asp?page=definitions/grande-entreprise.htm); intermediate-sized enterprises are *i)* enterprises with between 250 and 4999 employees, and turnover which does not exceed 1.5 billion euros or a balance sheet total which does not exceed 2 billion euros, or *ii)* enterprises with fewer than 250 employees but turnover greater than 50 million euros and a balance sheet exceeding 43 million euros (Source: http://www.insee.fr/en/methodes/default.asp?page=definitions/entreprise-taille-intermedi.htm); SMEs are enterprises that employ fewer than 250 people and have annual turnover of less than 50 million euro or a balance sheet total not exceeding 43 million euro (Source: http://www.insee.fr/en/methodes/default.asp?page=definitions/petite-moyenne-entreprise.htm); micro-enterprises are businesses employing fewer than 10 people, and with annual turnover or a total balance sheet which does not exceed 2 million Euros (Source: http://www.insee.fr/en/methodes/default.asp?page=definitions/microentreprise.htm). These categories of enterprises, defined on the basis of economic criteria in order to provide a better understanding of the economic fabric (Hecquet, 2010), were defined by the following regulation: *Décret n°2008-1354 du 18 décembre 2008 relatif aux critères permettant de déterminer la catégorie d'appartenance d'une entreprise pour les besoins de l'analyse statistique et économique*. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000019961059.

still prohibited for the 65,000 light-duty vehicles in state fleets as of February 2015.[34]

Notwithstanding the above-mentioned biases, for lack of other extensive sources of information on corporate car fleets, we will now explore further the specific features of the corporate car market segment using data provided by the long-term rental industry.

**A high turnover rate, a recent fleet**

A notable feature of corporate car fleets is their high turnover rate and relative newness. The average duration of long-term rental contracts was 39.5 months (or 3.3 years) in 2012, up from 37.3 months (3.1 years) in 2005 (SNLVLD, 2005 and 2012e).[35] Since these statistics are based on vehicles purchased by long-term rental companies on the new-vehicle market, the average age of the long-term rental fleet can be assessed at a little over 1.5 years. Such a high turnover rate enables corporate car fleets to keep up with the release of new models, which is one of the main selling points of long-term rental companies. After being used a few years by a corporation, long-term rental vehicles would then be sold on the second-hand market to households (or other corporations, usually micro-enterprises, craft businesses) (*Flottes Automobiles*, 2013i).

Short-term rental companies are yet another example of the high turnover rate of corporate car fleets. According to industry statistics, the average age of short-term rental vehicles in France in 2008 was 7 months (CNPA, 2008).

To further illustrate this, the 2010 national survey on the use of light commercial vehicles reveals that professional LCVs in France were two times more recent than private LCVs in 2010: the age gap is indeed significant, between 6.6 years on average for the former category and 13.1 years on average for the latter category (SOeS, 2012a).

**Passenger cars, light-duty vehicles and passenger-car derivatives**

Another notable feature of the corporate car market segment is its distribution across vehicle types. According to SNLVLD statistics, 60% of new-vehicle

[34] *Circulaire n°5767/SG du 16 février 2015 sur la mutualisation et l'optimisation de la gestion du parc automobile de l'Etat et des opérateurs.* Available from: http://circulaires.legifrance.gouv.fr/pdf/2015/02/cir_39242.pdf.

[35] By way of comparison, the average holding duration of vehicles in the French household fleet could be more than 50% longer: the 2008 French National Transport and Travel Survey (ENTD) revealed a 5-year average vehicle holding duration (Hivert and Madre, 2013).

registrations by long-term rental companies in 2012 were passenger cars, 40% were light-duty vehicles (SNLVLD, 2012e).[36]

As far as vehicle types are concerned, the corporate market segment differs from the household market segment in two ways: *i)* the household market segment for new vehicle sales is much more asymmetrical with regard to vehicle types: it comprises 96% passenger cars and only 4% light-duty vehicles (SNLVLD, 2012e)[37]; *ii)* looking more closely at the corporate market segment, one can observe that it is actually made up of three, not two, vehicle types: passenger cars, light-duty vehicles, and a subcategory of light-duty vehicles which is specific to the corporate car market segment, namely passenger-car derivatives. Indeed, as already mentioned in Section 3.2, the passenger-car derivative (more accurately described as a light commercial vehicle derived from a passenger car) is a particular body type of light commercial vehicle, the outcome of the conversion of a passenger car body type into a commercial vehicle, which owes its particular success in France to the significant difference in tax treatment between corporate passenger cars and corporate light-duty vehicles.[38]

According to SNLVLD sources, the 40% light-duty vehicles in new registrations by long-term rental companies for their corporate customers in 2012 consisted of 27% ordinary light-duty vehicles and 13% passenger-car derivatives (SNLVLD, 2012e). Thus, one in three light-duty vehicles newly registered by corporations in France could actually be a passenger-car derivative.

### 3.3.3 An assessment of the use of light-duty vehicles in corporate car fleets

#### Corporate car fleets could account for 25% of the total mileage of light-duty vehicles in France

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[36] Statistics provided by *L'Automobile&L'Entreprise* (2013) for the whole corporate car market segment give similar results, with a 62/38 distribution in new vehicle sales in 2012 between passenger cars on the one hand, and light-duty vehicles on the other hand.

[37] Statistics provided by *L'Automobile&L'Entreprise* (2013) concur for the household car market segment, giving a 97/3 distribution of new vehicle sales in 2012 between passenger cars on the one hand, and light-duty vehicles on the other hand.

[38] See Chapter 7 for further information on the tax schemes applicable to light commercial vehicles in corporate car fleets in France, and Chapter 5 for more detailed analyses on the French market for passenger-car derivatives.

As with the observation of the main features of the corporate vehicle fleet and of the corporate vehicle market, there are very few official or academic sources of information on the use of light-duty vehicles in corporate car fleets.

The 2010 French national survey on the use of light commercial vehicles revealed that LCVs used by professional users travelled on average 18,200 km in 2010, which suggests much more intensive use of LCVs in corporate car fleets than in household fleets: indeed, LCVs used by private users only travelled 10,000 km on average in 2010. Altogether, professional LCVs (which made up about 60% of the total LCV fleet) travelled a little over 60 billion kilometres in France in 2010, which was about 73% of the total mileage (in vehicle-kilometres travelled) of LCVs in France that year (SOeS, 2012a). Based on estimates by the French Commission for National Transport Accounts (CCTN), SOeS (2013d) assessed that light commercial vehicles in France travelled 93 billion kilometres in 2012. Accordingly, 73% of the total annual mileage of light commercial vehicles in France would mean an estimated 68 billion kilometres travelled in 2012.

As no source of information is readily available to assess the use of passenger cars in corporate car fleets, we will analyse the insights provided by long-term rental companies on such topics. According to SNLVLD (2012e), the average long-term rental contract for corporate fleets in 2012 allowed for 29,900 km per year. This average annual mileage in long-term rental contracts has remained stable around 30,000 km since 2006. Although the number of kilometres allowed in the long-term rental agreement is not proof of actual use, the flexibility mechanisms offered by long-term rental companies to best adapt the contract conditions to the effective needs of customers make this information a good enough proxy for the analysis of annual mileages covered. Roughly comparing this data with the 14,200 km average yearly mileage of light-duty vehicles in France, based on the estimates by the French Commission for National Transport Accounts (SOeS, 2012a), it appears that light-duty vehicles registered by long-term rental companies on behalf of their corporate fleet customers could be used twice as intensively as the national average.

Under the assumptions that, on the one hand, corporate passenger cars make up 8% of the total passenger car fleet in France (2.5 million vehicles out of 31.575 million in 2012) and that, on the other hand, corporate passenger cars are used twice as intensively as private passenger cars, we find that corporate passenger cars could account for close to 15% of the total mileage of passenger cars registered in France, or close to 64 billion of the 426 billion kilometres travelled by passenger cars in 2012 (SOeS, 2013d).

On the basis of these rough estimates, we thereafter infer that corporate car fleets, which represent close to 16% of total light-duty vehicles (8% of passenger cars, 59% of light commercial vehicles), may be responsible for approximately 130 billion kilometres – half by passenger cars, half by light commercial vehicles

– or close to 25% of the total mileage of all light-duty vehicles registered in France (15% of the total mileage of passenger cars and 73% of the total mileage of light commercial vehicles).

**Few insights into the day-to-day patterns of use of corporate vehicles**

Only little information is available on the patterns of use of corporate car fleets. Based on a survey of 1,060 fleets conducted in 2011, OVE (2011a) provided some insights into the daily use of corporate car fleets. This survey revealed in particular that, however intensive the use of some corporate vehicles may be, two-thirds of light-duty vehicles in the corporate fleets surveyed travelled less than 100 km per day.[39] The OVE survey further revealed that two-thirds of all trips by corporate vehicles occurred in an urban or suburban environment.

On the other hand, the 2010 national LCV survey revealed the following distribution for the 18,200 km average annual mileage travelled by professional LCVs in 2010: 37% occurred in an urban environment (6,800 km) and 18% on motorways (3,300 km), as compared with 41% and 9% respectively for private LCVs. The remaining 45% (8,100 km) took place on other roads or closed user sites (SOeS, 2012a).

# 3.4 The costs of fleets to corporations

## 3.4.1 The TCO concept

There is little information available on the aggregated costs of fleets to corporations. We were able to find reports in the general press or professional journals, usually based on rough estimates, that medium to large corporate fleets could rank among the leading cost categories in their respective corporations, sometimes ranking second after wages (*Le* Monde, 2013b), sometimes ranking third after real-estate rentals and long-distance travel (*Flottes Automobiles*, 2013f: p.53).

Aggregated cost estimates are very heterogeneous. An industrial group would report spending 3.7 million EUR annually on its 600-vehicle fleet in

[39] This would not be inconsistent with SNLVLD statistics stating that corporate vehicles travel 30,000 km on an annual basis. Indeed, a 30,000 km average annual mileage could be achieved by travelling 95 km per day, 6 days a week, 52 weeks per year, which would be compatible with the use of a pool service vehicle running all year long, holidays included, for instance. Alternatively, a 30,000 km average annual mileage could be achieved by travelling 115 km per day, 5 days a week, 47 weeks per year, which would be consistent with the use of an official vehicle running all year long but for 5 weeks of annual paid holiday, for instance.

France, i.e. close to 6,200 EUR per vehicle and per year on average (*Flottes Automobiles*, 2013f: p.54). A local authority in the Paris region would report spending close to 2.1 million EUR (45% in capital expenditure) on a fleet of 574 vehicles – 85% passenger cars, 15% light commercial vehicles, that is, 3,600 EUR per vehicle per year on average (*Flottes Automobiles*, 2013f: p.57). A public company subsidiary involved in large infrastructure management would report spending 2.8 million EUR on a 644-vehicle fleet including 75% light commercial vehicles, that is, a little over 4,300 EUR per vehicle and per year on average (*Flottes Automobiles*, 2013g: p.29). Finally, a private company in the IT sector would report spending close to 7 million EUR on a 850-vehicle fleet including 75% light commercial vehicles, i.e. 8,200 EUR per year per vehicle on average (*Flottes Automobiles*, 2013b: p.26). Whether these differences in unitary cost estimates stem from heterogeneities in the composition of the fleets, or from differences in the use patterns of the vehicles, or again from inadequacies in the aggregation processes (*La Tribune*, 2009: p.14; *Les Echos*, 2014: p.6), remains however unclear.

According to OVE (2014c), in recent years the decision-making processes of corporations have steadily shifted away from single-criterion decisions based on vehicle purchase price, to comprehensive assessments that also take into account maintenance costs, fuel costs, tax expenses and vehicle resale value. The growing penetration of long-term rental into the corporate fleet market in France might have been a factor in this shift. Indeed, long-term rental fees necessarily take into account the resale value of the vehicles (in order to assess depreciation), and they can also account for the additional expenses relating to the use of the vehicles (e.g. insurance, fuel and maintenance costs) if the rental contract provides for such services.

To further refine the understanding of the total costs of corporate fleets to corporations, OVE promotes a three-level approach to the concept of TCO (*Total Costs of Ownership*) that has been increasingly used in the industry over the last few years (OVE, 2014c) and is illustrated in Figure 3.6:[40]

1) *The TCO of the vehicle*: The TCO of the vehicle would account for all vehicle-related costs incurred by the corporation during the ownership period of the vehicle. This TCO would usually take into account: *i)* the purchase price of the vehicle (including possible discounts); *ii)* the financial charges (or opportunity cost of capital, when the vehicle is purchased in cash); *iii)* the expected residual value at the end of the

[40] The TCO concept has been used in several other contexts for a much longer time however. See, for further information, this interesting note by G. Goodall: http://www.infotech.com/research/tco-whats-old-is-new.

ownership period (this value will be very much dependent on the make and model, and on the expected intensity of use of the vehicle); *iv)* the estimated fuel use (this value will depend on the vehicle's unitary consumption and on the expected mileage); *v)* the estimated maintenance and tyre costs (this value will depend on the expected mileage); and *vi)* the estimated taxes (this value will very much depend on the vehicle type, because light commercial vehicles enjoy much more favourable conditions than passenger cars) and social charges (this value will depend on the purposes of use of the vehicle, because 'official vehicles' are taxed as a benefit in kind). According to OVE (2014c), the sum of vehicle-TCO for all vehicles could account for 75% of the total costs of the fleet.

2) *An additional TCO due to the driver*: On top of the above-listed costs, some additional costs are likely to be incurred by the corporation, due to: *i)* additional fuel, maintenance and tyre expenses caused by unexpectedly intensive use; *ii)* additional fuel, maintenance and tyre expenses caused by a suboptimal driving behaviour; and *iii)* additional insurance and repair costs due to accidents. According to OVE (2014c), the sum of additional driver-TCO for all vehicles could account for 20% of the total costs of the fleet (and up to 50% in some instances).
3) *An additional TCO due to fleet management*: The additional fleet management-TCO includes additional costs relating to the costs of administrative and operational management of the fleet, including for registration procedures, fine payment procedures, etc. According to OVE (2014c), the sum of additional fleet management-TCO for all vehicles could account for 5% of the total costs of the fleet.

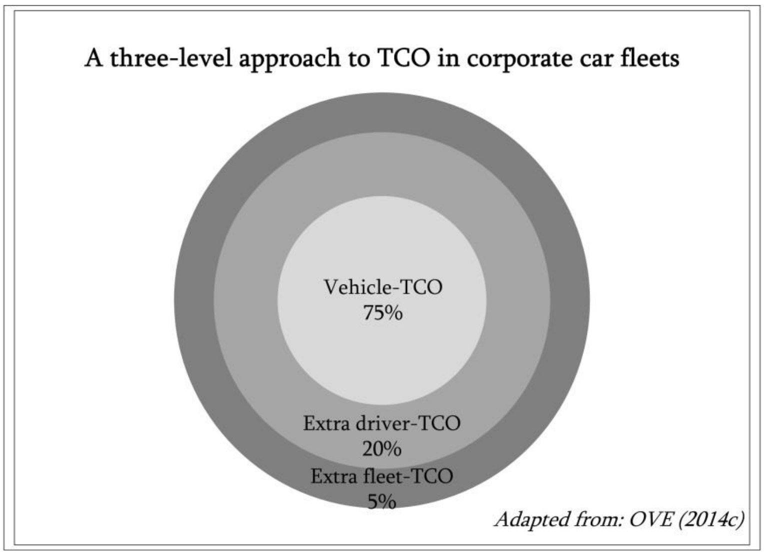


**Figure 3.6: A three-level approach to the TCO of fleets (OVE, 2014c)**

### 3.4.2 A TCO simulation at the vehicle level

Several industry sources provide valuable insights into the TCO of individual corporate vehicles. We choose here to report on a methodology that OVE has developed since 2012, which provides TCO simulations for a wide range of vehicle market segments in the passenger car and light commercial vehicle categories (OVE, 2014d).

**Between 6,000 and 19,000 EUR per year for a corporate passenger car, between 5,000 and 9,000 EUR per year for a light commercial vehicle**

Based on a selection of 60 passenger car models[41] and 25 light commercial vehicle models,[42] OVE (2014d) analyses the costs incurred by corporations for their corporate vehicles. Costs are assessed for a duration of ownership of 4 years and for a total mileage of 100,000 km (which is consistent with previously reported statistics from SNLVLD for the average ownership duration and average use of corporate vehicles in long-term rental). Their calculation includes: *i)* depreciation costs (assessed for each model as the difference between a list price, discounted by 10%, and an estimated resale value – vehicles are depreciated over 4 years); *ii)* financial charges (using a 4% rate over 4 years); *iii)* energy costs (based on an average 1.50 EUR/litre pump price for petrol, and an average 1.33 EUR/litre for diesel in 2013; and based on the standardised fuel consumption of each model); *iv)* maintenance and servicing costs (including the costs of tyres, insurance, etc., and based on the industry average for each model); *v)* taxes and social charges.

On the basis of these assumptions, the average TCO computed by OVE (2014d) across French corporate car fleets was, in 2013, approximately 35,300 EUR over 4 years (close to 750 EUR per month) for passenger cars (from 23,600 EUR in the economical segment, to 76,800 EUR in the luxury segment), and 26,600 EUR over 4 years (about 550 EUR per month) for light commercial vehicles (from 20,700 EUR in the passenger-car derivative segment, to 36,800 EUR in the large commercial van segment). Figure 3.7 illustrates the breakdown of TCO for each vehicle type.

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[41] The selection consists of the 10 best sellers for each of the 6 market segments: economical, low, medium-low, medium-high, high and luxury. These 60 models accounted for 257,200 vehicles registered in French corporate car fleets in 2013 (OVE, 2014d).

[42] The selection is based on: *i)* the 5 best sellers in the commercial minivan, commercial van and large commercial van market segments; and *ii)* the 10 best sellers in the passenger-car derivative market segment. These 25 models accounted for 224,500 vehicles registered in French corporate car fleets in 2013 (OVE, 2014d).

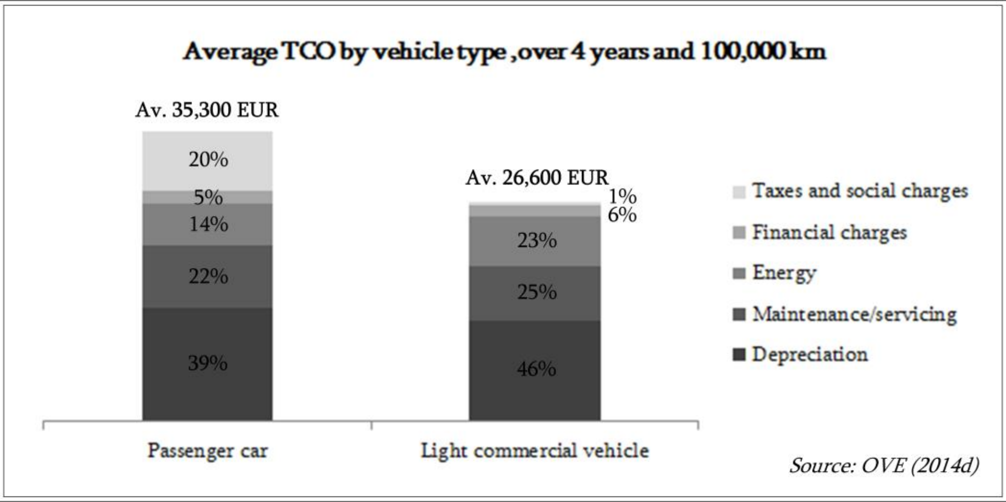


**Figure 3.7: TCO breakdown for passenger cars and light commercial vehicles in 2013 (OVE, 2014d)**

### Insights into the influence of taxes and social charges on TCO

The TCO calculation by OVE results in a 8,700 EUR-gap in TCO (close to 2,200 EUR per year) between corporate passenger cars and corporate light commercial vehicles. Yet interestingly, the significant difference in taxes and charges (approximately 7,000 EUR) between the two vehicle types accounts for 80% of the total TCO gap.

This observation suggests significant differences in the tax conditions applicable to corporate passenger cars on the one hand, and corporate light-duty vehicles on the other hand. Indeed, the calculation of taxes and social charges by OVE (2014d) includes the following items:[43]

1) *Benefit-in-kind taxation*: This taxation is only applicable to 'official vehicles' based on the consideration of the personal benefit that employees draw from the use of their vehicle for personal purposes on top of professional ones (benefit-in-kind taxation here is applied to passenger cars only, on the assumption that most of them are 'official vehicles', whereas most light commercial vehicles are probably 'service vehicles'). Various methods exist to assess the value of the benefit in kind, based on real costs or using flat rates based on the vehicle purchase price (the flat rate can be 12% if private fuel expenses are covered, or 9% otherwise). For this simulation, 12% flat rates were applied, for all

[43] Detailed information presented here come from OVE (2014d). For further information on the terms and conditions of the last four schemes, see Chapter 7.

passenger cars. On average across all passenger car segments, benefit-in-kind taxation accounted for 9% of the TCO (about 800 EUR per year).

2) *Non tax-deductible depreciation*: The estimated depreciation of vehicle assets is deductible for business tax purposes. French accounting rules allow for vehicles to be depreciated over 4 to 5 years (here they are depreciated over 4 years). However, national accounting rules set an 18,300 EUR ceiling on the tax-deductible depreciation of passenger cars, whereas no such ceiling exists for light commercial vehicles. For this simulation, the difference between the purchase price of passenger cars and the 18,300 EUR ceiling is considered as additional business income and a 33.33% business tax is applied. Therefore, tax-deductible depreciation has no differential impact for small passenger cars compared with light commercial vehicles, but can have a significant impact on the TCO of passenger cars in the luxury segment. On average across all passenger car segments, non-tax-deductible depreciation accounted for 4% of the TCO (about 350 EUR per year).
3) *Value-added tax (VAT)*: Corporations are entitled to deduct the VAT they pay on light commercial vehicles and their fuel and maintenance expenses (considered as 'working tools'), whereas they cannot deduct the VAT on passenger cars. Regrettably, TVA expenses are not simulated by OVE, but remain concealed in the corporation's expenses for vehicle purchase, fuel, maintenance, etc.
4) *Annual taxes on corporate passenger cars* (under the TVS scheme):[44] This annual tax on $CO_2$ emissions only applies to corporate passenger cars; light commercial vehicles are exempt from TVS liability. On average across all passenger car segments, TVS accounted for 7% of the TCO (about 600 EUR per year), with significant differences among market segments.
5) *Environmental incentives and penalties at purchase* (under the bonus/malus scheme): Only passenger cars are liable for the environmental penalty (known as the 'malus' scheme). However, both passenger cars and light commercial vehicles are eligible for environmental incentives (known as the 'bonus' scheme). In this simulation, some only passenger cars in the higher market segments were subject to a penalty.
6) *Vehicle registration taxes* (for both light commercial vehicles and passenger cars).

[44] See Chapter 7 for further information on this tax scheme.

Altogether, this simulation highlights the significant differences in TCO that can arise from different tax conditions. On the basis of a preliminary analysis, we calculate that benefit-in-kind taxation could have the most influence on corporate decisions about whether or not employees should be granted 'private use rights' on the vehicle. Yet, it is our understanding that such a decision would also depend on other considerations, including, from a human resource perspective, the need to attract and retain talent on competitive labour markets (see Section 3.2.1). Benefit-in-kind taxation should, however, have no impact on the choice between a corporate passenger car and a corporate light commercial vehicle.

All other taxes, on the other hand (with the sole exception of vehicle registration taxes), seem much more favourable to light commercial vehicles than passenger cars. We assume this could have some influence on the decisions corporations make about vehicle type for some use patterns that would be compatible with either type.

## 3.5 Some insights into the external costs of corporate car fleets

This section will provide some insights into the specific features and impacts of French corporate car fleets with regard to safety, energy, and emissions.

### 3.5.1 Safety issues

**33,000 accidents and 194 fatalities caused by the use of light-duty vehicles for work-related travel and commuting in 2012**

In line with Articles 9 and 10 of European Directive 89/391/EEC of 12 June 1989 on the introduction of measures to encourage improvements in the safety and health of workers at work (EEC, 1989), France made it mandatory for employers to assess and report on work-related health and safety risks.[45] In this context,

[45] *Loi n°91-1414 du 31 décembre 1991 modifiant le code du travail et le code de la santé publique en vue de favoriser la prévention des risques professionnels et portant transposition de directives européennes relatives à la santé et à la sécurité du travail.* Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte= JORFTEXT000000173965; and:
*Décret n°2001-1016 du 5 novembre 2001 portant création d'un document relatif à l'évaluation des risques pour la santé et la sécurité des travailleurs, prévue par l'article L. 230-2 du code du travail et modifiant le code du travail.* Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000000408526.

road accidents are, or should be, of particular concern to employers, because of their high contribution to work-related accidents in France.

According to statistics provided by the French National Health Insurance Fund for Employees (CNAMTS, 2013), out of the 641,000 work-related accidents which occurred in 2012,[46] about 3% (19,600) were road accidents. These road accidents accounted for close to 5% (1,900 out of 40,100) of all new occurrences of permanent work disability due to work-related accidents, 4% of total days of temporary work disability due to work-related accidents (1,491,000 out of 37,823,000), and a little over 20% of all work-related fatalities (115 out of 558). These statistics reveal that road accidents were among the most severe work-related accidents in France in 2012.

In addition to work-related accidents, road accidents represent a significant proportion of the commuting accidents of employees: 54,600 road accidents were recorded, which was more than 60% of the 90,000 commuting accidents recorded in 2012.[47] These accidents were responsible for 65% of new occurrences of permanent work disability resulting from commuting accidents (5,200 out of 8,100), 61% of the total days of temporary work disability resulting from commuting accidents (3,725,000 out of 6,103,000), and 85% of fatalities relating to the daily commute (271 out of 323). Altogether, road accidents accounted for 10% (74,200) of total work-related and commuting accidents, and for 44% (386) of total work-related and commuting fatalities in France in 2012 (CNAMTS, 2013).

Analysing these statistics with more detail about the type of vehicle involved in the accidents, it appears that passenger cars alone accounted for 31,500 accidents (33% of work-related road accidents and 46% of commuting road accidents), 2,848 new incidences of permanent work disability (34% of those due to work-related road accidents and 43% of those due to commuting road accidents), 1,955,000 days of temporary work disability (31% due to work-related road accidents and 40% due to commuting road accidents) and 176 fatalities (37% due to work-related road accidents, 49% due to commuting road accidents).

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[46] The statistics for work-related accidents cover 9 branches of activity, and 18.3 million employees in France in 2012. Accidents are recorded in CNAMTS' data sets as soon as the condition of the employee involved in the accident requires that he/she would be off work for more than 24 hours.

[47] Owing to the severity of commuting road accidents, the French National Health Insurance Fund for Employees (CNAMTS) issued a White Paper in 2012, proposing 12 measures to lower the safety risks incurred by employees on their daily commute (CNAMTS, 2012).

Light commercial vehicles accounted for another 1,800 accidents (7% of work-related road accidents but less than 1% of commuting road accidents), 173 new occurrences of permanent work disability (7% of those due to work-related road accidents but less than 1% of those due to commuting road accidents), 173,000 days of temporary work disability (8% of those due to work-related road accidents and close to 2% those due to commuting road accidents) and 18 fatalities (11% of work-related road accidents, 2% of commuting road accidents).

Altogether, work-related and commuting road accidents attributable to light-duty vehicles caused 33,300 accidents and 194 fatalities in France in 2012 – which is more than 5% of total road fatalities that year (see Chapter 1 for further information on road safety issues in France). It is unclear what proportion of these accidents and their consequences can be directly attributable to corporate car fleets, because of the lack of information on vehicle ownership in road safety data.[48] However, we can assume that this proportion is quite significant, in particular for: *i)* work-related road accidents; *ii)* road accidents attributable to light commercial vehicles.

Corporations have become increasingly aware of safety issues over the last decade (*Le Monde*, 2012). Indeed, the potential consequences for employers of such alarming statistics are manifold. First, work-related and commuting road accidents entail heavy economic costs for employers (and for society at large), in terms of medical expenses, lost productivity, vehicle and property damage, pain and suffering, and loss of life. Second, because employer contributions to the French National Health Insurance Fund for Employees are calculated on the basis of *i)* the total headcount, *ii)* the activity sector, and *iii)* actual performance in terms of work-related safety (which is assessed on the frequency and severity of work-related accidents affecting employees), poor road safety performance by employers can cost them a great deal in extra social security contributions. Finally, work-related accidents can, under certain conditions, also constitute a criminal offence on the part of the employer, punishable by a 45,000 EUR fine and imprisonment for a period up to 5 year. As far as corporate car fleets and road accidents are concerned, the employer's criminal liability can be established if it can be demonstrated, for instance, that the employee was making a work-related phone call at the time of the accident, or that the tyres of

[48] However, Charbotel *et al.* (2010) provide an analysis of work-related vs. non-work-related road accidents over the period 1997-2006, and provide specific information on the accidents involving 'special vehicles' (taxi, ambulance, fire service or police vehicles). Police vehicles accounted for 4.8% of road accidents while at work in 2003-2006 (3.4% in 1997-2000); then came taxis (1.7% in both periods), ambulances (1.0% in 1997-2000 then 0.8% in 2003-2006) and fire service vehicles (0.4% then 0.5%).

the corporate vehicle were in poor condition, or that the corporate vehicle showed anomalies.

**The low safety performance of light commercial vehicles**

Together with several other partners, the French National Health Insurance Fund for Employees (CNAMTS) issued a White Paper in 2007, proposing 12 measures to increase the safety performance of light commercial vehicles (CNMATS, 2007). The White Paper recognised the fact that light commercial vehicles were the poor relations in corporate car fleets with respect to safety issues in general, and to vehicle safety equipment in particular. Drawing on a national survey of 4,000 light commercial vehicles, CNAMTS reported that only 57% of LCVs were fitted with driver airbags (77% for LCVs aged 4 years or less), 33% with ABS (Anti-lock Breaking System), 10% with passenger airbags (14% for LCVs aged 4 years or less), and 2% with speed limiters and/or speed control systems (cruise control). CNAMTS also recognised that tyre explosions on motorways were three times as frequent for light commercial vehicles as for passenger cars, the main reasons for this being: *i)* poor monitoring of tyre pressure, and *ii)* the common practice of vehicle overloading.

Since improvement in vehicle safety equipment is widely acknowledged to be a major contributor to the safety performance of light commercial vehicles (CNAMTS, 2007; *La Tribune*, 2009, *Le Monde*, 2012; *Flottes Automobiles*, 2013a; OVE, 2014b), the National Health Insurance Fund for Employees launched successive incentive schemes, in 2011, 2012, and 2013,[49] to help employers purchase light commercial vehicles equipped with the following six pieces of safety equipment: ABS, EBA (Emergency Brake Assist), ESC (Electronic

[49] The 2011 incentive scheme (labelled '*Coût de pouce pour un utilitaire plus sûr*', running from April 2011 to 31 May 2012) provided for a single 3,000 EUR subsidy per company for the purchase of new LCVs equipped with the 6 pieces of safety equipment. The 2012 incentive scheme (labelled '*Utilitaire léger, le + sécurité*', running from 1 June 2012 to 15 October 2012) provided for a 2,500 EUR subsidy per vehicle with a cap of 25,000 EUR per company. The 2013 incentive scheme (running from 1 July 2013 to 15 October 2013) reproduced the conditions of the 2012 scheme. All three schemes were restricted to SMEs not exceeding 49 employees.

Stability Control), passenger airbags, partitioning and/or restraining systems,[50] speed limiters and/or speed control systems (OVE, 2014b).

On top of vehicle safety equipment, other actions that employers can undertake to improve the overall safety performance of corporate car fleets include: *i)* better planning of car trips, *ii)* better fleet management (vehicle monitoring and maintenance, tyre management, etc.), *iii)* stricter rules on the use of geolocation systems and mobile phone devices while driving, and *iv)* raising driver awareness about safe driving behaviour (*Le Monde*, 2012).

### 3.5.2 Energy factors

Energy factors in the corporate car fleet in France raise three types of questions: *i)* how much energy is used by the fleet as a whole?; *ii)* how much energy is used by each vehicle on average?; *iii)* what type(s) of energy is(are) used by the vehicles?

Only limited information is readily available on the actual fuel use of the corporate car fleet in France. Information provided by long-term rental companies is, in this regard, limited. Only 27% of vehicles registered by corporate fleets through long-term rental had subscribed to a fuel card service as part of their rental contract in 2012 (SNLVLD, 2012). For those vehicles however, SNLVLD stated that 633 million litres of fuel were bought in 2012 through the fuel card services associated with long-term rental contracts (down from 990 million litres in 1990) (SNVLD, 2005 and 2012a). Expressed as fuel consumption per individual fuel-card subscription (which makes more sense than a fuel consumption per vehicle since 3 out of 4 vehicles did not subscribe to the service), this reveals an average annual consumption of 2,100 litres of fuel per individual fuel-card.[51]

As the amount of fuel consumed by a given vehicle is much dependent on engine horsepower and on vehicle energy type (because diesel engines are for the time being more energy-efficient than petrol engines), we will now look

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[50] A partitioning system is a '*restraint system (*i.e. *bulkhead, grill or cargo barrier) designed to fully or partially separate the occupant compartment area of the vehicle from the cargo compartment area*'. Restraining systems are '*structures such as racking systems, partitioning systems, load rails, etc., that may be fitted to a vehicle in order to restrain cargo*'. (TRL Limited, 2008)

[51] Under the assumption of a fuel consumption rate of 7 litres per 100 km (under real-world driving conditions), 2,100 litres can power a vehicle for close to 29,000 km. This, at least, is consistent with the average yearly mileage of long-term rental contracts (29,900km in 2012) (SNLVLD, 2012e).

more closely at the specific features of corporate car fleets with regard to these two criteria.

First, it should be noted that the corporate car market segment in France has been heavily dominated by diesel in recent decades. Two sets of reasons are commonly provided for this state of affairs (*Le Monde*, 2012; *Le Parisien*, 2013a; *Les Echos*, 2013; OVE, 2014a): *i)* the fairly intensive use of corporate vehicles is more suited to diesel-powered vehicles (which are more energy-efficient than their petrol counterparts at cruising speed); and *ii)* favourable tax conditions for diesel-powered vehicles in corporate car fleets have given them a strong competitive edge over their petrol counterparts.[52] Another reason sometimes given is the higher residual value of diesel-powered vehicles on the second-hand vehicle market (*Les Echos*, 2013), which would stem from the preference of households for: *i)* the lower fuel consumption of diesel vehicles compared with petrol vehicles; and *ii)* the cheaper pump price of diesel compared with petrol in France.

According to the professional journal *L'Automobile&L'Entreprise* (2013), 92.0% of new-vehicle sales to corporate car fleets in France in 2012 were diesel-powered vehicles, as compared with 67.8% for new-vehicle sales to other market segments.

SNLVLD provides similar insights into the high proportion of diesel vehicles in corporate car fleets: based on a sample representing 96.5% of its members' long-term rental vehicles (1,121,000 out of the 1,161,000 vehicles in use in 2012), it appears that 96.9% of the vehicles registered with long-term rental companies were diesel-powered in 2012 (1,086,000 of the 1,121,000 vehicles in sample) (SNLVLD, 2013a).

### 3.5.3 Emissions

#### Emissions of particulate matter and other local pollutants

In the light of the high proportion of diesel engines among corporate vehicles (and particularly light commercial vehicles), we assume that they would probably play a significant part in the total emissions of particulate matter and other local pollutants by light-duty vehicles in France. However, we could find no assessment of the emissions of local pollutants by corporate car fleets. Such an assessment would require an in-depth knowledge of the composition and age distribution of corporate vehicles. Moreover, to assess the impacts on human health of local pollutant emissions by corporate vehicles, more information would be needed on the use patterns of these vehicles and, in particular, on the

[52] See Chapter 7 for further information on the tax schemes applicable to corporate car fleets.

proportion of their total mileage covered in an urban environment). These issues need to be further investigated.

From the public policy standpoint, it should be noted that, under Article R323-22 of the French Highway Code,[53] light commercial vehicles are subject to an *annual* technical check of their local pollutant emissions, starting four years after their initial registration. In addition, since October 2013, the tax base of the annual tax on corporate passenger cars (the TVS scheme) has included a second component besides $CO_2$ emissions, in order to account for local air pollution caused by corporate *passenger cars*.[54]

Finally, because the turnover rate of corporate car fleets is fairly high, emissions of local pollutants by corporate vehicles are likely to improve steadily in line with the evolution of European emission standards.

#### The continuing decline in $CO_2$ emissions by corporate passenger cars in France

As part of its action to mitigate climate change, the European Union has sought to foster reductions in $CO_2$ emissions by light-duty vehicles with legislation targeting the *supply side* of the automotive market. Two regulations, in 2009 and 2014, set mandatory $CO_2$ emission targets on the European market for *new* passenger cars (130 $gCO_2$/km by 2015, and 95 g $CO_2$/km by 2021).[55] Because of the significant share of corporate fleets in the market for new passenger cars in Europe, car manufacturers have developed new models which, while meeting the specific needs of corporate customers, would comply with European requirements.

In France, climate policy began targeting the *demand side* of the automotive market as early as 2006, first through the TVS tax scheme (a circulation tax – also known as a 'road tax' – on corporate passenger cars), then through the bonus/malus scheme on sales of new passenger cars.[56] Indeed, $CO_2$ emissions have been a central preoccupation for corporate car fleets since 2006, when the TVS tax scheme (which specifically targets corporate passenger cars, not light-

[53] Available from: http://legifrance.gouv.fr/affichCode.do?idSectionTA=LEGISCTA000006177155&cidTexte=LEGITEXT000006074228&dateTexte=20140615

[54] See Chapter 7 for further information on the TVS tax scheme.

[55] See Annex B for further information on the European policy framework targeting $CO_2$ emissions from light-duty vehicles.

[56] The bonus/malus scheme was designed and implemented in the aftermath of the October 2007 'Grenelle Environment Round Tables'. See: *Loi n° 2007-1824 du 25 décembre 2007 de finances rectificative pour 2007*, Art.63. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000017839505.

duty vehicles) was first converted from a tax based on engine horsepower to a tax based on $CO_2$-emission levels.[57] Because of increasingly dissuasive tax rates, corporate car fleets have endeavoured to lower the emissions of their passenger cars through: *i)* fleet renewal; and *ii)* purchase of more energy-efficient vehicles.

The results have been compelling: according to SNLVLD statistics, in 2007, 82% of the long-term rental fleet of corporate passenger cars emitted 160 $gCO_2$/km or less, whereas 8% emitted more than 200 $gCO_2$/km (SNLVLD, 2007). In 2013, six years after the introduction of $CO_2$ emissions as the basis of the TVS tax scheme, 34% of the long-term rental fleet of corporate passenger cars emitted 105 $gCO_2$/km or less, 79% emitted 135 $gCO_2$/km or less, whereas, at the other end of the scale, 9% still emitted more than 165 $gCO_2$/km, and 3% more than 200 $gCO_2$/km (SNLVLD, 2014).

Furthermore, according to statistics provided by OVE, the average $CO_2$ emission level of long-term rental corporate passenger cars decreased by 21% in just 6 years (-3.8% or -5 $gCO_2$/km per year on average), from 145 $gCO_2$/km in 2007 to 115 $gCO_2$/km in 2013 (OVE, 2013a and 2014c). Thus, corporate car fleets have remained 3 $gCO_2$/km ahead of the average $CO_2$ emissions of new passenger car sales in France, which decreased from 148 $gCO_2$/km in 2007 to 118 $gCO_2$/km in 2013 (OVE, 2014c).

Taking the average unitary emissions of the long-term rental corporate passenger car fleet as a low estimate for the average unitary emissions of the whole corporate passenger car fleet (i.e. 130 $gCO_2$/km in 2010[58]), and based on a rough estimate of 60 billion km travelled per year by corporate passenger cars, we find that corporate passenger cars could be accountable for at least 7.8 million tonnes of $CO_2$ emissions, or about 8.5% of the total 92 million tonnes of $CO_2$ emissions from light-duty vehicles in France in 2010.[59] Moreover, taking the average unitary emissions of the whole passenger car stock in France as an upper estimate for the average unitary emissions of the whole corporate passenger car fleet (i.e. 178 $gCO_2$/km in 2010),[60] and based on a rough estimate of 60 billion km travelled per year by corporate passenger cars, we find that corporate passenger cars could account for at most 10.6 million tonnes of $CO_2$

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[57] See Chapter 7 for further information on this tax scheme.

[58] Source: OVE (2013). 2010 is chosen as the year of reference for $CO_2$ emission for the sake of comparability of results with subsequent calculations relating to $CO_2$ emissions from light commercial vehicles.

[59] $CO_2$ emission estimates for 2010 are taken from Breteau and Léglise (2013).

[60] Based on Breteau and Léglise (2013).

emissions, or about 11.5% of the total 92 million tonnes of $CO_2$ emissions from light-duty vehicles in France in 2010.[61] These estimates compare with the 6.7% share of corporate passenger cars in the total fleet of light-duty vehicles in 2010, and with their 12.2% share in the total mileage of light-duty vehicles in 2010.[62]

**$CO_2$ emissions from professional LCVs also on the decline**

Light commercial vehicles have received special treatment, as far as $CO_2$ emissions are concerned, at both European and national levels. At European level, mandatory emission targets for new light commercial vehicles sold on the European market have been set at 175 $gCO_2$/km by 2017, and 147 $gCO_2$/km by 2020.[63]

In France, light commercial vehicles have remained unaffected by both the TVS tax scheme *and* the bonus/malus scheme.[64] This could explain why the $CO_2$ emissions of light commercial vehicles are not closely monitored by corporate car fleets (OVE, 2014d). According to OVE statistics (2014d), *new* light commercial vehicles acquired through long-term rental were already below the 147 $gCO_2$/km limit as of 2013. However, because of the particularly high proportion of passenger-car derivatives in the LCV fleet of long-term rental companies, this might not be representative of all new corporate LCV sales in France.

Based on the 2005 and 2010 national surveys on the use of light commercial vehicles, two analyses by the French Ministry of Transport provide some useful insights into trends in $CO_2$ emissions from light commercial vehicles in France (CGDD, 2011; Breteau and Léglise, 2013). They reveal that professional LCVs accounted for: *i)* 62% of the total LCV fleet, 75% of the total mileage of LCVs, and 77% of the total $CO_2$ emissions from LCVs in 2005 (with a scope limited to

[61] According to these estimates, corporate passenger cars could be responsible for between 7% and 9% of the total 113 million tonnes of $CO_2$ emissions from road motor vehicles (including light-duty vehicles and large goods vehicles, but excluding motorised two-wheelers) in France in 2010 (Breteau and Léglise, 2013).

[62] These ratios are calculated by applying the previously calculated ratios of 8% corporate passenger cars in the total passenger car stock and 15% corporate passenger car mileage in the total passenger car mileage, to CCTN estimates for the overall stock and traffic of passenger cars in France in 2010 (SOeS, 2011a).

[63] See Annex B for further information on the European policy framework targeting $CO_2$ emissions from light-duty vehicles.

[64] See Chapter 7 for further information on the scope and history of these tax schemes.

vehicles aged 20 years and less); and *ii)* 59% of the total LCV fleet, 74% of the total mileage of LCVs, and 75% of the total $CO_2$ emissions from LCVs in 2010 (with a scope including all vehicles, whatever their age). Checking these ratios against the national estimates by CCTN for the total fleet, traffic and $CO_2$ emissions of light-duty vehicles in general and light commercial vehicles in particular, it can be inferred that the overall contribution of professional LCVs to the $CO_2$ emissions from light-duty vehicles in France slightly decreased from 17.7% in 2005 to 17.1% in 2010.[65] This compares with the 9.3% share of professional LCVs in the total stock of light-duty vehicles in 2010 (9.6% in 2005), and with their 13.6% share in the total mileage of light-duty vehicles (stable from 2005 to 2010).

Focusing now on unitary emissions, these analyses reveal that the average unitary emissions (under real-world conditions) from professional LCVs in use in France decreased by 5% in 5 years (-1.1% per year), from 248 $gCO_2/km$ in 2005 to 235 $gCO_2/km$ in 2010.[66] Such figures suggest that, although they do not incur the same tax pressure as passenger cars with regard to $CO_2$ emissions, light commercial vehicles may not significantly lag behind in terms of relative efficiency gains.

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[65] The contribution of professional LCVs to total $CO_2$ emissions from road motor vehicles (including passenger cars, light commercial vehicles and large goods vehicles, but excluding motorised two-wheelers) was stable from 2005 to 2010, at about 14%. This compares with the 9% share of professional LCVs in the total fleet of motor vehicles, and with their 13% share in the total mileage of motor vehicles.

[66] By way of comparison, according to CCTN estimates used by CGDD (2011) and Breteau and Léglise (2013), over the same period of time, unitary emissions from the passenger car stock in France decreased by only 1% (0.2% per year), from 180 $gCO_2/km$ in 2005 to 178 $gCO_2/km$ in 2010.

| Basic indicators [1] | The share of professional LCVs in the total fleet, traffic and $CO_2$ emissions of light vehicles in France | |
|---|---|---|
| | 2005 | 2010 |
| Number of professional LVCs ($10^6$ units) | 3.4 | 3.4 |
| *as a % of the LV fleet* | *9.6%* | *9.3%* |
| Distance travelled by professional LCVs ($10^9$ km) | 65.5 | 66.5 |
| *as a % of LV traffic* | *13.6%* | *13.6%* |
| $CO_2$ emissions by professional LCVs ($10^6$ $tCO_2$) | 16.3 | 15.7 |
| *as a % of LV emissions* | *17.7%* | *17.1%* |

*LCV: Light Commercial Vehicle; LV: Light(-duty) Vehicle (including passenger cars and light commercial vehicles)*
*Note: 1. Ratios of professional LCVs in total LCV fleet, traffic and emissions were first obtained from the 2005 and 2010 LCV surveys; they were then applied to CCTN estimates for the overall fleet, traffic and emissions of LCVs in France.*

**Table 3.2: The share of professional LCVs in total $CO_2$ emissions from light-duty vehicles (CGDD, 2011; Breteau and Léglise, 2013)**

### Corporate car fleets could account for 25% to 29% of total $CO_2$ emissions from light-duty vehicles

Based on previous estimates for total $CO_2$ emissions by corporate passenger cars on the one hand (estimated between 8.5% and 11.5% of the total $CO_2$ emissions of light-duty vehicles in France in 2010), and light commercial vehicles on the other hand (estimated around 17% of the total $CO_2$ emissions of light-duty vehicles in France in 2010), corporate car fleets could together account for roughly 25% to 29% of total $CO_2$ emissions from light-duty vehicles in France. This compares with their estimated 16% share in the total light-duty vehicle stock, and with their estimated 26% share in the total mileage of light-duty vehicles in France.

Two opposing effects seem to balance each other to achieve such close estimates for the share of corporate car fleets in the overall mileage of light-duty vehicles, on the one hand, and for the share of corporate car fleets in the total $CO_2$ emissions of light-duty vehicles, on the other hand. First, owing to a fleet generation effect, we could expect that corporate car fleets would represent a smaller share in total emissions than in total mileage: indeed, corporate car vehicles tend to be more recent, and therefore emit rather less than other light-duty vehicles (relative to the distance travelled). On the other hand, owing to a fleet composition effect, we could expect that corporate car fleets would represent a higher share in total emissions than in total mileage: indeed, corporate car fleets include a larger proportion of light commercial vehicles (around 55% to 60%), and therefore emit rather more (relative to the distance travelled), than the average light-duty vehicle fleet in France (around 15%).

While on the topic of greenhouse gas emissions, it is worth noting that we could find no information on the emissions of HFCs by corporate car fleets.[67] It is, however, very likely that professional LCVs equipped with refrigerating systems on the one hand, and high-end corporate passenger cars fitted with air-conditioning on the other hand, would both represent significant shares of transport HFC emissions.

**French corporate car fleets are best in class in Europe with regard to $CO_2$ emissions**

A Europe-wide analysis by the long-term rental company GE Capital Fleet Services based on 200,000 vehicles held by their corporate customer base, revealed that France had the corporate car fleets with the lowest $CO_2$ emissions of all countries in 2012. With an average of 122.1 $gCO_2/km$, French corporate car fleets emitted 1% less than Benelux fleets, 4% less than UK fleets, 6% less than Spanish fleets, 8% less than Italian fleets, 11% less than German fleets, and 5% less than the European average. Interestingly, they were already best in class in 2008, with an average of 141.5 $gCO_2/km$, which was already 2% lower than the UK average, 6% lower than the Spanish average, 7% lower than the Italian average, 11% lower than the Benelux average, 14% lower than the German average, and 7% lower than the combined European average. (*JournalAuto.com*, 2013)

Three reasons can be provided for the relatively good performance of corporate car fleets in France with regard to $CO_2$ emissions as early as 2008. First, on the *regulatory* side, it should be noted that, before it was converted to a tax based on $CO_2$-emission levels (in 2006), the TVS tax scheme had been in place in France since 1956. It was then based on engine-horsepower, which has a significant, though complex, influence on $CO_2$ emissions. Thus, the initial circulation tax on corporate passenger cars in France may have initiated the trend towards more energy-efficient vehicles in corporate car fleets. Second, on the *supply* side, we have already noted that French car manufacturers retained a large majority share on the corporate car market segment in France in the 2000s (*L'Automobile&L'Entreprise*, 2013). Because French manufacturers are less focused on 'premium segments' than their German or British competitors (*Le Monde*, 2013a; *Les Echos*, 2013), the strategic industrial choices of French

[67] For the record, hydro-fluorocarbons (HFCs) are one of the three groups of fluorinated gases covered under the Kyoto Protocol, which are commonly used as refrigerants in refrigeration, air-conditioning and heat pump equipment, as blowing agents for foams, as solvents, and in fire extinguishers and aerosols. Transport was responsible was 24% of all HFC emissions in France in 2011 (CITEPA, 2013). See Chapter 1 for further information.

car manufacturers may have had an influence on the overall efficiency of corporate car fleets in their home market. Last, on the *demand* side, we would note that, because of early favourable tax conditions for diesel, the share of diesel cars in corporate car fleets (and in household fleets as well) was already higher in France than in any other Western European countries a decade ago (CCFA, 2014). Because diesel engines are more $CO_2$-efficent than petrol engines, the high proportion of diesel vehicles in French corporate car fleets may have contributed to their relatively good performance with regard to $CO_2$ emissions.

# 3.6 Conclusion

Through an extensive review of the academic and non-academic literature on corporate car fleets in France, we have been able to develop a set of definitions as well as an analytical framework for our investigation of corporate car fleets.

We have chosen a rather wide perimeter for our definition of corporate car fleets, which would cover all light-duty vehicles (including passenger cars and light commercial vehicles) *held* by corporations, whether public or private, whether large or small. The difference between corporate car fleets as we define them and the total volume of vehicles *owned* by corporations in France stems from the following two main exclusions: *i)* we have chosen to exclude vehicles owned by car dealerships, because these corporations only own the vehicles until their retail sales to end customers; and *ii)* we have also excluded vehicles owned by long-term rental companies and directly leased to households, with no involvement by the employer. On the other hand, we have stressed that there would be an overlap between our definition of corporate car fleets and the definition of the household vehicle fleet as it commonly researched through household mobility surveys. This overlap would consist of vehicles that are provided to households by an employer, for the exclusive use of the household (employee), to which the household (employee) has full-time access. We undertake an analysis of the features and use patterns of such vehicles in the next chapter.

Within the perimeter we have chosen for our definition of corporate car fleets, we have developed an analytical framework for the analysis of corporate car fleets (by looking at such criteria as corporation type, fleet size, vehicle body type, etc.), and we have presented a typology of our own making based on the 'rights' granted to the employee over the vehicle. This typology proposes a primary distinction between *service vehicles* and *official vehicles*, the difference being that the latter can be used for private trips and therefore qualify as a fringe benefit (or benefit in kind). This typology would, however, need to be tested for operational validity and for analysis workability through subsequent investigation.

Through a cross-analysis of multiple sources, we have been able to assess the share of corporate car fleets in the total light-duty vehicle fleet in France. Based on rough estimates, corporate car fleets in France may consist of 6 million light-duty vehicles (including 2.5 million passenger cars and 3.5 million light commercial vehicles), or 16% of the total fleet in use (about 8% of all passenger cars and close to 60% of all light commercial vehicles). On the other hand, we have stressed that corporate car fleets could account for close to 40% of total annual new light-duty vehicle sales in France. Put together, this 40%-share of corporate car fleets in total sales and their 16%-share in the total light-duty vehicle fleet, point to the *high turnover rate* of corporate vehicles (their turnover could be about three times as fast as the turnover of private vehicles).

In addition, in recent years, new vehicle sales in the corporate market segment have remained fairly steady compared with the household segment. This good performance in the corporate market for new light-duty vehicles has fuelled the interest of market players. French manufacturers, which still retain a 60% share of this market segment, have been facing increasingly fierce competition from foreign competitors – especially German and Japanese – specialising in 'premium' segments. In addition, long-term rental companies have gradually gained market share on the corporate vehicle market. They now account for 60% of all new vehicle sales to corporations in France, and have therefore become a major source of information on corporate car fleets.

Looking now at the use of light-duty vehicles by corporate car fleets, we have been able to assess the share of corporate vehicles in the total mileage of the light-duty vehicle stock in France. According to our estimates, corporate car fleets in France could account for 130 billion vehicle-kilometres travelled (about half by passenger cars, half by light commercial vehicles), or close to 25% of the total mileage of light-duty vehicles in France. This, as compared with the 16% share of corporate vehicles in the total light-duty vehicle stock in France, would point to a *highly intensive use* of corporate vehicles (at least 50% more intensive than the use of private light-duty vehicles).

Our review of the literature has provided further insights into the costs of corporate vehicles to corporations. Drawing on a cost assessment methodology developed by the industry, based on the concept of Total Costs of Ownership (TCO), we have shown that, depending on the market segment, the costs to corporations of holding and using a passenger car over 4 years and 100,000 km could range from 6,000 EUR per year (for an economical car) to 19,000 EUR per year (for a luxury car). Taxes would represent 20% of this amount, including 9% for benefit-in-kind taxation alone (on the assumption that the vehicle is used by the employee on private trips). On the other hand, the costs to corporations of holding and using a light commercial vehicle over 4 years and 100,000 km would tend to range from 5,000 EUR to 9,000 EUR per year depending on the market segment. Because light commercial vehicles enjoy much favourable tax conditions compared with passenger cars, taxes would only account for 1% of the total costs of ownership of corporate light commercial vehicles. Because of the significant impact of taxes on TCO, their possible influence on the vehicle choice decisions of corporate fleets will require further investigation.

On the basis of a preliminary analysis, we calculate that benefit-in-kind taxation could have the greatest influence on corporations' decisions aboutwhether or not 'private use rights' should be granted to the employee on the vehicle. However, it is our understanding that such a decision would also depend on other considerations, including, from a human resource perspective, the need to attract and retain talent on competitive labour markets. Benefit-in-kind taxation should, however, have no impact on the choice between a corporate passenger car and a corporate light commercial vehicle, because it does not discriminate between the two vehicle types. Almost all other taxes, on the other hand, favour light commercial vehicles over passenger cars, which could influence the decisions of corporations with regard to vehicle type for some use patterns and purposes that would be compatible with either type.

Finally, we have highlighted several specific issues relating to the *external* costs of corporate car fleets. Corporations are increasingly aware of road safety issues. Indeed, despite recent progress, work-related and commuting road accidents attributable to light-duty vehicles are still high (33,300 accidents and 194 fatalities in France in 2012, which is more than 5% of total road fatalities that year). However, we could not assess the proportion of the road accident toll specifically attributable to corporate car fleets. On energy issues, we have shed light on the highly dominant position of diesel on the corporate market. More than 90% of new-vehicle sales to corporate car fleets are diesel vehicles, which is 15 percentage points higher than in the household market. Although the intensive use of corporate vehicles might be partly responsible for this high proportion of diesel engines, favourable tax conditions for diesel-powered vehicles in corporate car fleets are likely to give them a strong competitive edge over their petrol counterparts. Last, we assessed the share of corporate car fleets in the total $CO_2$ emissions of light-duty vehicles in France between 25% and 30%. The high proportion of light commercial vehicles in corporate car fleets is at least partly responsible for this high share of corporate car fleets in total $CO_2$ emissions relative to their overall share in the total mileage of the light-duty vehicle stock.

# Chapter 4
# Corporate vehicles held by private households

*We wish to extend special thanks to Laurent Proulhac and Julie Chrétien for their valuable contributions to this chapter. Both of them made available to us their expertise in data analysis: Laurent Proulhac for the purpose of analysing the holding and use of corporate cars by private households; Julie Chrétien for the purpose of analysing the influence of corporate cars on the broader mobility patterns of private households.*

## 4.1 Introduction

### 4.1.1 Background

Our preliminary investigation into corporate car fleets in Chapter 3 showed that there could be some overlap between vehicles held by corporations, on the one hand, and vehicles held by private households, on the other (see Figure 3.2). Indeed, some vehicles, while owned or leased by the employer, can be considered as 'held' by the employee's household to the extent that the latter has exclusive use of, and full-time access to, this vehicle. Based on our categorisation of corporate vehicles (see Figure 3.3), such vehicles could include: *i)* assigned service vehicles for which the employee has supplementary commuting rights (exclusive use of, and full-time access to, the vehicle are granted, but private use rights are not), and *i)* 'official vehicles' (maximum rights are granted on the vehicle, including private use rights).

The holding and use of automobiles by private households are long-established research topics in France (see, for example: Madre and Gallez, 1993; Motte-Baumvol, 2007; Robin, 2010; Roux, 2012). Indeed, various databases have been developed based on large-scale surveys, from national to local level, which offer information about the travel behaviour of private households in general, and about their holding and use of motor vehicles in particular. Through the National Transport and Travel Survey (ENTD), we learn, for instance, that in 2008 French private households held 32.7 million vehicles (1.55 vehicles per household on average for households holding at least one vehicle), which on average were 8.7 years old and travelled 13,000 km per year. We also learn that, on an average weekday in 2008, people living in the City of Paris would make four times fewer car trips per day than people living in the suburbs of Paris (0.41 trips per day, as compared with 1.58), five times fewer than people living in the city centres of other large urban areas (1.99 trips per day), and eight times fewer than people living in the suburbs of small urban areas (3.17 trips per day). (Robin, 2010)

The in-depth understanding of the ownership and use of cars by French households that has been built up by researchers over the last decades on the basis of such surveys,[1] provides a sound background for future studies on long-term scenarios for the development of household vehicle holding and use in France (see, for instance: Madre *et al.*, 2012), or long-term scenarios for the adoption of electric vehicles by French households (see, for instance: Windisch, 2013).

### 4.1.2 Statement of the problem

Unlike for private households, there are no large-scale surveys on the holding and use of automobiles by corporations in France. For this and other reasons, there is a deficit of knowledge about the features and patterns of use of corporate vehicles. Existing surveys and databases that contain detailed information on motor vehicles used by private households are a potential (though partial) source of information on the holding and use of *corporate cars* by these households.

Given this opportunity to use household travel surveys to collect information on corporate vehicles, it would have to be confirmed whether private households indeed hold a significant share of the corporate vehicle fleet in France in order to validate the academic relevance of exploring household travel surveys to investigate corporate car fleets.

Assuming methodological concerns can be taken care of, several lines of investigation seem worth pursuing in order to start building a basic knowledge of corporate vehicles in terms of their use by private households. Two different perspectives can be adopted in that regard. Looking at the problem from the perspective of *vehicles*, it would be interesting to analyse the main features and

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[1] For instance, the National Transport and Travel Surveys have been conducted approximately once every ten years since the 1960s.

general patterns of use of corporate vehicles in private household fleets. On the other hand, looking at this problem from the perspective of *households*, it would also be interesting to analyse the specific features of those households with one or more corporate vehicle(s) in their fleet, and understand how access to such a vehicle influences the mobility patterns of all members of the household.

### 4.1.3 Purpose of the analysis

The quantitative analysis conducted in this chapter aims to achieve four main knowledge objectives on corporate cars held and used by private households in France. After providing basic information on the share of corporate vehicles in the wider household stock, we endeavour to analyse the specific features of households holding one or more corporate vehicle(s) in their fleet compared with other private households. In particular, we want to shed light on the socio-demographic features of households holding corporate vehicles in their fleets (income, socio-occupational category, residential area, etc.), and discuss whether these households have one (or more) typical profile(s).

Second, focusing on vehicles *per* se, we aim to review the features of corporate vehicles held by private households (including their age, horsepower, fuel type, etc.), and discuss whether these features differ from those of the other vehicles in household fleets.

Third, we aim to look into the patterns of use of the corporate vehicles in household fleets (in terms of distance travelled, trip purposes, temporal and spatial distribution of trips, etc.), and highlight possible differences from the patterns of use of the other vehicles in household fleets.

Last, going back to our initial focus on households, we aim to analyse the influence of corporate cars on the broader vehicle holdings and mobility patterns of households.

### 4.1.4 Approach

Building on the insights gained from the initial investigation of corporate car fleets we developed in the previous chapter, we use existing databases on private household mobility in order to observe, through this specific prism, the holding and use of corporate cars by private households in France.

As already mentioned, in what follows we take the view that private households can 'hold' corporate vehicles even though formal ownership of the said vehicles is actually held by the employer or a by third-party company such as a long-term rental company (see Chapter 3 for our respective definitions for the terms 'holding' and 'ownership' in the particular context of corporate cars). Indeed, we know from previous investigations that some private households are provided by employers with full-time access and use of corporate cars to meet their private as well as professional automobility needs.

Because household travel surveys have, to the best of our knowledge, never been used in France to collect information on corporate vehicles, we will first verify *i)* that private households hold a significant share of the corporate vehicle stock in France, *ii)* that household travel surveys collect information on corporate vehicles in a systematic and robust manner, and *ii)* that corporate vehicles represent a large enough share of the household motor vehicle stock for the analyses based on this subset of vehicles to be deemed significant.

For the main part of our analysis, we will use data from a regional household travel survey conducted in 2010 in the Paris region, the EGT survey, thereby focusing on what we assumed to be one of the regions in France with the highest concentration of corporate cars held by private households, because of the high concentration of corporations in general, and of large organisation headquarters in particular.

To achieve our knowledge objectives, we will adopt two different perspectives. On the one hand, we will adopt a *household-centred perspective* (i.e. a user-centred perspective) when analysing *i)* the specific features of households holding one or more corporate vehicle(s) in their fleet, and *ii)* the influence of access to a corporate vehicle on wider mobility patterns in the household. On the other hand, we will adopt a *vehicle-centred perspective* when analysing the main features and general patterns of use of corporate vehicles in private household fleets.

On every key topic, we will develop both a descriptive approach and a comparative approach. Indeed, we will, for instance, simultaneously *describe* the features of corporate cars held by private households, and *compare* these features with those of the other vehicles held by private households. Depending on the type of information considered, comparisons will be held at the vehicle level (comparing corporate vehicles with private vehicles) or at the household level (comparing households holding at least one corporate vehicle with those holding private vehicles exclusively).

### 4.1.5 Outline of the chapter

The chapter is structured into five main parts and a conclusion. First, we will describe the methodology for using household travel surveys to analyse the features and use patterns of corporate cars (Section 4.2). Second, we will shed light on the key characteristics of those households in the Paris region which hold one or more corporate car(s) (Section 4.3). Then, we will analyse the key features of the corporate vehicles held by private households (age, horsepower, fuel type, etc.) (Section 4.4), as well as the specific features of the patterns of use of these vehicles (distance travelled, trip purposes, time and space distribution of trips, etc.) (Section 4.5). Finally, we will look into the influence of corporate cars on the broader mobility patterns of private households (Section 4.6). In the conclusion (Section 4.7), we will discuss the results of our quantitative analysis in the light of the results of our earlier investigation of corporate car fleets based on the academic and professional literature.

# 4.2 Methodology: Our exploration of household travel surveys

## 4.2.1 Overview of household travel surveys

Various databases have been developed from large-scale surveys, from national to local level, which offer information about the travel behaviours of private households in general, and about their holding and use of motor vehicles in particular.

At the national level, the National Transport and Travel Survey (ENTD, for *Enquête Nationale Transports et Déplacements*) is jointly conducted by France's National Institute of Statistics and Economic Studies (INSEE) and the Ministry of Sustainable Development's Observation and Statistics Service (SOeS). Its purpose is to gather information on: *i)* the journeys undertaken by French households, whatever their length, duration, modes of transport, time of year, time of day or reason for travelling; *ii)* the opportunities for access to public transport and the means of private transport held and used by the households. The National Transport and Travel Surveys are more or less periodic: they have been conducted approximately once every ten years since the 1960s. The 2007-2008 survey was the fifth in the series, after those of 1966-1967, 1973-1974, 1981-1982 and 1993-1994. Not only do ENTD surveys cover a wide range of household travel, including commuting trips (regular travel to work or school), daily mobility and long-distance travel (including all trips of more than 80 km from home), they also collect special data on car use via motor vehicle logbooks ('*carnet véhicule*') (Armoogum *et al.*, 2010).

At the local level of urban areas, more than 100 Household Travel Surveys (EMD, for *Enquête Ménages Déplacements*) have been conducted in France since 1976 in more than 50 cities: Lyon in 1977, 1986, 1995 and 2006, Bordeaux in 1978, 1990, 1998 and 2009, Grenoble in 1978, 1985, 1992, 2002, 2009-2010, etc. The French National Centre for Studies on Road Networks, Transport, Urban Planning and Public Structures (CERTU) has developed a standardised methodology for these urban household travel surveys, called 'EMD standard CERTU', to ensure the robustness and comparability of survey results between cities and over time. The survey relies on four forms, dealing with: *i)* household characteristics (including type of residence and ownership of private transport means), *ii)* individual characteristics (for household members aged 5 and above, including socio-professional category, possession of a driving licence, travel behaviours), *iii)* travel behaviours (origin, destination, duration, modes of transport and purpose of all journeys undertaken by the household members on a given weekday), and *iv)* personal opinion (on urban amenities and transport modes). In the early 2000s, CERTU customised the original 'EMD standard CERTU' methodology for two new geographical ranges, creating the 'EDVM standard CERTU' (EDVM standing for *Enquête Déplacements Villes Moyennes*) for medium-sized towns (defined as urban areas with a population under 100,000 inhabitants) on the one hand, and on the other hand, the 'EDGT standard CERTU' (EDGT standing for *Enquête Déplacements Grand Territoire*) for territories consisting of a combination of dense zones and periurban, or even rural, areas. (Armoogum *et al.*, 2010; CERTU, 2013)

In the Paris region (also known as *Île-de-France*), a specific survey has been developed: the EGT survey (*Enquête Globale de Transport*), which is roughly based on the same operating principles and questionnaires as those of the EMD surveys. Five EGTs have been conducted in the last 50 years: in 1976, 1983, 1991, 2001, and most recently in 2010. Unlike ENTD surveys, EGT surveys and other EMD surveys focus exclusively on local mobility. (Armoogum *et al.*, 2010; CERTU, 2013)

### 4.2.2 Database selection

Table 4.1 presents some basic data on corporate vehicles in household fleets from the 2010 EGT database and the 2007-2008 ENTD database.

For our quantitative analysis of the holding and use of corporate cars by private households in France, we chose to begin with the exploration of the 2010 EGT survey database. The reasons for this choice of data source were twofold. The main reason what that, from a preliminary analysis of EGT and ENTD databases (see Table 4.1), we found that the share of corporate vehicles in the overall motor vehicle fleet of private households was higher in the Paris region than in France in general (6.0% as compared with 2.9%), as was their share in the overall annual car mileage of private households (13.0% as compared with 5.9%). This observation confirmed our initial assumption that the Paris region would be one of the regions in France (maybe *the* region in France) with the highest concentrations of corporate cars in private household fleets, due to the high concentration of corporations in general, and large organisation headquarters in particular. We deemed that it would, in turn, enhance the robustness of our quantitative analysis. Moreover, the results of the most recent EGT survey (2010) had just been made available at the time of starting our research project.

| HHs' automobile fleet and annual mileage | Corporate vehicles | Private vehicles | Total fleet |
|---|---|---|---|
| Greater Paris region (2010 EGT survey) | | | |
| Number of vehicles | 289,134 | 4,570,225 | 4,859,359 |
| *as a % of total fleet* | *6.0%* | *94.0%* | *100.0%* |
| Daily mileage (.$10^3$ km) | 9,339 | 62,579 | 71,919 |
| *as a % of daily mileage* | *13.0%* | *87.0%* | *100.0%* |
| France (2007-2008 ENTD survey) | | | |
| Number of vehicles | 961,797 | 31,764,038 | 32,725,835 |
| *as a % of total HH fleet* | *2.9%* | *97.1%* | *100.0%* |
| Weekly mileage (.$10^6$ km) | 454.6 | 7,191.4 | 7,646.0 |
| *as a % of weekly mileage* | *5.9%* | *94.1%* | *100.0%* |

*HH: Household*

**Table 4.1: Share of corporate vehicles in the overall vehicle fleet and in the overall automobile mileage of private households (2010 EGT survey, 2007-2008 ENTD survey)**

### 4.2.3 Corporate cars in the 2010 EGT survey database: outreach and limitations

To the best of our knowledge, there are no data available on the total size of the corporate vehicle fleet in the Paris region. Therefore, we can have no direct confirmation that the 290,000 vehicles held by private households in the Paris region (according to the 2010 EGT survey) constitute a significant share of the total corporate vehicle fleet in the region. However, on the basis of data provided by the ENTD survey at national level, French households could hold close to one million corporate vehicles in their fleets, which would represent about 17% of our initial estimate for the total corporate vehicle fleet in France (close to 6 million vehicles; see Chapter 3 for a detailed account of this estimate). We consider this a good enough validation of the academic relevance of using household travel surveys to investigate corporate car fleets in France.

The 2010 EGT survey relies on 4 tables (also called 'forms', or '*fiches*' in French): *i)* a Household form, *ii)* an Individual form, *iii)* a Travel form, and *iv)* a Trip form (see TNS SOFRES, 2009a, 2009b, 2009c and 2009d; MEDDE, 2013c). Data on the vehicles held by the household are collected through the Household form. This form includes a specific question on the ownership of the vehicles. The corresponding variable, encoded as *POSSV*, identifies whether vehicles are 1) owned by the household, 2) owned by the household with a financial contribution by the employer, 3) owned by the employer (a note is made in the form to earmark official cars or 'perk' cars – in French, '*véhicule de fonction*': see Figure 4.1), or else 4) held by the household through another arrangement (rental, leasing, lending, etc.) (STIF and DRIEA, 2010).

| | Véhicule 1 | Véhicule 2 | Véhicule 3 | Véhicule 4 |
|---|---|---|---|---|
| | | | | |
| **M24.** Le véhicule est-il ?<br>**1.** Possédé par le ménage<br>**2.** Possédé par le ménage avec participation financière de l'employeur<br>**3.** Possédé par l'employeur (voiture de fonction)<br>**4.** Autres cas (location, leasing, prêté par quelqu'un) | ☐ | ☐ | ☐ | ☐ |

*Based on: TNS SOFRES, 2009c*

**Figure 4.1: Encoding of vehicle ownership in the 2010 EGT survey (Snapshot of the Household form)**

For the sake of our analysis, we use the *POSSV* variable to discriminate between the following two broad categories of vehicles: *i)* vehicles that will subsequently be labelled as 'corporate vehicles' (for which the value encoded for the *POSSV* variable is 3), and *ii)* other vehicles subsequently labelled as 'private vehicles' (for which the value encoded for the *POSSV* variable is 1, 2, 4 or n.d.).[2] Table 4.2 displays the distribution of vehicles between these two categories.

| Vehicle category | Encoded value for *POSSV* variable in the 2010 EGT survey | Number of vehicles | *as a % of total vehicles in the region* |
|---|---|---|---|
| Private vehicles | 1, 2, 4, n.d. | 4,570,225 | *94.0%* |
| **Corporate vehicles** | **3** | **289,134** | ***6.0%*** |

**Table 4.2: Corporate and private vehicles at households' disposal in the Paris region (2010 EGT survey)**

[2] Vehicles owned by the household with a financial contribution by the employer (*POSSV*=2) and vehicles held by the household through another arrangement (rental, leasing, lending, etc.) (*POSSV*=4) together represent less than 2% of total weighted vehicles. In addition, vehicles for which *POSSV* was not documented represent 0.2% of weighted vehicles (25 observations).

It seems relevant to use the EGT survey to explore the holding and use of corporate vehicles by private households, since the sample is significant. For each vehicle held by the household, the EGT will provide information on the year of first registration (which can be used to calculate the age of the vehicle), the taxable horsepower rating and the type of fuel. However, we will not be able to retrieve useful information on how long the vehicle is held (which differs from the vehicle age as soon as the vehicle changes hands), the vehicle body type (in particular, passenger cars and light commercial vehicles with a payload up to 800kg are listed as a single category),[3] or the vehicle make (the information is collected during the survey but is not encoded in the database).

In addition, for each vehicle held by the household, the EGT will provide information on its patterns of use on weekdays (number of trips, distance travelled, duration of use, trip purposes, etc.). A separate database in the EGT survey ('EGT weekend') could provide additional information on the patterns of use of the vehicles at weekends, but we prefer to focus our analysis on weekdays for this first stage of analysis and avoid the added difficulties of using two databases with entirely different samples.

We consider that an inherent limitation of our approach based on the EGT survey is that, being a regional survey, it will only provide information on the households whose habitual place of residence is located in the Paris region. Whether our findings for the Paris region would still hold at national level, or in any other region of France, will be subject to further discussion. Also, being a household-centred survey, the EGT survey will only provide information on those of the corporate vehicles that are held by private households. It is our understanding that our analysis of the subset of corporate vehicles covered by the EGT survey will have only little relevance in shedding light on the features of other categories of corporate vehicles, such as the 'service cars' used for professional purposes exclusively.

[3] Light commercial vehicles with a payload up to 800 kg include ordinary vans such as the Peugeot Partner, Citroën Berlingo or Renault Kangoo, all three of which ranked among the top 10 sellers among light commercial vehicles in France in 2012 (CCFA, 2012b).

# 4.3 What type of households hold corporate cars?

This section explores the key characteristics of households which hold one or more corporate car(s). The results presented in the first two subsections provide a static analysis based on the 2010 EGT survey of household travel in the Paris region for years 2009-2010. We first discuss the relative significance of corporate vehicles as a share of households' vehicle fleets in the region. We later discuss whether the private households which hold corporate cars present the same characteristics as their counterparts which exclusively hold private cars. In the third subsection, we provide a historical perspective on these initial results for the Paris region using the previous EGT surveys (4 surveys from 1976 to 2001).

## 4.3.1 Assessing the penetration rates of corporate vehicles in private household fleets in the Paris region

Private households in the Paris region are characterised by a rather low rate of car holding compared with the rest of France. Indeed, the 2010 EGT survey shows that 71.3% of households in the Paris region hold an automobile, whereas this proportion is known to be 81.0% at national level (Robin, 2010). Furthermore, only 23.8% of all households in the Paris region hold two or more vehicles whereas, at national level, the proportion rises to 36.2% (Robin, 2010).

*Penetration rates of corporate vehicles in the private households' fleet*: As previously said, the 2010 EGT survey reveals that 289,134 corporate vehicles were held by private households in the Paris region, representing 6.0% of the total number of vehicles held by households in the region. In order to adopt a perspective that would be more consistent with that of the EGT survey (whose data collection method is household-centred), we suggest developing a concept of 'corporate vehicle penetration rate' by measuring the proportion of private households which hold corporate vehicles. Out of the 4,907,249 households in the Paris region, we find that 269,388 households hold at least 1 corporate vehicle (see Table 4.3). In other words, corporate vehicles have penetrated 5.5% of all households (more than 1 in 20) in the Paris region. Taking for reference the subcategory of motorised households – i.e. vehicle-holding households – (3,495,469 households), this means that 7.7% of them hold at least one corporate vehicle.

*Corporate car-reliant households*: 1.6% of all households (2.3% of motorised households) in the region hold corporate vehicles exclusively. This figure would define the proportion of households that rely entirely on corporate vehicles for their car travel needs.

Such figures tend to show that corporate cars represent a significant share of the vehicles held by private households in the Paris region. By way of comparison, the proportion of households holding one or more corporate vehicle(s) is almost one fourth of all multi-vehicle households (1,166,891 households, or 33.4% of all households).

| HH types based on vehicle fleet composition | Number of HHs | *as a % of total HHs* | *as a % of motorised HHs* |
|---|---|---|---|
| Total HHs | 4,907,249 | *100.0%* | - |
| Motorised HHs | 3,496,469 | *71.3%* | *100.0%* |
| **Motorised HHs holding at least 1 corporate vehicle** | **269,388** | ***5.5%*** | ***7.7%*** |
| Motorised HHs holding corporate vehicles exclusively | 79,190 | *1.6%* | *2.3%* |

*HH: Household*

**Table 4.3: Penetration rates of corporate vehicles in private household fleets (2010 EGT survey)**

## 4.3.2 Describing the population of households holding corporate vehicles in the Paris region

Sticking to the household-centred perspective we previously adopted, we will now assess whether the population of households which hold corporate vehicles present the same characteristics as the following two reference populations: *i)* the total population of households in the Paris region, and *ii)* the population of all motorised households (i.e. households that hold vehicles, whether corporate or not) in the Paris region. For further reference, the three populations we define here based on their vehicle fleet composition are nested as shown in Figure 4.2.

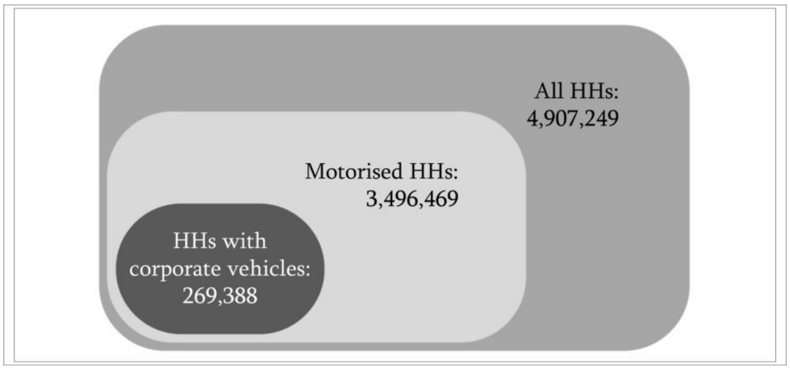


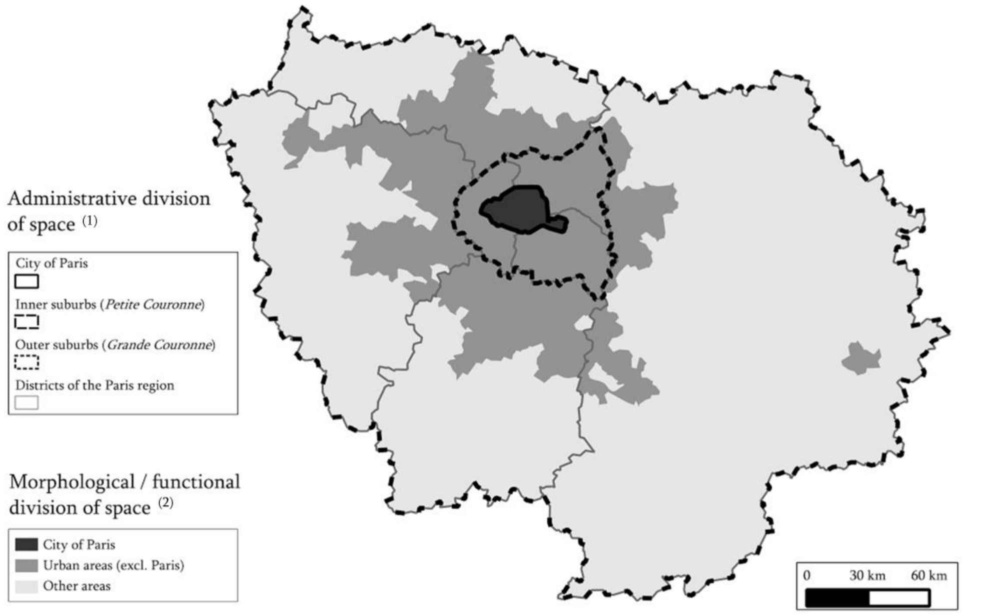

**Figure 4.2: Three nested household populations based on their vehicle fleet composition (2010 EGT survey)**

**Selecting control variables**

We will compare the above-mentioned three populations of households by analysing their respective distributions for a set of control variables available in the 2010 EGT survey database. We select these control variables from data collected either at household level or at individual level for the household's reference person.

*At the household level:* On the basis of the dictionary of variables in the 2010 EGT survey (STIF and DRIEA, 2010), we identify 5 main categories of information amongst the 101 items collected for each household surveyed through the Household form: *i)* on the household's main residence's location, *ii)* on the household's composition, *iii)* on the household's housing's features, *iv)* on the household's income level, and *v)* on the household's level of transport equipment. Among these items, we choose the following three control variables at household level:

1) Household's residential area: Using the *RESCOMM* variable, which encodes the municipality of residence, we will analyse the distribution of households across area types. To account for the discrepancy in vehicle fleet composition and utilisation between urban areas on the one hand and periurban areas on the other hand (see STIF and DRIEA, 2013a and 2013b), we choose to use a morphological, functional division of space rather than an administrative division of space for our analysis (see Figure 4.3 for further information on the two methods for the division of space);
2) Household's income: Using the *REVENU* variable, which encodes the monthly net income category, we will analyse the distribution of households across income quintiles. To account for the composition of the household, we choose to use as the basis for calculation the disposable income per consumption unit (CU), whereby the reference person counts for 1 CU, each further adult in addition to the reference person counts for 0.5 CU, and each child counts for 0.3 CU;
3) Household vehicle count: Using the *NB_ VD* variable, which encodes the number of cars (passenger cars and light-duty vehicles alike) held by the household, we will analyse the distribution of households across motorisation classes (non-motorised, single-vehicle, multi-vehicle).




*Notes: 1. The administrative division of space presented here relies on the districts (in French:* départements*) : the City of Paris is one district of its own; the* Petite Couronne *includes the 3 districts of the inner suburbs of Paris (Hauts-de-Seine, Seine-Saint-Denis, and Val-de-Marne); the* Grande Couronne *includes the 4 districts of the outer suburbs of Paris (Seine-et-Marne, Yvelines, Essonne, andVal-d'Oise). This division of space has been stable for the Paris region since 1968. 2. The morphological, functional division of space presented here relies on the 2010 zoning of urban areas by the French national institute for statistics and economic studies (INSEE). INSEE defines an "urban area" as "a group of touching municipalities, without pockets of clear land, encompassing an urban centre (urban unit) providing at least 10,000 jobs, and rural districts or urban units (urban periphery) among which at least 40% of employed resident population works in the centre or in the municipalities attracted by this center". Source : http://www.insee.fr/en/methodes/default.asp?page=definitions/aire-urbaine.htm [Accessed: 22nd January 2014]*

**Figure 4.3: Administrative and morphological divisions of space in the Paris region**

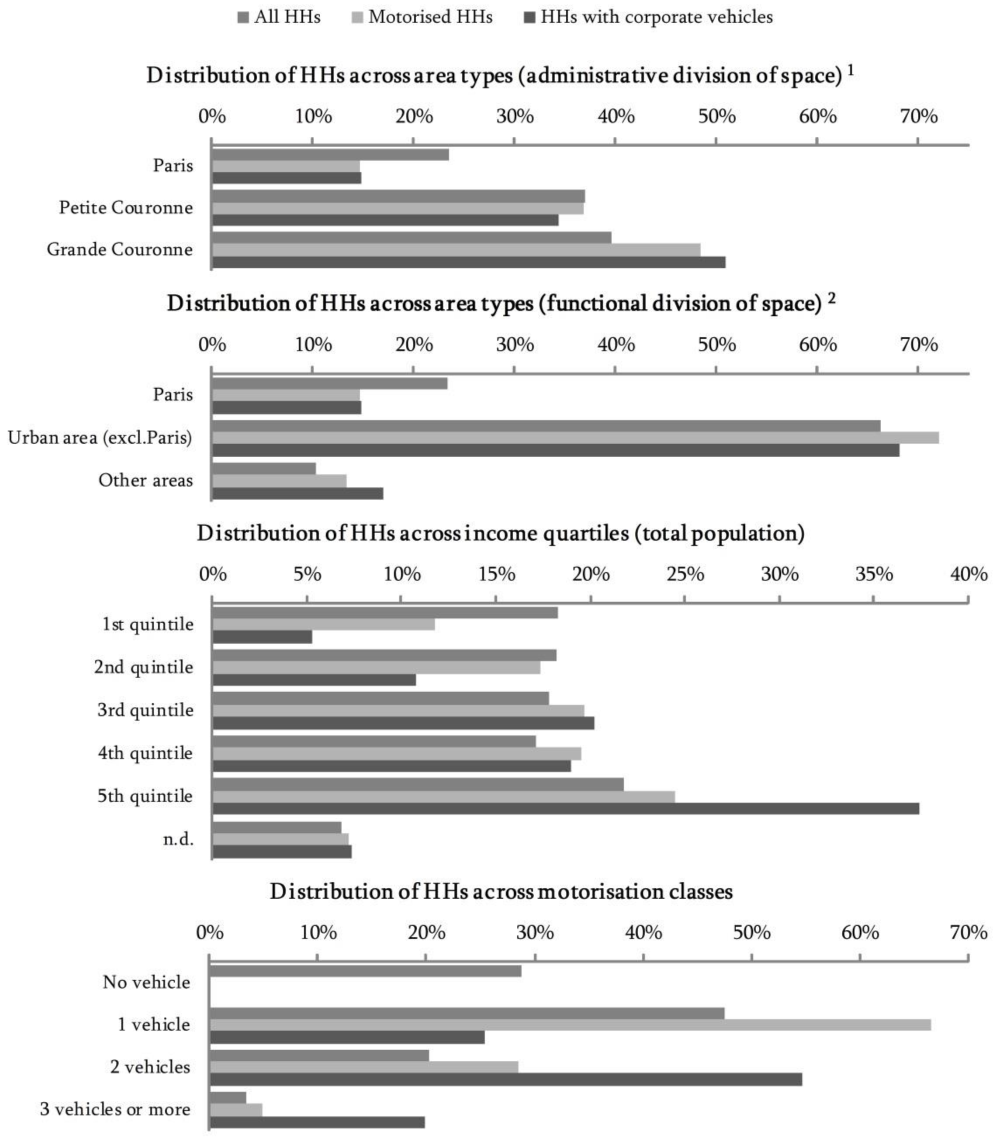
*At the individual level for the reference person:* In addition to the items collected through the Household form, we identify 3 main categories of information amongst the 61 items collected for each person surveyed through the Individual form: *i)* on the interviewee's individual characteristics, *ii)* on the interviewee's occupation and socio-occupational category, and *iii)* on the interviewee's possession of a driving license, public transport pass, and/or subscription to car-sharing or bike-sharing services. Among these items, we choose the following three control variables at the individual level, focusing on the reference person in the household:

1) Reference person's occupation and socio-occupational category: Using the *CS8* variable, which encodes 8 aggregated 'occupations and socio-occupational categories' (for further information on the meaning and rationale for using such categories to explain household behaviour, see Boeda, 2009), we will analyse the distribution of households across socio-occupational categories. To be more consistent with the close

relationship between the corporate vehicle and the working status of the household, we will focus our analysis on the working population (excluding students, retirees, and other non-working persons) rather than browsing the whole range of categories (see Figure 4.4 for further details on the socio-occupational categories considered);

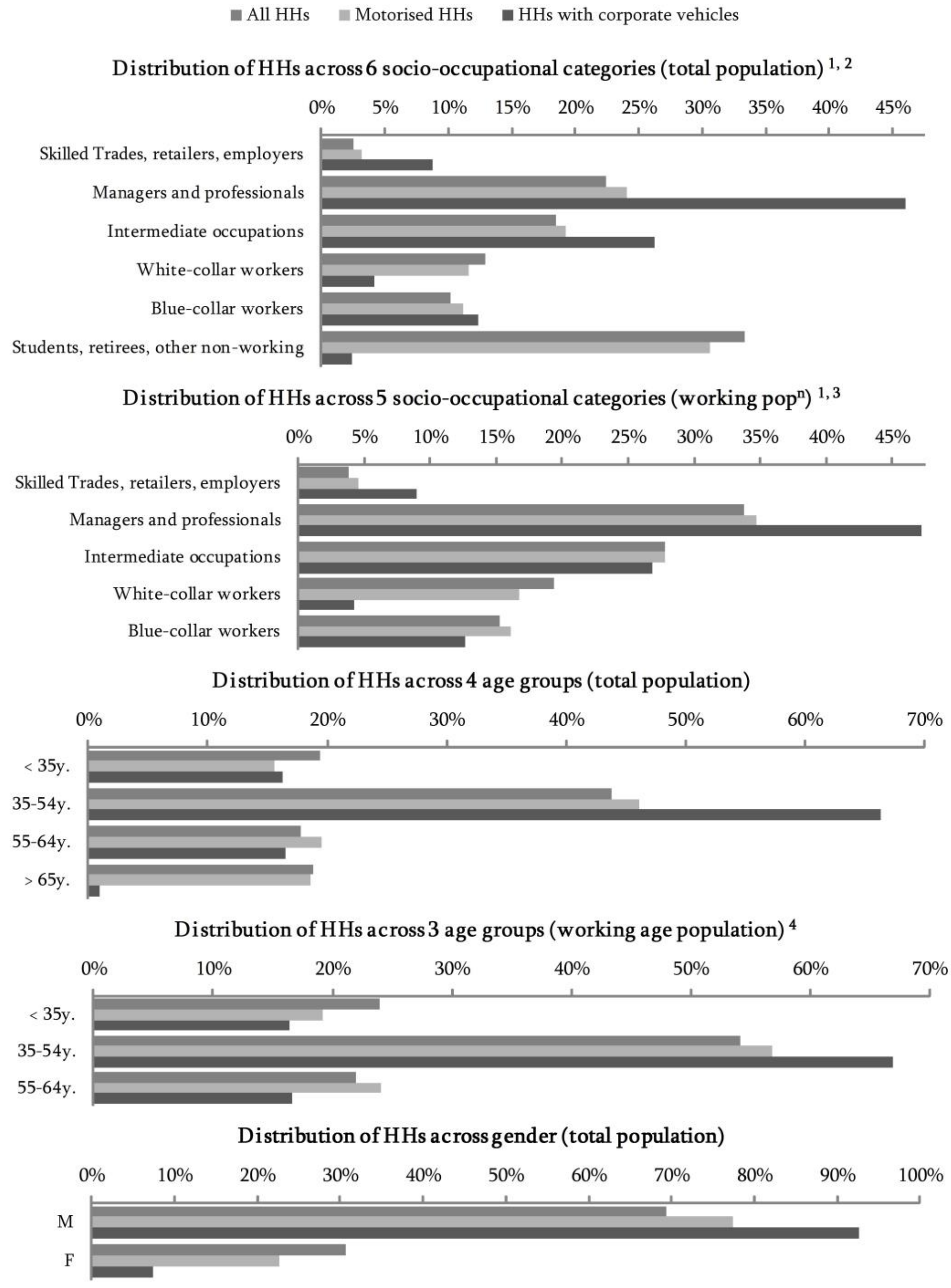
2) Reference person's age: Using the *AGE* variable, we will analyse the distribution of households across age groups. Again, to be consistent with the close relationship between the corporate vehicle and the working status, we will focus our analysis on the working age population (64 years and under) rather than including the whole range of age groups in our analysis;
3) Reference person's gender: Using the *SEXE* variable, we will analyse the distribution of households between genders.

The distributions of household populations for these six control variables are presented in Figure 4.4 and Figure 4.5.




*Notes: 1. The administrative division of space presented here relies on the districts (in French:* départements*) : the City of Paris is one district of its own; the* Petite Couronne *includes the 3 districts of the inner suburbs of Paris (Hauts-de-Seine, Seine-Saint-Denis, and Val-de-Marne); the* Grande Couronne *includes the 4 districts of the outer suburbs of Paris (Seine-et-Marne, Yvelines, Essonne, andVal-d'Oise). This division of space has been stable for the Paris region since 1968. 2. The morphological, functional division of space presented here relies on the 2010 zoning of urban areas by the French national institute for statistics and economic studies (INSEE). INSEE defines an "urban area" as "a group of touching municipalities, without pockets of clear land, encompassing an urban centre (urban unit) providing at least 10,000 jobs, and rural districts or urban units (urban periphery) among which at least 40% of employed resident population works in the centre or in the municipalities attracted by this center". Source : http://www.insee.fr/en/methodes/default.asp?page=definitions/aire-urbaine.htm [Accessed: 22nd January 2014]*

**Figure 4.4: Distribution of HHs by type of residence area, income and motorisation for different vehicle fleet compositions (2010 EGT survey)**




*Notes: 1. Farmers have been excluded from the analysis for their share in the total number of HHs in the Paris region is not significant (<0.1%). 2. Students, retirees and other unemployed have been grouped together to form a single category of unemployed people. 3. Working population excludes students, retirees and other unemployed. 4. Working age population excludes HHs whose reference person is 65 or older.*

Figure 4.5: Distribution of HHs by occupation, age and gender of the reference person for different vehicle fleet compositions (2010 EGT survey)

**What are the specific features of households holding corporate vehicles?**

Based on the distributions of household populations for the six variables we selected, we can identify the following specific features in the population of households holding corporate vehicles.

*Residential area*: Households holding corporate vehicles present the same share of residential locations in the City of Paris (14.8%) as the wider population of motorised households (14.7%). The proportion of periurban residential locations however tends to be higher for the population of households holding corporate vehicles (17.0%) than for the population of motorised households as a whole (13.3%). Table 4.4 shows that, in periurban areas (i.e. areas other than Paris and the urban areas other than Paris), 1 in 10 motorised households (9.8%) hold a corporate vehicle, compared to 7.8% in the City of Paris and 7.3% in urban areas other than Paris in the Paris region.

| Area types (functional division of space) | Number of HHs holding at least 1 corporate vehicle | *as a % of total HHs in the area* | *as a % of motorised HHs in the area* |
|---|---|---|---|
| Paris | 39,946 | *3.5%* | *7.8%* |
| Urban area (other than Paris) | 183,613 | *5.7%* | *7.3%* |
| Other areas | 45,827 | *9.0%* | *9.8%* |
| **Greater Paris region** | **269,388** | ***5.5%*** | ***7.7%*** |

*HH: Household*

**Table 4.4: Differences in the penetration rates of corporate vehicles across area types (2010 EGT survey)**

*Income*: Households holding corporate vehicles present a much higher income profile than the population of motorised households as a whole. Interestingly, while the 3rd and 4th quintiles are almost unchanged from one population to the other, the 5th and highest income quintile is much more represented in the population of households holding corporate vehicles (37.4%) than in the wider population of motorised households (24.5%). Symmetrically, the lowest two quintiles together represent just 16.1% of the population of households holding corporate vehicles, compared with 29.1% for the whole population of motorised households.

*Vehicle count*: Households holding corporate vehicles present a much higher proportion of multi-motorisation (74.6%) than the wider population of motorised households (33.4%). As shown in Table 4.5, this is reflected in average motorisation rates which rise from 1.39 in the population of motorised households to 1.97 in the subset of motorised households holding at least one corporate vehicle.

| HH types based on vehicle fleet composition | Motorisation rate | Proportion of multi-vehicle HHs |
|---|---|---|
| Total HHs | 0.99 | 23.8% |
| Motorised HHs | 1.39 | 33.4% |
| **Motorised HHs holding at least 1 corporate vehicle** | **1.97** | **74.6%** |
| Motorised HHs holding no corporate vehicle | 1.34 | 30.0% |

*HH: Household*

**Table 4.5: Motorisation rates and proportions of multi-vehicle households for different household populations (2010 EGT survey)**

*Socio-occupational categories*: Looking at the total population, it appears that households holding corporate vehicles are almost absent from the category that encompasses all households in which the reference persons are unemployed (including retirees, students, and other non-working people). This would reflect the close connection between corporate vehicles and occupational status. When looking at the working population, it appears that almost half of the households holding corporate vehicles (47.2%) have reference persons in the 'managers and professionals' category, which is a much larger proportion than that observed for the population of motorised households as a whole (34.8%). In addition, 'skilled trades, retailers and employers' are represented in the population of households holding corporate vehicles twice as much as they are in the wider population of motorised households (8.9% compared to 4.5%). Thus, both higher-ranking categories tend to be over-represented among households holding corporate vehicles. The proportion of intermediate occupations seems to be little affected by the holding of a corporate vehicle (27.8% of motorised households, 26.9% of households holding corporate vehicles). It follows from the above that the remaining categories of white- and blue-collar workers tend to be under-represented among households holding corporate vehicles (4.3% and 12.7%, respectively), compared with their presence in the reference population of motorised households (16.8% and 16.1%, respectively). These raw distributions should not, however, hide the fact that corporate vehicles represent a significant share of the vehicle fleet of households from both the 'intermediate occupations' category and the 'blue-collar workers' category. Indeed, Table 4.6 shows that 10.5% of motorised households with intermediate occupations and 8.5% of motorised households in the 'blue-collar workers' category hold at least one corporate vehicle.

| Socio-occupational category (of the HH reference person) | Number of HHs holding at least 1 corporate vehicle | *as a % of total HHs in the category* | *as a % of motorised HHs in the category* |
|---|---|---|---|
| Farmers | (n.s.) | (n.s.) | (n.s.) |
| **Skilled trades, retailers, employers** | **23,506** | **19.1%** | **21.3%** |
| **Managers and professionals** | **124,009** | **11.3%** | **14.7%** |
| **Intermediate occupations** | **70,622** | **7.8%** | **10.5%** |
| White-collar workers | 11,211 | 1.8% | 2.8% |
| **Blue-collar workers** | **33,312** | **6.7%** | **8.5%** |
| Students, retirees, other unempl. | 6,423 | 0.4% | 0.6% |
| **All categories** | **269,388** | **5.5%** | **7.7%** |

*HH: Household; n.s.: not significant*

**Table 4.6: Differences in the penetration rates of corporate vehicles across socio-occupational categories (2010 EGT survey)**

*Age*: Looking at the total population, it appears that households holding corporate vehicles are almost absent from the over-65 age group. This would only corroborate the close connection between the corporate vehicle and occupational status. When focusing on the working age population (excluding reference persons aged 65 or more), we observe that two thirds of households holding corporate vehicles have a reference person in the 35-54 age group (66.9%, compared with 56.9% for motorised households as a whole), whereas the younger age group accounts for just 16.4%, and the older age group for 16.6% (19.1% and 24.0% respectively for motorised households as a whole). Thus, even when the scope of our analysis is limited to the working age population, it would appear that households holding corporate vehicles present a specific age structure, with fewer young households and even fewer older households than in the population of motorised households as a whole.

*Gender*: Households holding corporate vehicles present a much higher proportion of male reference persons (92.6%) than is observed for motorised households as a whole (77.3%) and for the total population of the region (69.3%).

**Is there a typical profile of households holding corporate vehicles?**

On the basis of the observations above, we might be tempted to portray the typical household holding a corporate vehicle as a high-income, multi-vehicle, urban household with a male reference person in his mid-thirties to mid-fifties ranking in the higher-level categories of the socio-occupational hierarchy. However, we have identified some features in the population of households holding corporate vehicles that somewhat differ from this typical profile. Focusing on a few of these features that could be perceived as puzzling, we will venture some hypotheses as to the reasons behind the penetration of corporate vehicles into the categories of private households concerned:

1) The penetration rates of corporate vehicles among motorised households in the 'intermediate occupations' and 'blue-collar workers' categories (10.5% and 8.5%, respectively) are less than those observed among motorised households in the 'skilled trades, retailers and employers' and 'managers and professionals' categories (21.3% and 14.7%, respectively). However, this should not hide the fact that the former categories represent almost 40% (38.6%) of households holding corporate vehicles in the Paris region. We speculate that some these households might not have exactly the same type of rights over their corporate vehicles (including private-use rights) as the households in the higher socio-occupational categories. Also, and more probably, we assume that different socio-occupational categories could have access to different vehicle segments, with high-end vehicles (saloon, luxury) being a privilege of the higher socio-occupational categories, whereas compact cars and minivans could be more common for intermediate-level categories.
2) The penetration rate of corporate vehicles among motorised households in the periurban areas is higher than in urban areas (9.8% compared to 7.8% in the City of Paris and 7.3% in urban areas other than Paris), although it is not as sensitive to residential location as the overall motorisation rate. This observation raises the question of the nature of the linkage between, on the one hand, the concentration of corporate cars, and on the other hand, the functional characteristics of the territory. It would be interesting to find out whether any of the following hypotheses might make sense: *i)* the corporate vehicle could be an enabler of remote residential location choices; *ii)* households would be more likely to negotiate a corporate vehicle as part of their revenue package when living in periurban areas; or else *iii)* urban households could be somewhat less interested in holding a corporate car that would generate additional constraints (of parking, etc.) and limited

benefits (due to road congestion, etc.) compared with an efficient public transit system.

3) The distribution of motorised households between single-vehicle households on the one hand and multi-vehicle households on the other hand, is almost the exact opposite for households holding at least one corporate vehicle (25%/75%) to the situation for households holding no corporate vehicle at all (70%/30%). At this stage, three competing hypotheses can be formulated to explain such a significant impact of corporate vehicles on the household vehicle count: *i)* corporate vehicles could be considered as 'extra' vehicles by the households that use them; *ii)* possible restrictions in the use of corporate vehicles for private purposes could lead to a specialisation between vehicles in the household fleet; or *iii)* the economic and social characteristics (income level, household size and composition, etc.) of households holding corporate vehicles could be the main driving factor for their multi-motorisation.

## 4.4 Some key features of corporate vehicles held by private households

This section presents a comparative analysis between the following two categories of vehicles held by private households in the Paris region: 'corporate vehicles' on the one hand, 'private vehicles' on the other. We will analyse the key similarities and differences between them with regard to such features as age, horsepower, fuel type, etc. Table 4.7 provides a preview of some key differences that we will further discuss in this section.

| Basic fleet characteristics | Corporate vehicles | Private vehicles | Total fleet |
|---|---|---|---|
| Number of vehicles | 289,134 | 4,570,225 | 4,859,359 |
| *as a % of total HH fleet* | *6.0%* | *94.0%* | *100.0%* |
| Age | 3.2 yrs (*median: 2.8 yrs*) | 8.5 yrs (*median: 7.8 yrs*) | 8.2 yrs (*median: 7.0 yrs*) |
| Share of diesel-powered vehicles | 90.0% | 48.3% | 50.8% |

*HH: Household*

**Table 4.7: Basic fleet characteristics discriminating between corporate and private vehicles (2010 EGT survey)**

## 4.4.1 Corporate vehicles are newer

A first significant observation we can make about corporate vehicles held by private households is that they are 2.5 times newer on average than their private counterparts (3.2 years compared to 8.5 years).

Figure 4.6 provides a more detailed illustration of the differences in the age distributions of corporate vehicles and private vehicles. Almost 80% of the corporate vehicles held by private households are 4 years old or less (25% are 1 year old or less), as compared with only 30% (8% respectively) for private vehicles. Conversely, only 4% of the corporate vehicles held by private household are aged 10 years or more, as compared with more than one third for private vehicles.

This tends to confirm previous information mentioned in Chapter 3 about the high turnover in corporate car fleets compared with private car fleets. For the record, the average duration of long-term rental contracts for company cars in 2010 was 38.3 months, or 3.2 years (SNLVLD, 2010), which happens to be exactly the average age of corporate vehicles held by private households based on the 2010 EGT survey results (see Table 4.7).

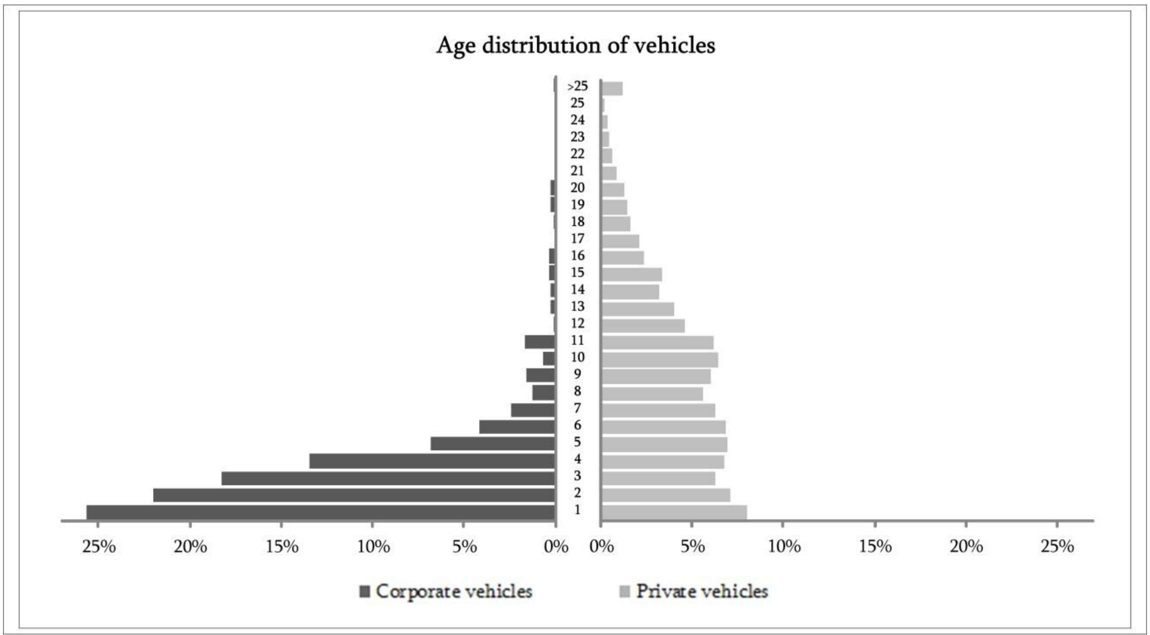



**Figure 4.6: Age distributions for corporate and private vehicles (2010 EGT survey)**

## 4.4.2 Corporate vehicles have high engine displacement

Continuing our exploration of the similarities and differences between corporate and private vehicles in terms of basic fleet characteristics, we will now compare the distributions of both fleets across taxable horsepower categories (engine ratings established for tax purposes). In France, since 1998,[4] the tax treatment of engine horsepower has been based on both $CO_2$ emissions and maximum engine power. It is worth noting that diesel engines are somewhat favoured in French taxable horsepower calculations because of their lower $CO_2$ emissions compared with petrol-powered vehicles of equivalent engine power.

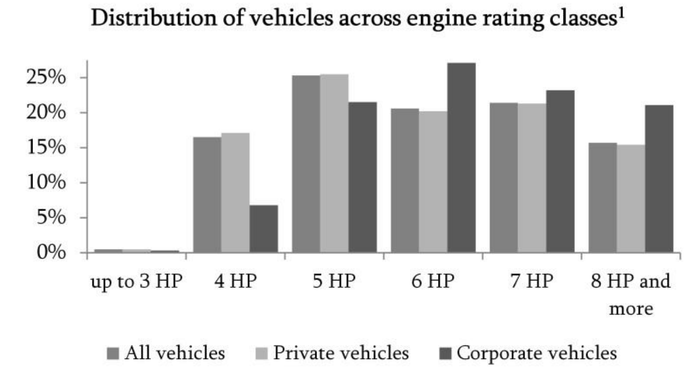
By way of illustration, the following is a breakdown of vehicle models by horsepower (HP): '4 HP' class – Peugeot 2008 HDi and Volkwagen Polo TDI (diesel-powered compact cars); '6HP' class – Peugeot 3008 HDi and Peugeot 5008 HDi (diesel-powered saloons) and Mercedes-Benz A-Class (petrol-powered compact car); finally the '8 HP' class – Peugeot 807 HDi (diesel-powered minivan) and Mercedes-Benz C-Class (petrol-powered saloon).

As shown in Figure 4.7, more than 70% (71.4%) of households' corporate vehicles are rated '6 HP' and above, which is almost 15 percentage points higher than the proportion of private vehicles rated in the same classes (56.9%). Furthermore, 21.1% of the corporate vehicles held by households are rated '8 HP' and above, as compared with 15.4% for private vehicles. So it would appear that corporate vehicles are selected, on average, from among the high-end automobile market segments, whereas private vehicles are more evenly distributed across market segments (insofar as taxable horsepower classes can be considered a proxy for market segments, which we acknowledge is arguable).

This observation is consistent with the high penetration rates of corporate vehicles among the higher socio-occupational categories (i.e. 'managers and professionals' and 'skilled trades, retailers and employers'). Indeed, for these categories, as noted in Chapter 3, the 'official car' is associated with high status.

Finally, we would note that corporate vehicles account for 8.0% of total household vehicles rated '8 HP' and above, which is 2 more percentage points than their share in the total household vehicle fleet.

[4] See: *Loi n° 98-546 du 2 juillet 1998 portant diverses dispositions d'ordre économique et financier*, Art.62. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000000572192.




*Note: 1. Engine rating classes (also called 'rated horsepower classes') are established for tax purposes. They are country-specific. In France, they result from complex calculations and are only remotely related to actual engine horsepower. Fiscal horsepower (HP, or CV in French for* 'cheval vapeur'*) appears on the vehicle registration certificate.*

**Figure 4.7: Engine taxable horsepower distributions for corporate and private vehicles (2010 EGT survey)**

## 4.4.3 Corporate vehicles are mostly diesel-powered

A third notable fact about corporate vehicles is that a much higher proportion of them have diesel engines than do private vehicles (90.0% compared to 48.3%). This observation backs up previous information collected in Chapter 3 on the dependency on diesel of corporate car fleets.

Since there has, on the one hand, been a growing trend towards diesel in France's total automotive fleet over recent decades and years (see Chapter 1), and since, on the other hand, we have shown that corporate vehicles held by private households are on average 2.5 times newer than their private counterparts, it would seem relevant to check for generational effects to account for such a gap in the distribution of diesel-powered vehicles between corporate vehicles and private vehicles. Table 4.8 illustrates the distribution of diesel-powered vehicles among corporate and private vehicles for three different vehicle age classes (under 4 years, 5 to 9 years, 10 years and above).

The gap in dieselisation between corporate and private vehicles is fairly stable, at around 30 percentage points, across all vehicle age classes. Indeed, 62.0% of the most recent private vehicles (4 years and less) are diesel-powered, as compared with 92.4% for corporate vehicles in the same age class; 53.5% of private vehicles between 5 and 9 years old are diesel-powered, as compared with 84.5% for corporate vehicles; and 34.6% of private vehicles aged 10 years or more are diesel-powered, as compared with 65.7% for corporate vehicles.

Therefore, generational effects only account for part of the gap in dieselisation between corporate and private vehicles held by households in the Paris region. Other possible explanations for such a significant gap may lie in: *i)* different patterns of use between the two categories of vehicles (very intensive use is a strong incentive to choose a diesel-powered vehicle, because of the difference in pump prices in France); and/or *ii)* discriminatory tax rules on petrol-powered vehicles in corporate fleets.

| Vehicle age classes | Share of diesel-powered vehicles | | |
|---|---|---|---|
| | Corporate vehicles | Private vehicles | Total fleet |
| Vehicles aged 4 yrs. or less | 92.4% | 62.0% | 66.6% |
| Vehicles aged 5 to 9 yrs. | 84.5% | 53.5% | 54.5% |
| Vehicles aged 10 yrs. or more | 65.7% | 34.6% | 34.9% |
| **All vehicles** | **90.0%** | **48.3%** | **50.8%** |

**Table 4.8: Share of diesel-powered vehicles by age class for corporate and private vehicles (2010 EGT survey)**

While acknowledging the significance of the above-mentioned differences in basic fleet characteristics between corporate vehicles and private vehicles, we nevertheless found one similarity between the two categories of vehicles.

Indeed, when engine types are looked at more closely, it appears that alternative drivetrains, including electric and hybrid drivetrains as well as LPG, represent very minor shares in both vehicle categories (see Table 4.9). Although the share of hybrid drivetrains in the corporate vehicle stock (0.6%) is twice as high as it is for private vehicles (0.3%), the overall proportion of alternative drivetrains is no more than 1.5% for corporate vehicles, and an even lower 0.9% for private vehicles.

| Motorisation mix | Corporate vehicles | Private vehicles | Total fleet |
|---|---|---|---|
| Diesel | 90.0% | 48.3% | 50.8% |
| Petrol | 8.5% | 50.7% | 48.2% |
| *Others* | 1.5% | 0.9% | 1.0% |
| *Incl. Hybrid drive-trains* | *0.6%* | *0.3%* | *0.4%* |
| *Electric drive-trains* | *0.0%* | *0.0%* | *0.0%* |
| *Misc. (LPG, etc.)* | *0.9%* | *0.6%* | *0.6%* |

*LPG: Liquefied Petroleum Gas*

**Table 4.9: Motorisation mixes of corporate and private vehicles (2010 EGT survey)**

# 4.5 Assessing the use of corporate vehicles by private households

Having identified key differences in the basic fleet characteristics of the two vehicle categories held by private households, we will now look further into the quantitative and qualitative differences (mileage, travel purposes, etc.) between the patterns of use of each of these vehicle categories. As already mentioned, all subsequent analysis focuses on weekdays.

## 4.5.1 Quantifying the extra use of corporate vehicles compared with private vehicles

A preliminary analysis of available data on vehicle use in the 2010 EGT survey database permits the following observation: looking at vehicles individually, private households tend to use corporate vehicles more than they use private vehicles. To quantify what we will now call the 'extra use' of corporate vehicles (i.e. as compared with the use of private vehicles), we will investigate the following basic indicators of daily vehicle use:[5]

1) *Rate of utilisation of the fleet*: For each vehicle category (corporate and private), we analyse the proportion of vehicles that were actually used by the households on the day prior to the survey.
2) *Number of trips*: For each vehicle that was actually used on the day prior to the survey, data are collected on the number of trips travelled on that day. We aggregate these data to compute indicators on the average frequency of use of the vehicles in each category (corporate and private).
3) *Distances travelled*: The database contains data on the length of each trip travelled by a household member on the day prior to the survey. We aggregate these data to analyse the distribution of distances travelled by the vehicles in each category. We also analyse total and average distances travelled on the day prior to the survey for each category of vehicle.
4) *Duration of use*: As with distances, the database contains information on the duration of each trip travelled by a household member on the day prior to the survey. We aggregate these data to analyse the distribution

[5] As already mentioned in the methodology section, for each vehicle held by the household, the EGT will provide information on its patterns of use during weekdays (number of trips, distance travelled, duration of use, trip purposes, etc.), but it will not provide information on the patterns of use of the vehicle during weekends or holidays, since these do not fall within the scope of this particular survey.

of durations, as well as average durations of use of vehicles for each category on the day prior to the survey.

The results of this fourfold quantification of the 'extra use' of corporate vehicles held by private households are presented in Table 4.10.

According to these results, the 'extra use' of corporate vehicles held by private households compared to their private counterparts can be broken down into two main effects:

1) *More frequent use*: Overall, 78% of corporate vehicles held by private households were used on the day prior to the survey. This figure suggests more frequent use of corporate vehicles compared with private vehicles (61% of vehicles used on the day prior to the survey): the probability of a vehicle in the former category being used by a household member on a given day is therefore 17 points higher than the same probability for a vehicle in the latter category. Differences in the socio-demographic characteristics of the households concerned (e.g. share of retirees and unemployed, share of population aged between 30 and 40) could partly explain this gap.
2) *More intensive use:* On average, corporate vehicles that were used on the day prior to the survey performed 4.0 trips per vehicle during the day, covering an estimated distance of 41.7 km with an estimated duration of use of 141 min. Such figures suggest more intensive use of corporate vehicles compared with private vehicles (3.7 trips, for a total of 22.5 km and 81 min. travelled daily): on an average day of use, vehicles in the former category perform 8% more trips, they cover 85% more distance and they travel 74% longer compared with vehicles in the latter category. Differences in the mix of trips purposes of the vehicles could partly explain the gap in distance travelled daily.

As was already suggested in Table 4.1, when the two effects of frequency and distance are combined, a corporate vehicle held by a private household covers, on an average weekday, 2.4 more distance than a private vehicle (32.3 km/vehicle/day, as compared with 13.7 km/vehicle/day). This in turn means that corporate vehicles account for a much greater proportion of the total daily mileage of the private household fleet in the Paris region (13%) than their proportion as a share of the vehicle fleet (6%) (see Table 4.1).

| Basic indicators of daily vehicle use | Corporate vehicles | Private vehicles | Total fleet |
|---|---|---|---|
| Rate of utilisation of the fleet[1] | **78%** | 61% | 62% |
| Number of trips[2] | **4.0 trips/day/veh.** | 3.7 trips/day/veh. | 3.8 trips/day/veh. |
| Daily distances travelled[2] | | | |
| Average | **41.7 km/day/veh.** | 22.5 km/day/veh. | 23.9 km/day/veh. |
| Distribution | | | |
| *<10 km* | *14.1%* | *35.9%* | *34.3%* |
| *10-20 km* | *13.5%* | *23.5%* | *22.7%* |
| *20-30 km* | *16.9%* | *14.6%* | *14.8%* |
| *30-40 km* | *12.3%* | *9.7%* | *9.9%* |
| *40-50 km* | *11.8%* | *5.6%* | *6.0%* |
| *>50 km* | ***31.4%*** | *10.7%* | *12.3%* |
| Daily duration of use[2] | | | |
| Average | **141 min./day/veh.** | 81 min./day/veh. | 85 min./day/veh. |
| Distribution | | | |
| *<30 min.* | *8.4%* | *14.8%* | *14.3%* |
| *30-60 min.* | *7.6%* | *26.3%* | *24.9%* |
| *60-90 min.* | *16.4%* | *23.6%* | *23.1%* |
| *90-120 min.* | *15.0%* | *14.9%* | *14.9%* |
| *>120 min.* | ***52.6%*** | *20.4%* | *22.8%* |

*Notes : 1. Proportion of vehicles in the category that were actually used by the households on the day prior to the survey. 2. Scope: only vehicles that were actually used by the households on the day prior to the survey.*

**Table 4.10: Basic indicators of daily vehicle use for corporate and private vehicles (2010 EGT survey)**

Due to the limited scope of our exploration of the EGT survey (we did not include the 'EGT weekend' database), we could not check for potential 'extra use' of corporate vehicles over weekends or holidays. However, using the average annual mileage retrieved from the *ANKMV* variable (households seem to enter rough figures, apparently rounded to the nearest 1,000 or 5,000 km), we find that corporate vehicles held by private households on average travel 24,500 km annually, as compared with 12,500 km for private vehicles. Thus calculated, subject to the robustness of the data used, each corporate vehicle would appear to be used just twice more intensively than its private counterpart, all time periods considered (including weekdays, weekends and holidays). This is altogether consistent with the more precise data on daily vehicle mileage analysed above (for which the ratio of 'extra use' was 2.4), although it might point to a slightly more limited use of corporate vehicles for weekend and holiday trips compared with private vehicles.

### 4.5.2 Additional insights into the patterns of use of corporate and private vehicles

Having quantified the relative 'extra use' of corporate vehicles held by households compared to private vehicles, we will now offer some additional insights into the specific use patterns of these vehicles. For this purpose, we use the information collected through the Trip form in the 2010 EGT survey and compare the characteristics of the trips made with a corporate vehicle on an average weekday (6.5% of all household automobile trips) to those of trips made with a private vehicle on that same day (82.4% of all household automobile trips).

As shown in Table 4.11, the Trip form makes it possible to discriminate between vehicles (whether corporate or private) held by households, on the one hand, and vehicles that households may use on a one-off basis (such as hired cars, company service vehicles, etc.), on the other hand. The latter are labelled as 'non-household vehicles' in Table 4.11 and subsequent Tables.

| Volume of trips | HH's corporate vehicles | HH's private vehicles | Non-HH vehicles | All automobile vehicles |
|---|---|---|---|---|
| Number of daily trips ($10^3$) | 1,011 | 12,793 | 1,730 | 15,534 |
| *as a % of total automobile trips* | *6.5%* | *82.4%* | *11.1%* | *100.0%* |

*HH: Household*

**Table 4.11: Volume of automobile trips for various vehicle categories (2010 EGT survey)**

#### Greater distances, longer durations and higher speeds for corporate vehicles

As illustrated in Table 4.12, trips performed in households' corporate vehicles are characterised, on average, by greater distances, longer durations, and higher speeds than trips performed in households' private vehicles.

Indeed, the average trip distance is 1.8 times higher for corporate vehicles (10.3 km) than for private vehicles (5.7 km). The distribution profile of trip distances is much flatter for households' corporate vehicles than for other automobile vehicles, with trips over 10 km still representing 36.1% of all corporate vehicle trips, which is twice as high as the ratio for households' private vehicles (17.2%).

Moreover, the average trip duration is 1.6 times longer for corporate vehicles (34.2 min.) than for their private counterparts (21.1 min.). Trips with a duration of over 30 min. (resp. 60 min.) represent 48.5% (resp. 18.4%) of all corporate vehicle trips, which is very high indeed compared to 26.0% (resp. 5.9%) for private vehicles held by households.

All in all, the average speed of all trips using households' corporate vehicles (18.1 km/hr.) is 11% higher than for trips using households' private vehicles

(16.3 km/hr.), possibly pointing to: *i)* greater use of vehicles outside peak hours; and/or *ii)* a different geographical distribution of trips (greater use of interurban roads and motorways is all the more likely in that corporate vehicles travel longer distances).

| Basic trip characteristics | HH's corporate vehicles | HH's private vehicles | Non-HH vehicles | All automobile vehicles |
|---|---|---|---|---|
| Trip distance | | | | |
| Average | **10.3 km** | 5.7 km | 7.0 km | 6.1 km |
| Distribution | | | | |
| *<1 km* | *14.8%* | *21.7%* | *19.2%* | *21.0%* |
| *1-3 km* | *18.3%* | *30.6%* | *27.5%* | *29.4%* |
| *3-5 km* | *12.7%* | *13.7%* | *14.5%* | *13.7%* |
| *5-10 km* | *18.2%* | *16.8%* | *17.8%* | *17.0%* |
| *10-20 km* | ***20.6%*** | *11.6%* | *13.8%* | *12.4%* |
| *>20 km* | ***15.5%*** | *5.6%* | *7.3%* | *6.4%* |
| Trip duration | | | | |
| Average | **34.2 min.** | 21.1 min. | 28.6 min. | 22.6 min. |
| Distribution | | | | |
| *<5 min.* | *2.0%* | *1.8%* | *0.8%* | *1.7%* |
| *5-10 min.* | *12.5%* | *18.2%* | *13.1%* | *17.3%* |
| *10-20 min.* | *27.3%* | *40.9%* | *37.0%* | *39.6%* |
| *20-30 min.* | *9.6%* | *13.1%* | *12.8%* | *12.8%* |
| *30-60 min.* | ***30.1%*** | *20.1.%* | *25.6%* | *21.3%* |
| *>60 min.* | ***18.4%*** | *5.9%* | *10.8%* | *7.3%* |
| Trip speed | | | | |
| Average | **18.1 km/hr.** | 16.3 km/hr. | 14.8 km/hr. | 16.3 km/hr. |
| Distribution | | | | |
| *<10 km/hr.* | *31.0%* | *42.4%* | *44.5%* | *41.9%* |
| *10-20 km/hr.* | *34.2%* | *32.4%* | *32.7%* | *32.5%* |
| *20-30 km/hr.* | *17.6%* | *14.2%* | *13.1%* | *14.4%* |
| *>30 km/hr.* | ***17.2%*** | *11.0%* | *9.7%* | *11.2%* |

*HH: Household*

**Table 4.12: Distance, duration and speed distributions of households automobile trips for various vehicle categories (2010 EGT survey)**

### Corporate vehicles account for 9.3% of all automobile trips during the morning peak

As illustrated in Table 4.13, 18.7% of all trips performed with the corporate vehicles held by private households occur during the morning peak (between 07:00 and 09:00), as compared with only 12.9% for private vehicles. This observation does not, however, hold for the evening peak (between 17:00 and 20:00), which represents 24.2% of all corporate vehicle trips as compared with 27.9% of all private vehicle trips. It would appear that the 'return home' trips of corporate vehicles are spread over a longer period of time compared with those of private vehicles. All in all, for corporate vehicles and private vehicles alike, around 34%-35% of all trips occur between 17:00 and 22:00.

| Time and space distributions of trips | HH's corporate vehicles | HH's private vehicles | Non-HH vehicles | All automobile vehicles |
|---|---|---|---|---|
| Time distribution of trips | | | | |
| *22:00-04:00 Night* | *3.8%* | *3.8%* | *7.2%* | *4.2%* |
| *04:00-07:00 Early morning* | ***2.2%*** | *1.6%* | *1.4%* | *1.6%* |
| *07:00-09:00 Morning peak* | ***18.7%*** | *12.9%* | *11.1%* | *13.1%* |
| *09:00-12:00 Morning* | *14.9%* | *15.9%* | *13.5%* | *15.6%* |
| *12:00-14:00 Lunch time* | *12.1%* | *11.2%* | *15.7%* | *11.7%* |
| *14:00-17:00 Afternoon* | *14.1%* | *19.4%* | *19.7%* | *19.1%* |
| *17:00-20:00 Evening peak* | *24.2%* | *27.9%* | *23.0%* | *27.2%* |
| *20:00-22:00 Evening* | ***10.0%*** | *7.3%* | *8.2%* | *7.6%* |
| Space distribution of trips | | | | |
| *Paris ⇔ Paris* | ***6.1%*** | *2.9%* | *6.0%* | *3.5%* |
| *Paris ⇔ PC* | ***9.4%*** | *4.3%* | *7.6%* | *5.0%* |
| *Paris ⇔ GC* | ***5.1%*** | *1.7%* | *2.3%* | *2.0%* |
| *PC ⇔ PC* | *22.6%* | *24.2%* | *25.7%* | *24.2%* |
| *PC ⇔ GC* | ***14.9%*** | *8.3%* | *8.7%* | *8.8%* |
| *GC ⇔ GC* | *39.7%* | *57.6%* | *48.4%* | *55.4%* |
| *Other (out of the region)* | ***2.2%*** | *1.0%* | *1.5%* | *1.1%* |

*HH: Household; PC: Petite Couronne; GC: Grande Couronne (see notes in Table 5.3)*

**Table 4.13: Time and space distribution of households automobile trips for various vehicle categories (2010 EGT survey)**

Analysing all the automobile trips declared by households (for the record: 15.5 million trips daily, 6.5% of them using corporate vehicles), corporate vehicles account for 9.3% of the morning peak trips. This would point to a significant use of corporate vehicles by households for commuting purposes.

Quite surprisingly, on the other hand, corporate vehicles are somewhat under-represented in automobile trips occurring during working hours (between 09:00 and 12:00 and between 14:00 and 17:00): they account for only 5.4% of those trips.

As for the spatial distribution of trips, it appears that trips to and from the City of Paris account for twice as many corporate vehicle trips (altogether 20.6%) as private vehicle trips (8.9%). Here, the structure of the job market might be partly responsible for this very specific pattern, with the City of Paris concentrating a large share of the higher-ranking positions. Interestingly, trips between the inner suburbs (*Petite Couronne*) and the outer suburbs (*Grande Couronne*) are also over-represented in corporate vehicle trips (14.9%, as compared to 8.3% for private vehicles), thereby further emphasising the radial structure of the patterns of use of these vehicles.

**Work-related trips make up close to 45% of all corporate vehicle trips**

As illustrated in Table 4.14, trips performed with households' corporate vehicles present a high proportion of 'commuting' and 'professional' purposes (resp. 28.4% and 16.1% of all trips by the vehicles in this category) compared with those performed with households' private vehicles (resp. 15.3% and 2.5% of all trips by the vehicles in that category). Together, the relative weight of the two work-related categories of trip purposes is 2.5 times higher for corporate vehicles held by households than for their private vehicles (44.5% vs. 17.8%). Symmetrically, private purposes taken together (including routine and exceptional activities, as well as accompanying trips) account for almost twice as much of the total trips performed with households' private vehicles compared with trips performed with corporate vehicles (43.3% vs. 23.9%).

It would therefore appear that corporate vehicles held by households are of particular significance for the analysis of daily commuting, since they account for more than 1 in 10 trips with that purpose (11%). As might be expected, their relative weight in professional trips is even higher, and they indeed account for 1 in 4 trips for that purpose (24.6%). So corporate vehicles held by households appear to account for as much as 13.7% of all work-related trips (compared with 69.3% for households' private vehicles). Conversely, looking at all three private categories of trip purposes, we observe that households' corporate vehicles only account for 3.8% of the trips made for such purposes (compared to 87.0% for households' private vehicles).

The conclusion we draw from the above is that: *i)* corporate vehicles held by private households appear to serve work-related needs primarily but not exclusively (almost 1 in 4 trips is for private purposes); and *ii)* although corporate vehicles are not as systematically used for strictly professional purposes as they are for the daily commute to work, private households appear to rely quite heavily on their corporate vehicles for professional trips (almost 1 in 4 professional trips is performed with households' corporate vehicles).

| Trip purposes | HH's corporate vehicles | HH's private vehicles | Non-HH vehicles | All automobile vehicles |
|---|---|---|---|---|
| Distribution of purposes by vehicle category | | | | |
| *Commute* | ***28.4%*** | *15.3%* | *21.5%* | *16.8%* |
| *Professional* | ***16.1%*** | *2.5%* | *10.6%* | *4.3%* |
| *Private-routine* | *8.1%* | *16.6%* | *17.7%* | *16.1%* |
| *Private-exceptional* | *5.6%* | *11.9%* | *10.3%* | *11.3%* |
| *Service to passenger* | *10.2%* | *14.8%* | *5.8%* | *13.5%* |
| *Return home* | *31.6%* | *39.0%* | *34.1%* | *38.0%* |
| *All purposes* | *100.0%* | *100.0%* | *100.0%* | *100.0%* |
| Weight of vehicle categories by trip purpose | | | | |
| *Commute (*)* | ***11.0%*** | *74.8%* | *14.2%* | *100.0%* |
| *Professional (*)* | ***24.6%*** | *47.7%* | *27.7%* | *100.0%* |
| *Private-routine (**)* | *3.3%* | *84.5%* | *12.2%* | *100.0%* |
| *Private-exceptional (**)* | *3.2%* | *86.7%* | *10.1%* | *100.0%* |
| *Service to passenger (**)* | *4.9%* | *90.3%* | *4.8%* | *100.0%* |
| *Return home* | *5.4%* | *84.6%* | *10.0%* | *100.0%* |
| *(* )Work-related purposes* | ***13.7%*** | *69.3%* | *16.9%* | *100.0%* |
| *(**) Private purposes* | *3.8%* | *87.0%* | *9.2%* | *0.9%* |
| *All purposes* | *6.5%* | *82.4%* | *11.1%* | *100.0%* |

*HH: Household*

**Table 4.14: Trip purposes for various vehicle categories (2010 EGT survey)**

### Investigating the underlying factors behind the 'extra use' of corporate vehicles: trip purpose distribution vs. geographical spread

Looking closer at the purpose of trips to check for potential effects of the trip purpose distribution underlying the 'extra use' of corporate vehicles, Table 4.15 shows that work-related trips (i.e. trips taken for commuting and professional purposes) display higher average distance values than trips taken for private purposes. All vehicles considered, the average distances of commuting trips and professional trips are 8.6 km and 10.1 km respectively, whereas all other trip purposes record average distances in the range of 4 to 6 km. Thus, the high proportion of work-related trip purposes in the patterns of use of corporate vehicles (44.5% of all trip purposes of corporate vehicles, as compared with

17.8% for private vehicles) at least partly accounts for the observed 'extra use' of these vehicles relative to their private counterparts.

However, Table 4.15 also illustrates how corporate vehicles display higher average trip distance than private vehicles for every single category of trip purpose. Indeed, the average distance travelled for commuting trips is 44% longer for corporate vehicles (11.9 km) than for private vehicles (8.3 km). The same kind of gap is also observed for all private trip purposes (+41% for 'private-routine'; +45% for 'private exceptional'; +51% for 'service to passenger'), which therefore suggests patterns of use that might be spread over geographically larger areas for corporate vehicles than for private vehicles. This would, moreover, be consistent with the higher penetration of corporate vehicles among households residing in periurban areas (see Table 4.4).

The gap between corporate vehicles and private vehicles gets even bigger as far as return-home trips are concerned, with the average distance of these trips being twice as long for corporate vehicles as it is for private vehicles (11.3 km, as compared with 5.7 km). Besides the broader geographical spread, this may point to less frequent trip chaining[6] in the patterns of use of corporate vehicles compared with those of private vehicles. In practical terms, this could mean, for instance, that the drivers of corporate vehicles are less likely to stop on their way home to pick up children from school or to shop for groceries.

Finally, it is interesting to note that the least significant gap in average trip distance between corporate vehicles and private vehicles is observed for professional trips purposes: the average professional trip using a corporate vehicle is only 8% longer than the average professional trip using a private vehicle. We have already highlighted, however, that professional trips purposes are much more frequent in the patterns of use of corporate vehicles (16.1% of all trip purposes) than in those of private vehicles (only 2.5%).

All in all, this leads us to draw two broad qualitative conclusions about the underlying factors behind the 'extra use' of corporate vehicles. First, the *high proportion of work-related trip purposes* in the patterns of use of corporate vehicles (for corporate vehicles, commuting and professional trip purposes together account for 44.5% of all trip purposes, as compared with 17.8% for private vehicles), combined with their *higher average distances relative to other trip purposes*, accounts for part of the 'extra use' of corporate vehicles compared with private vehicles. And second, all the patterns of use of corporate vehicles held by private households seem to be *spread over larger geographical areas* than the patterns of use of their private counterparts. Indeed, this is reflected in the fact that *average trip distances are about 50% higher for all trip purposes* (including commuting, all three categories of private trip purposes, and the

[6] For a definition of trip chaining, see: http://nhts.ornl.gov/2001/pub/tripchaining.pdf.

return home) *than for strictly professional purposes*, when looking at corporate vehicles compared with private vehicles.

| Average trip distance by trip purpose | HH's corporate vehicles | HH's private vehicles | Non-HH vehicles | All automobile vehicles |
|---|---|---|---|---|
| Trip purposes | | | | |
| Commute | **11.9 km** | 8.3 km | 8.2 km | 8.6 km |
| Professional | 11.0 km | 10.2 km | 9.0 km | 10.1 km |
| Private-routine | **6.7 km** | 4.8 km | 4.8 km | 4.8 km |
| Private-exceptional | **7.6 km** | 5.2 km | 6.4 km | 5.4 km |
| Service to passenger | **5.9 km** | 3.9 km | 7.2 km | 4.1 km |
| Return home | **11.3 km** | 5.7 km | 6.9 km | 6.1 km |
| All trip purposes | **10.3 km** | 5.7 km | 7.0 km | 6.1 km |

*HH: Household*

**Table 4.15: Average trip distance by trip purpose for various vehicle categories (2010 EGT survey)**

### How full are the vehicles? A glance at vehicle occupancy rates

The *NBPV* variable in the 2010 EGT survey makes it possible to ascertain the vehicle occupancy rate for each automobile trip made by private household members. Exploring this data, we find that corporate vehicles held by private households are more likely to be used by a single occupant (80.4% of trips, as compared with 70.0% for private vehicles), thereby resulting in lower average occupancy rates: 1.27 occupants per vehicle for corporate vehicles, as compared with 1.41 occupants per vehicle for private vehicles.

Another method for calculating vehicle occupancy rates can be found in the literature based on the 2010 EGT survey (DRIEA, 2013), whereby the vehicle occupancy rate is calculated as the ratio of the total number of automobile trips declared by household members, whether as a driver or a passenger, to the number of automobile trips declared as a driver only. Although the relative gaps in vehicle occupancy rates between corporate vehicles and private vehicles are similar to those observed with the first method, the absolute vehicle occupancy rate values calculated with this second method are generally lower than those resulting from the first method: 1.11 occupants per vehicle on average for corporate vehicles, as compared with 1.21 for private vehicles. A possible explanation for the lower occupancy rates resulting from the second method is that the individual trips of children under 6 years of age are not declared. Therefore their automobile trips (as passengers) are omitted from this calculation, whereas they are included in the data encoded in the *NBPV* variable.[7]

| Vehicle occupancy rates | HH's corporate vehicles | HH's private vehicles | Non-HH vehicles | All automobile vehicles |
|---|---|---|---|---|
| Average occupancy rate by trip (*NBPV* variable) (1) | **1.27 occ./veh.** | 1.41 occ./veh. | 1.43 occ./veh. | 1.40 occ./veh. |
| Average occupancy rate by trip (DRIEA method) (2) | **1.11 occ./veh.** | 1.21 occ./veh. | 4.43 occ./veh. (3) | 1.28 occ./veh. |
| Average occupancy rate by trip weighted by mileage (4) | **1.07 occ./veh.** | 1.15 occ./veh. | 2.06 occ./veh. | 1.20 occ./veh. |
| Ratio of trips with an occupancy rate of 1 (*NBPV* variable) (1) | **80.4%** | 70.0% | 70.3% | 71.1% |

*HH: Household; occ./veh.: occupant per vehicle*
*Notes: 1. The number of occupants is reported by households for each automobile trip and encoded in the* NBPV *variable. All occupants are supposed ot be reported, including children under 6 years of age. 2. The DRIEA method (DRIEA, 2013) calculates the vehicle occupancy rate as the ratio of the total number of automobile trips declared (as driver and as passenger) to the number of automobile trips declared as driver. Since only household members aged 6 years or more are interviewed, this calculation more likely underestimates vehicle occupancy rates. 3. This high occupancy rate apparently stems from rental vehicles and other specific cases. We could not find a proper explanation for the gap observed for the sale vehicle category through the* NBPV *variable. 4. This method is based on the DRIEA method, but all automobile trips (as driver and as passenger) are weighted by mileage.*

**Table 4.16: Vehicle occupancy rates for various vehicle categories (2010 EGT survey)**

A third method for calculating vehicle occupancy rates uses the same logic as the second method but weights each trip by its distance. Average vehicle occupancy rates resulting from this method reveal the same gap as before between corporate vehicles (1.07 occupant per vehicle) and private vehicles (1.15 occupant per vehicle), with absolute values even lower than with the second method. It therefore appears that, for both vehicle categories, longer distances are more likely covered alone whereas trips including at least one passenger cover rather shorter distances.

In what follows, we will focus on the first method of calculating vehicle occupancy rate in order to 'capture' all potential child occupants, while bearing in mind that the relative gaps are consistent across all methods.

Table 4.17 illustrates how vehicle occupancy rates differ from one trip purpose to another. Indeed, work-related trip purposes show the lowest vehicle occupancy rates of all: 1.10 occupants per vehicle on average for all commuting

[7] The same kind of explanation is provided by Quételard (2010) for differences in vehicle occupancy rates resulting from the two methods applied to the 2007-2008 ENTD survey.

trips, and 1.14 for professional trips, as compared with occupancy rates in the range of 1.35 to 1.40 for both private trips and return-home trips. As should be expected, trips in which the purpose is 'service to passenger' display the highest vehicle occupancy rate (1.91). From this we can derive how trip purpose distributions can influence the vehicle occupancy rates of our different vehicle categories: the high proportion of work-related trips in the patterns of use of corporate vehicles automatically leads to lower average vehicle occupancy.

However, we further note the following three observations with regard to vehicle occupancy rates: *i)* corporate vehicles display lower vehicle occupancy rates than private vehicles for all but two trip purposes (commuting and service to passenger); *ii)* the trip purpose for which corporate vehicles' occupancy rate is the lowest compared to private vehicles is the return home (1.25 vs. 1.40), thereby supporting the assumption that the drivers of corporate vehicles are less likely to stop on their way back home to pick up children from school (which is also consistent with late returns home); *iii)* conversely, the trip purpose for which the corporate vehicles occupancy rate is the highest compared to private vehicles is commuting (1.14 vs. 1.07), perhaps suggesting greater frequency of ridesharing to work compared with private vehicles (although it should be noted that occupancy rates on commuting trips are, in both cases, very low).

| Average occupancy rate [1] by trip purpose | HH's corporate vehicles | HH's private vehicles | Non-HH vehicles | All automobile vehicles |
|---|---|---|---|---|
| **Trip purposes** | | | | |
| Commute | **1.14 occ./veh.** | 1.07 occ./veh. | 1.37 occ./veh. | 1.10 occ./veh. |
| Professional | **1.07 occ./veh.** | 1.10 occ./veh. | 1.31 occ./veh. | 1.14 occ./veh. |
| Private-routine | 1.27 occ./veh. | 1.34 occ./veh. | 1.55 occ./veh. | 1.34 occ./veh. |
| Private-exceptional | 1.39 occ./veh. | 1.37 occ./veh. | 1.46 occ./veh. | 1.37 occ./veh. |
| Service to passenger | 1.95 occ./veh. | 1.92 occ./veh. | 1.67 occ./veh. | 1.91 occ./veh. |
| Return home | **1.25 occ./veh.** | 1.40 occ./veh. | 1.35 occ./veh. | 1.39 occ./veh. |
| **All trip purposes** | **1.27 occ./veh.** | 1.41 occ./veh. | 1.43 occ./veh. | 1.40 occ./veh. |

*HH: Household; occ./veh.: occupant per vehicle*
*Note: 1. Average occupancy rates are retrieved from the* NBPV *variable (see Table 5.16).*

**Table 4.17: Average vehicle occupancy rates by trip purpose for various vehicle categories (2010 EGT survey)**

# 4.6 Insights into the influence of corporate vehicles on mobility patterns

## 4.6.1 Our approach

In this section, we propose to take a step back from the analysis of the patterns of use of household vehicles in order to discuss whether corporate vehicles have a specific influence on the broader mobility patterns of household members. To do so, we suggest a two-step approach.

**Building 'typical' household profiles for corporate vehicles**

First, we will define two typical profiles of households among the most likely to hold corporate vehicles. Based on our previous analyses, we will build a first typical profile based on the following criteria: *i)* socio-occupational category of the household's reference person is either 'skilled trades, retailers and employers' or 'managers and professionals'; *ii)* age of the household's reference person is in the 35-65 years range (for access to positions of responsibility); *iii)* household income is in the upper two quintiles; *iv)* household holds more than one vehicle (multi-vehicle). Overall, 238,002 households in the Paris region fit this first profile, 30% of which hold a corporate vehicle. In this particular case, the corporate vehicle would tend to meet the common description of a *convenience vehicle for executives*. In addition, we will build another, less obvious, typical profile based on the following criteria: *i)* socio-occupational category of the household's reference person is 'intermediate occupations', 'blue-collar workers' or 'white-collar workers'; *ii)* household income is in the 2nd or 3rd quintiles; *iii)* household holds more than one vehicle (multi-vehicle). Overall, 240,065 households in the Paris region fit this second profile, 18% of which hold a corporate vehicle. Here, the corporate vehicle would rather meet the common description of a *work vehicle for operatives*.[8]

As illustrated in Table 4.18, we 'capture' 27% of all households holding a corporate vehicle with just the first profile, and 16% with the second profile. Altogether, these two basic profiles account for 43% of all households holding a corporate vehicle in the Paris region.

[8] See Chapter 3 for the origins of these descriptions.

| HH types based on vehicle fleet composition | Profile #1 | | Profile #2 | |
|---|---|---|---|---|
| | without corporate vehicle | with one or more corporate vehicle | without corporate vehicle | with one or more corporate vehicle |
| HH observations (unweighted) | 489 | 189 | 727 | 161 |
| **Total HHs (weighted)** | **166,157** | **71,845** | **197,422** | **42,643** |
| *as a % of HHs holding a corporate vehicle* | - | *27%* | - | *16%* |

*HH: Household*

**Table 4.18: Two typical profiles of households holding a corporate vehicle (2010 EGT survey)**

## Analysing key features of the mobility patterns of household members

For the two household profiles we just defined, we will analyse the mobility patterns of all household members and we will try to highlight the influence, if any, of the presence of a corporate car in the household fleet.

On the one hand, each household member will be individually classified, following the methodology of Chrétien (2014), as either 'immobile' (i.e. with no trip documented on the day prior to the survey), or 'car-exclusive' (i.e. with nothing but car trips on the day prior to the survey), or 'exclusive on an alternative means' (e.g. with nothing but public transit trips, or nothing but walking trips, on the day prior to the survey), or else 'multimodal' (i.e. with at least two trips, each performed with a different mode, on the day prior to the survey).[9] Then, we will analyse whether or not the presence of a corporate car in the household fleet influences the distribution of household members along this classification of individual mobility patterns.

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[9] Chrétien (2014) defines 16 different transport modes for the 2010 EGT survey: 7 different modes for public transit, 1 for company coaches, school coaches and demand-responsive transit, 1 for taxi, 2 for automobile (as driver and as passenger), 2 for two-wheelers (motorised and non-motorised), 2 for miscellaneous modes (motorised and non-motorised), 1 for walking. Walking is considered as a mode of its own only when the entire trip is done on foot. When walking occurs at the beginning and/or at the end of a trip to access or exit another mode, it has not been considered as a mode of its own. Thus, a trip whereby the individual walks to access the car, then drives, and then walks again to access the intended destination, will not be considered as an intermodal trip, but merely as a car trip. More generally, each trip which uses several modes of transport (also called: 'intermodal' trip) is classified according to its main mode of transport.

On the other hand, we will look at all the trips performed by the members of a given household and we will assess the modal share of the car, first as a proportion of total trips, then as a proportion of the total distances travelled. Then again, we will analyse whether or not the presence of a corporate car in the household fleet influences the overall modal share of the car in household mobility.

### 4.6.2 Main findings

**Corporate cars come with more car-exclusive household members**

Taking our two typical household profiles and analysing the distribution of their household members along the abovementioned classification of individual mobility patterns (immobile / car-exclusive / exclusive on an alternative means / multimodal), we found no significant impact for the presence of a corporate car in the household fleet on any of the individual mobility patterns, except for the 'car-exclusive' household members of the two household profiles.

Indeed, for households in the first profile, 42.6% of all household members are 'car-exclusive' in those households which hold a corporate vehicle, as compared with 36.3% in households which do not hold a corporate vehicle.[10]

A similar gap (+ 6 percentage points) is found for households in the second profile: 47.2% of all household members are 'car-exclusive' in households which hold a corporate vehicle, as compared with 41.2% in households which do not hold a corporate vehicle.

It therefore appears that households in both our typical profiles have a larger share of their members who qualify as 'car-exclusive' when they hold a corporate vehicle compared to when they do not.

**Corporate cars come with higher car modal shares**

Our analysis based on the typical household profiles further reveals that households which hold a corporate car are more likely to display significantly higher modal shares for the car (as measured in number of trips or in distance travelled).

Indeed, looking at our first household profile, we observe that the car accounts for 63.1% of all trips for households which hold a corporate vehicle, as compared with 56.4% for households with no corporate vehicle. Weighted by distance, this modal share rises to 78.4% for households holding a corporate vehicle, as compared with 63.7% for households with no corporate vehicle. Such a significant gap in the car's modal share (+7 percentage points for trip counts,

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[10] For the record, all households in our typical profiles, whether or not they hold a corporate vehicle, are multi-vehicle households.

+15 percentage points for travelled distances) for a single household profile tends to support the assumption that the availability of a corporate car is conducive overall to increased reliance on the car in households that fit our first profile.

For this household profile, we were further able to check the influence of the holding of a corporate car on mobility patterns for private purposes. Our analysis reveals that the car accounts for 62.9% of all private trips and 79.2% of the total private trip distances in households which hold a corporate vehicle, as compared with 57.8% and 77.4% respectively for households with no corporate vehicle. Thus, the greater reliance on the car we observed on the part of households which hold a corporate car is also verified, though to a lesser extent, when looking at households' mobility patterns for private purposes.

Looking now at the second household profile, we observe a similar influence of the corporate car on the overall modal share of the car in household mobility patterns. Indeed, the car accounts for 69.5% of all trips for households which hold a corporate vehicle, as compared with 64.5% for households with no corporate vehicle, therefore showing a 5-point gap in car modal share based on trip counts. Weighted by distance, this modal share rises to 84.9% for households holding a corporate vehicle, as compared with 74.9% for households with no corporate vehicle, therefore showing a 10-point gap in car modal share based on distances travelled. As with the first household profile, this would support the assumption that the corporate car is conducive overall to increased reliance on the car on the part of households fitting our second profile, up to extremely high levels.[11] However, when we looked at the mobility patterns of households for *private* purposes, we did not find that the availability of a corporate vehicle had any significant influence on the modal share of the car for private purposes.

A closer look at the residential locations of households fitting our second profile reveals an interesting pattern: households which hold a corporate vehicle are more likely to live in the inner suburbs of Paris (*Petite Couronne*) and less likely to live in the outer suburbs of Paris (*Grande Couronne*) compared with households holding no corporate vehicle (respectively 35.5% and 63.8%, as compared with 22.1% and 76.2%). The differences in the distribution of residential locations for the first household profile, though significant, are much

[11] The modal share of the car, measured in travelled distances, is 52.2% for the whole Paris region (from 24.7% for people living in the City of Paris, to 68.7% for people living in rural areas) (DRIEA, 2013.

less noticeable.[12] Two main hypotheses can be ventured to explain such differences in the distribution of residential locations for our second household profile: *i)* the availability of a corporate vehicle to households of moderate income (2nd and 3rd lower quintile for our second profile) frees up financial resources which would have been assigned to the transport budget and therefore allows for more expensive, less remote residential choices on the part of households; *ii)* the same business activities which require companies to make a work vehicle available to their employees (e.g. network maintenance services, sales representation) might also require that the employees live close to the market for greater responsiveness and logistical efficiency.

# 4.7 Conclusion

Household travel surveys, which have been around for decades, had never previously been used to investigate the characteristics and patterns of use of corporate vehicles in France. Yet we have demonstrated they can be a source of information worth exploring for this purpose, provided that they collect information on the holding and use of corporate vehicles by private households in a systematic and robust manner. On a rough estimate, private households could hold about one million corporate vehicles out of the total 6 million corporate light-duty vehicles in France. In the Paris region alone, private households hold close to 290,000 corporate vehicles (6% of the total household fleet in the region). It would thus appear that household travel surveys, at both national and local level, show good potential for shedding light on the features and use patterns of *one fraction* of the vehicles in corporate car fleets, namely vehicles that are made available to employees on a full-time and exclusive-use basis (including, but not limited to, 'official vehicles', which employees can use for their personal as well as professional needs). While we have chosen to use a survey focused on the Paris region for this initial exploration, we believe that it would be interesting to consider the national survey to reach a more global view on the issues at stake at national level.

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[12] For households meeting the first profile, the spatial distribution of residences is as follows: 32.3% of households which hold a corporate vehicle live in the inner suburbs of Paris (*Petite Couronne*) and 60.6% of them live in the outer suburbs of Paris (*Grande Couronne*), as compared with respectively 30.4% and 63.9% for households holding no corporate vehicles. Interestingly, households holding a corporate vehicle constitute a higher proportion of residents in the City of Paris (7.1%) than households holding no corporate vehicle (5.7%).

Corporate vehicles are present in 5.5% of the 4.9 million households in the Paris region, in 7.7% of the 3.5 million households that hold at least one vehicle, and in 23% of the 1.2 million households that hold two or more vehicles. They are an *integral part* of the mobility portfolio of private households in the region. While we might be tempted to portray a typical profile of households holding a corporate vehicle (high-income, multi-vehicle, living in an urban area, with a head of family in his mid-thirties to mid-fifties and ranking in the higher-level categories of the socio-occupational hierarchy), some of the features of this household population suggest greater diversity than appears at first glance. In particular, households in the 'intermediate occupations' and 'blue-collar workers' categories together represent almost 40% the population of households holding corporate vehicles in the Paris region, showing the high penetration of corporate vehicles in the intermediate-level socio-occupational categories. Moreover, corporate vehicles are also very present in periurban areas (10% of households). We believe that further analyses would be needed to reach a deeper understanding of the socio-demographic background of corporate vehicles held by households. One key issue to investigate would be the possible causal relationship between corporate-vehicle holding and multiple-vehicle holding in households in the Paris region: indeed, 3 out of 4 households holding at least one corporate vehicle are multi-vehicle households. The qualification and quantification of this purported causal relationship could provide useful insights for larger modelling studies on household car holding and use.

Using a vehicle-centred perspective, we highlighted several significant differences between corporate vehicles and private vehicles in household fleets. First, corporate vehicles are newer (3.2 years compared to 8.5 years on average for private vehicles): almost 80% of them are 4 years old or less (30% for private vehicles), and 25% of them are 1 year old or less (8% for private vehicles). Such observations attest to the high turnover of vehicles in corporate car fleets. In addition, judging by their taxable horsepower, corporate vehicles are selected, on average, in the high-end automobile market segments, whereas private vehicles are more evenly distributed across market segments. This is consistent with the high penetration rates of corporate vehicles in the higher socio-occupational categories, for which the 'official car' is associated with high status. Finally, corporate vehicles present a much higher proportion of diesel engines than private vehicles (90% compared to 48%). The dieselisation gap between corporate and private vehicles is fairly stable, around 30 percentage points, across all vehicle age classes. So generational effects can only account for part of the high dieselisation of corporate vehicles held by private households in the Paris region. Discriminatory taxation is most probably responsible for the rest of it. On top of these observations, we found that only 1.5% of corporate vehicles in household fleets were alternative-fuel vehicles (compared to 0.9% for private vehicles) as of 2010, suggesting the likelihood of challenges to the introduction of alternative technologies into corporate car fleets.

Going on to look at the patterns of use of corporate and private vehicles held by private households in the Paris region, we observed an '*extra use*' of corporate vehicles compared with private vehicles, a combination of more frequent trips and longer travel distances. On an average weekday, the average corporate vehicle covers *more than twice* the distance covered by the average private vehicle (and rough annual mileages seem to confirm this twofold differential over weekends and holidays). Consequently, corporate vehicles held by private households account for *13% of the total daily mileage* of the private household motor vehicle fleet in the Paris region. In addition, corporate vehicles seem of particular significance in the analysis of the daily commute, for they account for more than 1 in 10 trips with that purpose for household vehicles in the Paris region. Unsurprisingly, their relative weight in professional trips is even higher: they account for 1 in 4 such trips. It would thus appear that corporate vehicles held by private households serve work-related purposes *primarily*, although not exclusively (almost 1 in 4 trips they make are for private purposes).

All features of the patterns of use considered, we found two main factors driving the 'extra use' of corporate vehicles, namely: *i)* their higher proportion of work-related trip purposes (combined with the higher average distances of such trip purposes relative to other trip purposes); and *ii)* their wider overall geographical coverage (the reflected in the fact that average trip distances are about 50% higher for almost all trip purposes except professional purposes).

Taking a step back from the vehicle-centred analysis, we also discussed whether corporate vehicles have a specific influence on the broader mobility patterns of households. To do so, we defined two typical household profiles among the most likely to hold corporate vehicles (both holding multiple vehicles; one profile for 'executive households', another profile for 'operative households'), and analysed the individual mobility patterns of all household members. Our analysis found no significant impact of the presence of a corporate car in the household fleet on any of the individual mobility patterns *except for* a larger proportion of 'car-exclusive' members in households holding a corporate vehicle (this was true for both household profiles). In addition, we found evidence to support the assumption that corporate vehicles are conducive to increased overall reliance on the car on the part of households, judging by the modal share of corporate vehicles in total household trips (this too was true for both household profiles). Yet, when we looked at households mobility patterns for *private* purposes, only in the first profile did we find that the availability of a corporate vehicle had a significant influence on the modal share of the car. On the basis of the preliminary results provided by this profiling method, we believe gthat it would be worth performing a more robust regression to assess the influence of corporate vehicles on the overall mobility of private households. Nonetheless, we consider that these observations provide unprecedented (though partial) support for our earlier segmentation of corporate vehicles based on the series of ‘rights’ (exclusive use / full-time access / private use) over the vehicles granted to employees (see Figure 3.3).

# Chapter 5
# Light commercial vehicles in corporate fleets

## 5.1 Introduction

### 5.1.1 Background

It is commonly accepted that light commercial vehicles hold a special position in corporate car fleets. They are indeed traditionally considered as genuinely functional assets which companies select, acquire and use so as to best fulfil well-specified mobility needs involving the transport of production tools (e.g. carrying construction equipment to a construction worksite) or the transport of end products (e.g. delivering parcels or groceries to customers). They are used in all economic sectors, from agriculture to manufacturing, from construction to IT services, by public as well as private entities. To quote the French Automobile Manufacturers' Association (CCFA), '*they offer an appropriate response to business transport and mobility needs*' as a complement to the services offered by passenger cars on the one hand, and large goods vehicles (LGVs) on the other hand.

However, as CCFA notes, the European LCV market has been severely affected by the 2008 economic and financial crisis, falling to similar levels to those observed in 1996 (around 1.4 million units for EU-15, Switzerland and Norway), down by around 30% (or 600,000 units) from their record 2007 level, with decreases of 199,000 units for Spain, 120,000 for Italy, 100,000 for the UK, and 77,000 for France between 2007 and 2012 (CCFA, 2013). The new-LCV market would therefore appear to be as sensitive to overall economic conditions as any other asset involved in business operations.

The situation of LCVs in European countries appears to be further differentiated as a result of contrasting national tax schemes with regard to company possession and use of LCVs. Indeed, while LCVs represented 10% of new light-vehicle sales in Europe (EU-15+Switzerland and Norway) in 2012 (12% in 2007), this proportion ranged from as high as 20% in Norway, to the minimum 6% observed in Greece (CCFA, 2013).

Interestingly, France's position in this overall picture of LCVs in Europe is that of a *double leadership*: *i)* leadership in *the size of market* (384,000 new LCVs sold in France in 2012, ahead of the United Kingdom, with 248,000 units, Germany, with 225,000 units, Italy, with 117,000 units, and Spain, with 77,000 units), and *ii)* leadership in *the market share of national carmakers* (510,000 new LCVs sold by French car manufacturers in Europe in 2012, resulting in a 37% market share over 17 countries). A third striking feature of the French LCV market is that it consists almost exclusively of diesel-powered vehicles (up to 93% in 2013). (CCFA, 2013)

**France is a major market for LCVs**

As an initial approach to the increasing significance of LCVs in France, both in terms of numbers of units and in terms of traffic, we refer to the overall traffic assessment produced by national statistics (SOeS, 2011a; CCFA, 2000). Based on data presented in Table 5.1, we observe the following:

1) *Vehicle fleet:* With 5.810 million vehicles, LCVs represented 15.7% of total light vehicles in use in France in 2010 (36.985 million units, including 31.175 million passenger cars), up from 12.5% in 1980.
2) *Traffic flow:* With 91 million vehicle-kilometres travelled, LCVs contributed 18.5% to total light-vehicle traffic in France in 2010 (489 million vehicle-kilometres travelled), up from 13.1% in 1980.

In the 1980s, the LCV stock grew twice as fast as the stock of passenger cars (+59% vs. +29% over 10 years). In the following decade, the increasing share of LCVs in total light-vehicle traffic came mainly as a result of increasing annual mileage (+6% over 10 years) at a time when growth in the annual mileage travelled by passenger cars had already started to slow. More recently, the share of LCVs in the total light-vehicle stock seems to have stabilised somewhere between 15% and 16%. However, their average annual mileage is still on an upward trend, by contrast with passenger cars, whose average annual mileage has never topped its 1999 level (13,835 km), and has in fact almost continuously declined since then.

| LCV fleet and traffic assessment | 1980 | 1990 | 2000 | 2010 |
|---|---|---|---|---|
| **Average number of vehicles in use ($10^3$)** | | | | |
| All LVs (1) | 21,253 | 27,503 | 32,832 | 36,985 |
| LCVs (2) | 2,650 | 4,223 | 5,062 | 5,810 |
| *as a % of total LVs* | *12.5%* | *15.4%* | *15.4%* | *15.7%* |
| **Average mileage per year per vehicle (km)** | | | | |
| Passenger cars | 12,800 | 13,356 | 13,539 | 12,769 |
| LCVs | 14,500 | 14,633 | 15,533 | 15,588 |
| **Total vehicle traffic per year ($10^9$ veh.km)** | | | | |
| All LVs | 290 | 372.7 | 454.6 | 488.6 |
| LCVs | 38 | 61.8 | 78.6 | 90.6 |
| *as a % of total LV traffic* | *13.1%* | *16.6%* | *17.3%* | *18.5%* |

*LCV: Light Commercial Vehicle; LV: Light Vehicle*
*Note: 1. LVs include both LCVs and passenger cars registered in France, but they exclude motorised two-wheelers. 2. The referenceof SOeS for fleet estimates is the CCFA database and therefore LCVs include vehicles up to a 5-tonne AGW.*

**Table 5.1: An assessment of LCV fleet and LCV-related traffic in France over 1980-2010 (SOeS, 2011a)**

As illustrated in Table 5.2, annual sales of new LCVs in France increased by 40% between 1980 and 1990. However, as a result of successive economic downturns, the market has recently fluctuated around levels well below the record high of 461,462 units in 2007: with 384,049 units sold in 2012, it was just 2.5% higher than the 373,986 units sold in 2009. France nevertheless remains the largest market for new LCVs in Europe, and one of the countries with the highest proportion of LCVs in new light-vehicle sales (around 15%-16%), just behind Norway and Portugal. (CCFA, 2013 and previous)

Favourable tax conditions appear to play an important part in the diffusion of LCVs in the French LV market. More specifically, the *difference in tax treatment among vehicles in corporate fleets* needs to be considered: as far as corporate vehicles are concerned, passenger cars are targeted by tax regimes as nonessential equipment, whereas LCVs have long been recognised as operational working tools (they have been allocated the status of fixed tangible assets used for the purposes of operations) and therefore enjoy much more favourable tax conditions.[1] (OVE, 2013b and 2014a)

| New-LCV sales (1) | 1980 | 1990 | 2000 | 2010 |
|---|---|---|---|---|
| Number of vehicles | 277,887 | 393,795 | 414,966 | 417,612 |
| *as a % of total LCVs in use (2)* | *10.5%* | *9.3%* | *8.2%* | *7.2%* |
| *as a % of total LV sales (3)* | *12.9%* | *14.6%* | *16.3%* | *15.6%* |
| **Market share of French carmakers in new-LCV sales** | **82%** | **77%** | **70%** | **67%** |
| *(as compared to new passenger car sales)* | *(77%)* | *(61%)* | *(59%)* | *(54%)* |

*LCV: Light Commercial Vehicle; LV: Light Vehicle; AGW: Authorised Gross Weight*
*Notes: 1. CCFA sources include vehicles with AGWs up to 5 tonnes in the LCV category. 2. LCVs in use are taken from SOeS (2011), see Table 6.1. 3. LVs include both LCVs and passenger cars.*

**Table 5.2: Development of new-LCV sales in France from 1980 to 2010 (CCFA, 2013 and previous)**

### French carmakers hold a dominant position in their home market and beyond

Another strong feature of the French market for LCVs is the high market share French carmakers retain in their home market. After losing 15 points of their market share in new-LCV sales between 1980 and 2007, they stabilised their position around 66%-67% over the next 7 years. (CCFA, 2013 and previous)

This strong position of French carmakers in their home LCV market is reinforced by their growing presence in the European market. Despite a troublesome year in 2012 (French manufacturers' new-LCV sales in 17 Western European countries were down 14% from the previous year), French manufacturers retained a 37% market share on the European playing field for new-LCV sales in 2013 (up by 4 points from 2007). (CCFA, 2013)

French manufacturers rely on a broad offering of vehicles for the LCV market, most particularly in the small van subcategory (Authorised Gross Weight up to 2.5 tonnes). To illustrate their success in Western Europe (EU-15, Switzerland and Norway), we can observe that 5 of the best-selling models in 2012 were by French manufacturers, namely: Renault Kangoo (AGW around 2 tonnes), Citroën Berlingo (AGW around 2 tonnes), Peugeot Partner (AGW

[1] See Chapter 7 for further information on the tax schemes applicable to LCVs and passenger cars in corporate car fleets.

around 2 tonnes AGW), Renault Trafic (AGW between 2 and 3 tonnes), and Renault Master (AGW between 3 and 4.5 tonnes) (CCFA, 2013).

The size and depth of their home market is probably one of the greatest assets of French manufacturers in the face of stiffening competition (from German and Italian manufacturers in particular), as it allows them to enjoy the benefits of increasing returns to scale, it strengthens their brand image and it enables them to stimulate demand through model renewals.

**Diesel exclusiveness**

Finally, a third notable feature of the French market for LCVs is the ever-increasing proportion of diesel-powered vehicles. Indeed, the total dependency on diesel that has been the rule for large goods vehicles for decades appears to have steadily spread to lighter commercial vehicles.

As illustrated in Table 5.3, 95% of the entire fleet of LCVs with AGW above 2.5 tonnes was already powered by diesel engines in 2000 and the proportion has kept rising ever since. As for the lighter subcategory of vehicles (AGW up to 2.5 tonnes), petrol engines, which still retained a 35% share of this fleet in 2000, also seem to be heading towards a complete phasing out. Diesel engines gained 25 points of market share in 13 years and in 2013 they powered close to 90% of the lighter subcategory of LCVs in France. Overall, diesel's share in the total LCV stock in France rose from 73% in 2000 (as compared with 34% for the passenger car stock at the time) to 93% in 2013 (as compared with 61% for the passenger car stock), pointing to the fact that substantially all new-LCV sales in recent years were diesel-powered vehicles. (CCFA, 2013 and previous)

| Share of diesel vehicles in total LCVs in use (January 1st) | 2000 | 2005 | 2010 | 2013 |
|---|---|---|---|---|
| **All AGW categories (1)** | **73%** | **81%** | **88%** | **93%** |
| < 2.5 t. | 65% | 75% | 83% | 89% |
| 2.5-3.5 t. | 95% | 97% | 98% | 99% |
| *(as compared to passenger cars in use on January1st)* | *(34%)* | *(45%)* | *(56%)* | *(61%)* |

*LCV: Light Commercial Vehicle; AGW: Authorised Gross Weight*
*Note: 1. Vehicles between 3.5 and 5 tonnes in AGW have been neglected here as they represent less than 0.25% of all LCVs in France.*

**Table 5.3: An increasing share of diesel-powered vehicles among LCVs in France (CCFA, 2013 and previous)**

Thus, not only is the proportion of diesel engines in the French LCV stock very high in absolute terms, it is also 1.5 times higher than the proportion of diesel engines in the passenger car stock, and it continues to increase at a significant pace (7 to 8 points of market share every 5 years since 2000).

These observations suggest three sets of explanations which are not in any way mutually exclusive, rather the contrary: *i)* on the *demand* side, the specific uses of LCVs may be more suited to diesel-powered vehicles (say, prosaically, more kilometres driven at cruising speed, heavier loads, etc.); *ii)* on the *supply* side, the dominant position of French carmakers on the French LCV market may have led to a *de facto* technological lock-in in favour of diesel engines (as a result of industrial and energy policy decisions made in France from the 1960s onwards); and *iii)* on the *regulatory* side, favourable tax laws may have given diesel-powered LCVs a significant competitive edge over their petrol counterparts.[2]

### 5.1.1 Statement of the problem

Although much information is available about light commercial vehicles as a specific *product on the automotive market*, only rare publications have endeavoured to analyse light commercial vehicles as a *component of the transport system* (see, for instance: Savy and Tenfiche, 2014).

Light commercial vehicles are spontaneously (and sometimes erroneously) associated with corporate activities (as opposed to private household mobility). Yet virtually no research has been dedicated to analysing the special role that corporate fleets play in their management and use nor, reciprocally, to understanding the special position that LCVs hold in corporate car fleets (both in absolute terms and relative to corporate cars and large goods vehicles). Understanding what type of corporations use such vehicles, which tasks they are assigned, with what typical use patterns, etc., is key to assessing how corporate LCVs contribute to the transport system in general, and to the mobility needs of corporations in particular.

Unlike corporate passenger cars, corporate LCVs are usually considered to be functional assets, or genuinely operational working tools. For decades now, this has justified their very special (and very favourable) status with regard to taxes on corporate vehicles. Analysing recent changes in the characteristics of LCVs can provide some insights into *i)* the *dynamic effects* of tax policies on the composition of corporate LCV fleets, and *ii)* the *long-term repercussions* of changes in the corporate LCV fleet on the wider LCV stock in France.

Our assumption is that a series of surveys on the use of LCVs that has been carried out in France by the French Ministry of Transport since the early 1980s (thereafter called 'LCV surveys') can be used to shed light on all these topics.

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[2] See Chapter 7 for further information on the tax conditions applicable to LCVs and passenger cars in corporate car fleets.

### 5.1.2 Purpose of the analysis

The objectives that the quantitative analysis presented in this chapter aims to achieve can be classified in two categories.

First, we aim to use the results of LCV surveys to investigate corporate LCVs from three different perspectives: we want to gain further insights into *i)* the key characteristics of the corporations that use LCVs, *ii)* the main features of the vehicles *per se*, and *iii)* the main features of their patterns of use by corporations. When relevant, we will analyse the developments in all such features across successive LCV surveys.

Second, we aim to trace the effects of tax schemes targeting *corporate* LCVs on the diffusion of 'novelties' (or innovations, in the broad sense of the word) in the wider corporate LCV fleet. Focusing on two particular innovations (passenger-car derivatives[3] and diesel engines), we will analyse their gradual penetration in the LCV fleet.

### 5.1.3 Method

To explore the main features and patterns of use of the French corporate LCV fleet, we will examine the results of national surveys carried out by the Ministry of Transport on the use of LCVs in France (thereafter labelled 'LCV surveys').

For the sake of comparability and consistency, we will focus our *dynamic* analyses of various vehicle features and use-pattern characteristics on the last three LCV surveys, dated 2000, 2005, and 2010. For more in-depth analyses on some salient issues, we will use a detailed data file based on the 2010 LCV survey, and trace changes over the life of the fleet (approximately 20 years) based on the observation of variations among vehicles from different age cohorts.

Further information on the LCV surveys and on the methodology we developed for our analysis based on their results is provided in Section 5.2.

### 5.1.4 Outline of the chapter

This chapter consists of three main sections and a conclusion. In Section 5.2, we describe the methodology we developed in order to explore the possession and use of corporate LCVs based on the results of the French 'LCV surveys'. In Section 5.3, using data from the 'LCV surveys', we analyse the various user

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[3] As already mentioned, these special LCV body types result from the conversion of passenger car body types into commercial vehicles (mainly for tax purposes). See Chapter 7 for further information on the tax schemes applicable to light commercial vehicles in corporate car fleets in France.

profiles of LCVs in France and highlight the key role corporations play on this particular automotive market segment. In Section 5.4, we present the main findings from the 'LCV surveys' on the features and patterns of use of LCVs in corporate fleets. In Section 5.5, we attempt to trace the effects of tax schemes targeting corporate LCVs on the adoption of 'novelties' in the larger LCV fleet, with a twofold focus on *i)* new vehicle body types introduced in the 1990s (namely: 'passenger-car derivatives'), and *ii)* a particular engine type which has retained a hegemonic position over the LCV fleet for almost two decades now (namely: the diesel engine). In the concluding section (5.6), we will discuss the results of our quantitative analysis in the light of the results of our earlier literature-based investigation of corporate car fleets.

# 5.2 Methodology: Our exploration of national 'LCV surveys'

Understanding the use of commercial vehicles has long been an important concern of transport regulators. Indeed, starting in 1952, the French Ministry of Transport has carried out a continuing nationwide survey on the use of road freight transport vehicles (SOeS, 2013k). The aim of this survey is to assess the road freight volumes and mileage of large goods vehicles (the scope is limited to vehicles with AGWs above 3.5 tonnes), with a view to assisting the regulator in analysing the industry's economic situation, as well as assessing the implications of road freight activity for the everyday operations (safety, congestion, etc.) and planning of transport infrastructure. With large goods vehicles being owned and used solely by corporate entities, France's nationwide road freight transport survey is something of a pioneer amongst transport surveys targeted on companies.

As a complement to this survey, which does not cover commercial vehicles with an AGW below 3.5 tonnes, the French Ministry of Transport has for more than thirty years, on a five yearly basis, conducted a series of surveys on the use of light commercial vehicles (hereinafter called the 'LCV surveys'). Seven LCV surveys have taken place since 1981, the last in 2010-2011 (SOeS, 2012e).

This section provides an overview of the LCV surveys, their methodology and their content. It then presents the approach we adopted for the analysis of the survey results.

## 5.2.1 Overview of the LCV surveys

Descriptive information on the LCV surveys presented in this section is drawn from SOeS (2009; 2012c, d, e, f), SES (1999 and 2003); OEST (1988 and 1995), and Ministère des Transports (1983).

| Adjustments in survey design | Survey 1981 | 1986 | 1991 | 1996 | 2000 | 2005 | 2010 | Comments |
|---|---|---|---|---|---|---|---|---|
| **Scope** | | | | | | | | |
| Small coaches [(1)] included | yes | yes | no | no | no | no | no | Small coaches are less than 1.5% of total LCVs. Results for both categories are presented separately. |
| VASPs [(2)] included | yes | yes | yes | yes | no | no | no | VASPs are close to 5% of total LCVs. Results for VASPs are merged with those for LCVs. |
| Weight limit [(3)] | 3t. payload | 3t. payload | 3t. payload | 3t. payload | 3t. payload | 3.5t. AGW | 3.5t. AGW | LCVs w/ AGWs > 3.5t. decline from 3.2% of total in 1981 to 0.6% in 2000. Most results can be adjusted. |
| Age limit | 15 yrs. | 20 yrs. | 20 yrs. | 20 yrs. | 20 yrs. | 20 yrs. | no limit | Detailed data for 2010 allow for an isolation of LCVs older than 20 years. |
| **Sampling quality** | | | | | | | | |
| Parent population ($10^6$ units) | 3.1 | 4.3 | 5.4 | 5.6 | 5.6 | 6.2 | 5.8 | |
| Sample | 11,500 | 18,500 | 23,000 | 20,000 | 20,000 | 25,000 | 25,000 | Sampling fractions fluctuate from 3.5‰ to 4.5‰. |
| Rate of useable responses | 71% | 67% | 69% | 63% | 62% | 63% | 62% | |
| **Data labelling** | | | | | | | | |
| Nbr. of vehicle body types | 13 | 16 | 17 | 17 | 10 | 10 | 14 | Until 1991, data for passenger-car derivatives were |
| 'Pass.-car derivative' label (y/n) | (no) | (no) | (no) | (yes) | (yes) | (yes) | (yes) | merged with those of ordinary vans. |
| Nbr. of user (legal) categories | 8 | 7 | 7 | 7 | 6 | 6 | 5 | Categories for HHs, public admin., and associations are stable. Only categories for companies vary. |

*LCV: Light Commercial Vehicle; VASP:* Véhicule Automoteur Spécialement Aménagé *(motor vehicle with special design or layout); AGW: Authorised Gross Weight; HH: Household*

*Notes: 1. Small coaches include minibuses and minicoaches with less than 10 passenger seats. 2. VASPs are vehicles with special design or layout; they include public works vehicles, fire trucks, road service vehicles, carrier trucks, camper vans armoured vans, ambulances, refuse collection vehicles, etc. 3. Vehicles with a 3-tonne payload could have an AGW higher than 6 tonnes.*

**Table 5.4: Changes in the LCV survey methodology over time**

### The LCV survey methodology and its adjustments over time

Like the national road freight transport survey, the LCV surveys are essentially *vehicle-centred* (i.e. the statistical unit of the survey is the vehicle itself).

Looking at the 2010 LCV survey, we observe that the sampling uses the national motor vehicle registration (MVR) file, selecting vehicles classified in the $N_1$ subcategory under French and European regulations (see Chapter 3 for the various definitions found for the LCV category in French, European and other international contexts).[4] Indeed, the survey targets vehicles designed and constructed for the carriage of goods and having a maximum mass (AGW for 'Authorised Gross Weight', or PTAC in French) not exceeding 3.5 tonnes.

The 2010 LCV survey's sampling design is stratified according to: *i)* authorised gross weight of the vehicle, *ii)* the Principal Activity Code (in French, *code APE*, for '*Activité Principale Exercée*') for users with a business registration number, *iii)* the energy source of the vehicle, and *iv)* the age of the vehicle.

It is worth noting, however, that the methodology of the LCV surveys has been adjusted over time, in scope, in sampling method and in labels for the items of information collected. Some of the adjustments made over time are likely to have an impact on the comparability of results from one survey to the next. Table 5.4 presents a list of some of the most critical adjustments we will examine in the light of the purposes of our analysis (see subsection 5.2.2).

### A user perspective

Notwithstanding the fact that they take the vehicle itself as an entry point into the analysis of LCV use in France, the LCV surveys clearly adopt a user perspective. Unlike large goods vehicles, LCVs in France are possessed and used not only by corporate entities, but also by private households. Therefore, all LCV surveys, starting in 1981, have made it possible to discriminate between professional users of LCVs and private users (i.e. households), with the two categories being asked a partially distinct set of questions, for instance on the purposes of use of the vehicle.

Table 5.4 illustrates how the user categories listed in the LCV survey databases have varied over time. Three categories have however remained stable, namely: *i)* private households, *ii)* public administrations and *iii)* non-profit organisations and associations. The variety of legal statuses of companies in France (private or public, sole or collective ownership, self-employment, etc.) has led to classifications which vary in refinement from one survey to another, but the overall category of 'company users' could be aggregated within a homogeneous perimeter across all surveys.

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[4] European Directive 2007/46/EC (Annex II) and French Highway Code (Art. R311-1)

For our analysis, we will largely focus on LCVs used by 'professional users', including companies, public administrations and non-profit organisations and associations. For reasons of simplicity, from now on we will refer to these vehicles as 'professional LCVs' (as opposed to 'private LCVs', which are used by private households). Some results will be discussed on a subcategory level (i.e. companies vs. public administrations vs. non-profit organisations and associations) provided that such results involve sufficiently large samples and point to interesting differences among the various subcategories of professional users. Most results, however, will only be analysed on a more aggregated level.

### 5.2.2 Survey methodology and database content

#### Overall questionnaire layout

All questionnaires used for LCV surveys can be found in the associated summary documents by OEST, SES, and SOeS (see above for detailed references). By way of illustration, the 2010 LCV survey uses a 6-page questionnaire which the user of the vehicle can return on paper or electronically (SOeS, 2012c). This questionnaire consists of four main sections, which aim to collect information on:

1) *The vehicle*: vehicle body type (ordinary van, passenger-car derivative, etc.), commercial payload, authorised gross weight (in French: PTAC), mode of possession (plain ownership, with or without a loan, leasing, etc.), situation of the vehicle (currently in use vs. out of use, waiting to be sold in a car dealership, etc.), age, average fuel use, etc.;
2) *The owner and the user of the vehicle*: situation of the user (corporate or private user), legal status, business registration number and principal activity code for corporate users (private users are assigned a 'neutral' 0900Z activity code), socio-occupational category for private users;
3) *The general use of the vehicle (mileage and overall use during the calendar year preceding the year of the survey)*: present odometer reading, declared annual mileage, estimated daily mileage, mileage upon acquisition, distribution of the declared average annual mileage across types of area where journeys took place (urban, road, motorway, closed user site), distribution of the declared average annual mileage across geographical ranges (local, national or international), distribution of the declared average annual mileage across professional trip purposes, frequency of use (distribution across distance classes, etc.), use of air conditioning, purposes for professional and non-professional use;
4) *The daily use of the vehicle (all trips of 2 days selected in a week close to the date of the survey)*: for each trip in the 2 selected days, information is collected on the origin and destination, nature of load, distance driven

(loaded and unloaded), trip purpose, time driven, number of loading/unloading stops, total weight of freight, and type of goods.

The time needed to fill in a full questionnaire in 2010 was estimated by the survey manager to be around 45 minutes.

**Main survey outputs**

The survey manager would mainly export the following 6 data outputs for external analysis purposes: *i)* tonnes transported, *ii)* tonne-kilometres transported, *iii)* vehicle-kilometres travelled, *iv)* average annual mileage travelled, *v)* total vehicles in service, and *vi)* total vehicles currently in use (excluding vehicles about to be sold, or vehicles for which no questionnaire has been returned).

It has been the policy of the French Ministry responsible for transport to make publicly available a selection of detailed tables and cross-tabulations resulting from the LCV surveys. The detailed results of pre-selected cross-tabulations are available online in Excel format for the last two surveys (2005 and 2010). More recently, the complete, unsorted file of survey results has been made available in .csv-format for the 2010 survey. This access to the full original database allows a more thorough analysis of the survey results through testing of new cross-tabulations that could serve the specific purposes of our analysis.

Table 5.5 illustrates the developments in a selection of variables over the course of the 7 surveys. This table raises several questions: firstly, about the influence of the changes in survey methodology (see Table 5.4) on the comparability of data across surveys; secondly, on how consistent the LCV survey results are with data from other sources (see Tables 5.1 and 5.2).

| Key LCV survey outputs | 1981 | 1986 | 1991 | 1996 | 2000 | 2005 | 2010 (1) | |
|---|---|---|---|---|---|---|---|---|
| Unadjusted differences in scope (see Table 6.4) | w/ VASPs < 15 yrs. | w/ VASPs < 20yrs. | w/ VASPs < 20yrs. | w/ VASPs < 20yrs. | w/oVASPs < 20 yrs. | w/oVASPs < 20 yrs. | w/oVASPs < 20 yrs. | w/oVASPs all ages |
| **Total number of LCVs (2) ($10^3$ units)** | | | | | | | | |
| In service (3) | 2,562 | 3,544 | 4,365 | 4,830 | 4,985 | 5,499 | 5,177 | 5,785 |
| In use (4) | 2,365 | 3,491 | 4,295 | 4,634 | 4,748 | 5,085 | 5,011 | 5,598 |
| **Average annual mileage per vehicle (km)** | | | | | | | | |
| LCVs in use | 15,500 | 13,700 | 15,500 | 16,100 | 15,700 | 15,200 | 15,300 | 14,100 |
| **Total traffic per year ($10^9$ veh.km)** | | | | | | | | |
| LCVs in use | 37 | 48 | 67 | 75 | 75 | 77 | 77 | 79 |
| **Market shares of French carmakers in total LCVs in service by AGW category** | | | | | | | | |
| < 1.5 t. | n.d. | n.d. | n.d. | 90.6% | 90.3% | 89.1% | n.d. | 92.6% |
| 1.5-2.5 t. | n.d. | n.d. | n.d. | 68.9% | 75.8% | 81.8% | n.d. | 83.3% |
| 2.6-3.4 t. | n.d. | n.d. | n.d. | 62.3% | 58.3% | 53.1% | n.d. | 51.5% |
| 3.5 t. | n.d. | n.d. | n.d. | | 57.9% | 51.0% | n.d. | 52.8% |
| **All AGW categories** | **n.d.** | **n.d.** | **n.d.** | **77.5%** | **77.3%** | **75.1%** | **n.d.** | **74.3%** |
| **New-LCV sales (5)** | | | | | | | | |
| Number of LCVs ($10^3$ units) | 295 | 362 | 371 | 334 | 393 | 395 | 402 | |
| *as a % of total LCVs in use* | *12.5%* | *10.4%* | *8.6%* | *7.2%* | *8.3%* | *7.8%* | *8.0%* | *7.2%* |

*LCV: Light Commercial Vehicle; AGW: Authorised Gross Weight*

*Notes: 1. Thanks to the availability of detailed results for 2010 in a .csv-format database file, we could isolate vehicles aged 20 years or less in the 2010 survey results for comparison with previous surveys (this adjustment was however impossible for the carmaker nationality because the variable had been retrieved from the original database file). 2. LCV fleet totals are estimates on January, 1, for the year following the survey (e.g. Jan. 1, 2011 for the 2010 LCV survey). 3. Vehicles in service include all vehicles, whether used or unused (e.g. waiting to be sold in a car dealership, detained after the owner ceased activities, or stopped for heavy maintenance). 4. Vehicles in use exclude vehicles about to be sold, or vehicles for which no questionnaire has been returned. 5. From 1991 onwards, new-LCV sales are computed from the proportion of vehicles which were purchased new in the total vehicles purchased in the year of the survey; however, such data was not available for 1981 and 1986, so we used the year of first registration as a proxy for the year of purchase as a new vehicle. For 1991, the difference between the two methods of calculation is in the magnitude of 1,000 vehicles.*

**Table 5.5: Developments in a selection of variables across the LCV surveys from 1981 to 2010, and influence of the changes in methodology (SOeS, LCV surveys)**

### Changes in survey methodology and consistency of LCV survey data sets over time

Here we present a few of the changes in methodology that are likely to influence the consistency of data series over time:

1) *Vehicle age limit*: The discontinuity introduced by the difference in age limit between the 1981 survey and subsequent surveys could not be corrected on the basis of the available information. It therefore hinders comparability between this initial survey and those that followed.

Another change in the age limit for LCVs to be included in the survey occurred in 2010. Having access to the detailed survey database, we could, whenever the need arose, isolate vehicles older than 20 years in the 2010 LCV survey results, in order to avoid any disruption in data series from previous surveys.

2) *Vehicle body type*: Differences in scope could be adjusted as far as small coaches were concerned (which were included until 1986 only). Indeed, the detailed tables published by the manager allowed these categories to be isolated from the current definition of LCVs based on the European regulation's $N_1$ category. However, as far as VASPs were concerned (which were included in the scope of the survey until 1996, excluded afterwards, and accounted for approximately 5% of total LCVs), the detailed tables available did not allow this category to be discriminated in the first 4 surveys. It should therefore be considered that the data sets present a discontinuity in this respect between surveys up to 1996, on the one hand, and surveys from 2000 onwards, on the other hand.
3) *Vehicle weight*: Differences in scope due to different weight limits could be adjusted (for the record, LCVs with an AGW higher than 3.5 tonnes were included in the scope until 2000, but excluded afterwards). Indeed, the detailed tables published by the survey manager made it possible to isolate the heaviest vehicles in the computation of most variables, with new-LCV sales as a notable exception. There might therefore be a slight disruption in this data series between 2000 and 2005.

As a practical result of the foregoing, and for the sake of *consistency of data series over time*, we will thereafter focus our analysis on the last 3 LCV surveys (2000, 2005, and 2010), all the while bearing in mind that some differences in scope remain among these 3 surveys: *i)* due to different vehicle weight limits between 2000, on the one hand, and 2005/2010, on the other hand (which, if not adjusted, could cause discrepancies in estimates up to 0.6% of total LCVs); and *ii)* due to different age thresholds between 2000/2005, on the one hand, and 2010, on the other hand (which, if not adjusted, could also cause discrepancies in estimates in the magnitude of 1.5% of total LCVs).

### 5.2.3 Our approach: Exploring the use of LCVs in corporate fleets through the LCV surveys

**Dynamic analyses based on the 2000, 2005 and 2010 surveys, with a focus on the 2010 survey for more in-depth analyses**

As already mentioned above, because of differences in methodology, we will base our analysis on the results of the last 3 LCV surveys (2000, 2005, and 2010), bearing in mind that the following differences in scope remain: *i)* different vehicle weight limits between 2000 on the one hand, and 2005/2010 on the other hand; *ii)* different age limits between 2000/2005 on the one hand, and 2010 on the other hand.

Consequently, we will first base our exploration of the use of LCVs in corporate fleets on the *dynamic* analysis of the results of these 3 surveys, limiting our scope to LCVs not exceeding 3.5 tonnes in AGW and 20 years in age, for the sake of comparability of results across surveys. Such a dynamic analysis will enable us to highlight the most recent trends in a few key characteristics of the fleet and of its patterns of use in corporate fleets.

We will then select a few salient observations on which more in-depth analyses will be conducted based on the exhaustive data file available for the 2010 LCV survey. Indeed, not only will this file provide detailed snapshots of the fleet at a given point in time (e.g. activity sector in Table 5.8, vehicle body type in Table 5.13), but it will also make it possible to trace the *changes* that occurred in the course of fleet life through the observation of variations among vehicles belonging to different age cohorts.

For the sake of readability, when such changes relate to characteristics that can vary during the life of the vehicle (e.g. user category in Figure 5.2, annual mileage in Figure 5.5), we will present the vehicles' age cohorts in ascending order from left to right, in order to give a more direct representation of how those characteristics are likely to evolve over the life of an individual vehicle (even though that is not exactly what is observed from age cohorts). Conversely, when the changes relate to characteristics that cannot vary during the life of the vehicle (e.g. vehicle body type in Figure 5.3, vehicle energy type in Figure 5.4), we will present the vehicles' age cohorts in descending order from left to right so as to illustrate more explicitly the development in the said characteristics from the macroscopic standpoint of the fleet as a whole.

**Sorting 'professional LCVs' from 'private LCVs' in the LCV surveys**

Whenever relevant, we will suggest a comparative analysis between LCVs used by private households (from now on referred to as 'private LCVs'), on the one hand, and LCVs used in corporate fleets, i.e. by professional users (from now on referred to as 'professional LCVs'), on the other hand.

Additionally, when it makes sense both from a statistical point of view and from a substantive point of view, we will discriminate among the various subcategories of professional users to highlight significant differences in the fleet characteristics or use patterns. We will include in the category of 'professional LCVs' all LCVs with users registered as either companies, public administrations, or non-profit organisations and associations. As mentioned above, the latter two subcategories have been consistently listed over the last 3 LCV surveys and can therefore be compared at once across the 3 surveys. On the contrary, the subcategory relating to 'companies' was created by consolidating a variety of legal statuses (private and public, sole proprietorship and collective proprietorship, self-employment, etc.), which provided a homogeneous perimeter across all surveys.

# 5.3 Are LCVs an all-professional matter?

Based on the results of the LCV surveys, this section will investigate the extent to which the LCV fleet is shaped by corporate activities (as opposed to private household needs), analysing *i)* the key features of the professional and non-professional users of LCVs and their development over time, and *ii)* the players on the new-LCV market and the process of fleet renewal.

## 5.3.1 Some facts and figures about the professional and non-professional users of LCVs

**Professional users prevail, with a rather stable share in total LCVs in use**

Table 5.7 presents the distribution across user categories of the LCV fleet of vehicles aged 20 years or less. In the light of previous remarks on the 'working tool' status that LCVs have enjoyed in France and elsewhere, it comes as no surprise that users of LCVs are, and have always been, *predominantly professional*. Indeed, professional users represented 63% of LCV users in 2010,[5] leaving private households with a 37% share.

This distribution of LCVs among private and professional users remained quite stable between 2000 and 2010. After recording a 2.4% average annual growth rate (AAGR) from 2000 to 2005, the private fleet of LCVs aged 20 years or less decreased (-1.1% AAGR) from 2005 to 2010. The professional LCV fleet however displayed rather weak growth from 2000 to 2005 (+0.7% AAGR), but maintained a modest upward trend (+0.3% AAGR) from 2005 to 2010.

Looking at privately used LCVs, even though it cannot be demonstrated from the available data that the possession of LCVs by private households has peaked yet, the observation that the fleet of LCVs aged 20 years or less contracted between 2005 and 2010 might be predictive of a peak.

Looking now at the professional fleet in more detail, we observe that, considering their limited share in total LCVs, public administrations retained a relatively stable share of the total LCV fleet from 2000 to 2010, at around 4% (+/-0.25%). So did non-profit organisations and associations, with a share slightly above 1% (+0.05% to +0.25%). From observation of the last 3 LCV

[5] In Chapter 3, we claimed that, on the basis of the results of the 2010 LCV survey, professional users accounted for 59% of *all* LCV users. Here, for the sake of comparability with previous LCV surveys, we present data for the LCVs *aged 20 years or less*.

surveys, it appears that the professional fleet of LCVs aged 20 years or less behaves as a mature market, with steady, but very limited growth.

| User category | LCVs in use (1) aged 20 years or less (000 units - *as a % of total*) | | | | | |
|---|---|---|---|---|---|---|
| | 2000 | | 2005 | | 2010 | |
| **Private households** | **1,729** | ***36%*** | **1,943** | ***38%*** | **1,835** | ***37%*** |
| **Professional users** | **3,019** | ***64%*** | **3,142** | ***62%*** | **3,177** | ***63%*** |
| Companies (2) | 2,780 | *59%* | 2,877 | *57%* | 2,912 | *58%* |
| Public administrations | 180 | *4%* | 192 | *4%* | 213 | *4%* |
| Non-profit org. and assoc. | 59 | *1%* | 63 | *1%* | 52 | *1%* |

*LCV: Light Commercial Vehicle*
*Notes: 1. Excluding vehicles about to be sold, or vehicles for which no questionnaire has been returned. 2. Including private and public, all sizes, self-employed, etc.*

**Table 5.6: Number of LCVs in use by category of user (SOeS, LCV surveys)**

### Professional LCVs are unevenly distributed among activity sectors

Table 5.8 presents the distribution of professional LCVs in 2010, with professional users sorted by activity sector. The activity sectors considered in the 2010 LCV survey are based on the French classification of economic activities, the NAF, revised in 2008 (SOeS, 2012d; INSEE, 2008a). The first level of NAF-2008 consists of 21 sections which have been grouped, for the purposes of the 2010 LCV survey, into 9 main sectors as follows: *i)* agriculture, forestry and fishing (section A in NAF-2008); *ii)* manufacturing, extractive and other industries (sections B, C, D and E in NAF-2008); *iii)* construction (section F in NAF-2008); *iv)* wholesale trade, accommodation and food services (sections G and I in NAF-2008); *v)* transport and storage (section H in NAF-2008); *vi)* scientific and technical, administrative and support services (sections M and N in NAF-2008); *vii)* IT, finance and real estate (sections J, K and L in NAF-2008); *viii)* public administration, education, healthcare and social services (sections O, P and Q in NAF-2008); and *ix)* other services (sections R, S, T and U in NAF-2008). As previous surveys used different classifications for economic activities of professional users, we were unable to compare the distribution of professional LCVs across activity sectors over time.

In 2010, the two activity sectors with the greatest number of LCVs in use were, first, construction (almost 1 in 4 professional LCVs), and second, wholesale trade, accommodation and food services (almost 1 in 6 professional LCVs). The two sectors that came next (using 11% of professional LCVs each) were, on the one hand, scientific and technical, administrative and support services, and on the other hand, manufacturing, extractive and other industries.

At the other end of the scale, it is interesting to note that the transport and storage sector represented a little more than 7% of professional LCVs, only second to last before the IT, finance and real estate sector (4%).

| Activity of the professional user [(1)] | Professional LCVs in use [(2)] in 2010 | |
|---|---|---|
| | Number of vehicles (000 units) | *as a % of total professional LCVs* |
| Agriculture, forestry, fishing | 315 | *9%* |
| Manufacturing, extractive, and other industries | 371 | *11%* |
| **Construction** | **811** | ***24%*** |
| **Wholesale trade, accommod-ation and food services** | **579** | ***17%*** |
| Transport and storage | 236 | *7%* |
| Scientific and technical, administ-rative and support services | 376 | *11%* |
| IT, finance and real estate | 140 | *4%* |
| Public administration, education, health and social services | 182 | *5%* |
| Other services | 313 | *9%* |
| **All activities** | **3,322** | ***100%*** |

*LCV: Light Commercial Vehicle*
*Note: 1. Including companies (private and public, all sizes, self-employed, etc.), public administrations, and non-profit organisations and associations. 2. Excluding vehicles about to be sold, or vehicles for which no questionnaire has been returned.*

**Table 5.7: Distribution of professional LCVs across activity sectors (SOeS, 2010 LCV survey)**

To put these observations in perspective, we further analysed the use of LCVs by professional users from different activity sectors using a different indicator: the *fleet-to-workforce ratio* (see Chapter 3 for an introductory definition of this ratio). Using INSEE's data on wage employment and self-employment by activity sector, we were able to compute the fleet-to-workforce ratios of the 9 activity sectors detailed above.

As illustrated in Table 5.9, two sectors stood out as having particularly high demand for LCVs, namely: agriculture and construction. Both these sectors had LCV fleet-to-workforce ratios close to 5 vehicles per 10,000 jobs, which was 4 times the average ratio across activity sectors.

Although the sector of 'other services' came next with 2.1 LCVs per 10,000 jobs, it should be noted that this particular statistic is difficult to interpret because 75% of LCVs listed in this sector were associated both with the 'neutral' activity code for private households (9500Z) and with the legal situation of a professional entity (company, public administration, or else non-profit organisation or association). Whether the data relating to these vehicles should be reprocessed as pertaining to privately-used LCVs needs further analysis, and we chose not to proceed on the grounds of a lack of evidence that would permit a well-argued decision.

To complement and amend the previous observations on the transport and storage sector, we can observe that this sector has rather strong demand for LCVs in relation to its workforce, with 1.6 LCVs in use for 10.000 jobs in 2010.

| Activity of the professional user (1) | Workforce (2) in 2010 ($10^6$ jobs) | LCV fleet-to-workforce ratio in 2010 (LCVs in use (3) for 10.000 jobs) |
|---|---|---|
| **Agriculture, forestry, fishing** | **666** | **4.7** |
| Manufacturing, extractive, and other industries | 3,436 | 1.1 |
| **Construction** | **1,759** | **4.6** |
| Wholesale trade, accomod-ation and food services | 4,437 | 1.3 |
| Transport and storage | 1,516 | 1.6 |
| Scientific and technical, administ-rative and support services | 3,236 | 1.2 |
| IT, finance and real estate | 1,960 | 0.7 |
| Public administration, education, health and social services | 8,241 | 0.2 |
| Other services | 1,522 | 2.1 |
| **All activities** | **26,774** | **1.2** |

*LCV: Light Commercial Vehicle*
*Notes: 1. Including companies (private and public, all sizes, self-employed, etc.), public administrations, and non-profit organisations and associations. 2. Including metropolitan France and French overseas departments, including wage employment as well as self-employment: the 1.2 million jobs labelled as self-employment in the non-trade tertiary sector have been distributed among 5 sectors (wholesale trade, accomodation and food services; transport and storage; scientific and technical, administrative and support services; IT, finance and real estate; other services) in proportion to their respective wage employment; the 0.4 million jobs labelled as self-employment in the non-trade tertiary sector have been allocated fully to the public administration, education, healthcare and social services sector (INSEE, 2008b, p.11).*
*3. Excluding vehicles about to be sold, or vehicles for which no questionnaire has been returned.*

**Table 5.8: LCV fleet-to-workforce ratios by activity sector (INSEE, 2011b; SOeS, 2010 LCV survey)**

## 5.3.2 Insights into the LCV market and the renewal of the fleet

### A mature market?

Table 5.6 presents the acquisitions of new LCVs by private and professional users, and their share in the total fleet used by each user category. New-LCV sales to professional and private users increased by an average annual growth rate of 0.1% from 2000 to 2005, then 0.4% from 2005 to 2010. Therefore, their share in the total LCV fleet aged 20 years or less decreased from 8.3% in 2000 to 7.2% in 2010. Such observations might attest to a market that is reaching maturity. Yet, the question remains whether the new-LCV sales market will pick up again after fully recovering from the 2008 economic and financial crisis.

### An all-professional market for *new*-LCV sales

Professional users consistently accounted for more than 95% of all new-LCV sales between 2000 and 2010 (and companies at least 92%). This means that less than 5% of new LCVs are acquired by private households, thus implying that a vast majority of private users of LCVs purchase their vehicles on the second-hand market. Based on these observations, we expect that all changes in the main features of the LCV fleet (introduction of new vehicle body types, new drivetrains, etc.) will occur *through* the corporate LCV fleet.

The share of new LCVs in the total LCV fleet of professional users remained stable at around 12%-13% between 2000 and 2010. At this rate, assuming all vehicles were renewed on a regular basis, it would take a little over *8 years* to renew the entire LCV fleet of professional users.

| User category | New LCV sales (000 units - *as a % of total vehicles in use by the user category* [(1)]) | | | | | |
|---|---|---|---|---|---|---|
| | 2000 | | 2005 | | 2010 | |
| **Private households** | **18** | ***1%*** | **18** | ***1%*** | **20** | ***1%*** |
| **Professional users** | **377** | ***13%*** | **379** | ***12%*** | **382** | ***12%*** |
| Companies [(2)] | 364 | *13%* | 364 | *13%* | 369 | *12%* |
| Public administrations | 8 | *5%* | 10 | *5%* | 9 | *4%* |
| Non-profit org. and assoc. | 5 | *8%* | 5 | *8%* | 5 | *8%* |

*LCV: Light Commercial Vehicle*

*Notes: 1. Excluding vehicles about to be sold, or vehicles for which no questionnaire has been returned. 2. Including private and public, all sizes, self-employed, etc.*

**Table 5.9: New-LCV sales and fleet renewal rates for different user categories (SOeS, LCV surveys)**

# 5.4 Key findings on LCV features and use patterns in corporate fleets

By mainly (though not exclusively) focusing on *professional* LCVs, this section will provide new insights, based on the LCV surveys, into: *i)* the main features of the professional LCV fleet, and *iii)* the patterns of use of the vehicles.

## 5.4.1 Focus on a few features of professional LCVs and their development in time

### LCVs are tending to shift towards heavier categories, with professional LCVs in the lead

Table 5.10 illustrates the developments in the distribution of the LCV fleet across AGW categories, from 2000 to 2010. LCVs under 1.5 tonnes in AGW were progressively phased out of the fleet in use, first by professional users (there were 14.9% fewer vehicles in this category in 2005 compared with 2000, then 4.4% fewer in 2010 compared with 2005), and then by private households (-3.5% between 2000 and 2005, -3.4% between 2005 and 2010).

Meanwhile, all other AGW categories expanded, for both private and professional users. However, as far as professional users were concerned, the 1.5-2.5 tonnes category recorded a flat trend from 2005 to 2010 (+0.2%) after a 6.6% increase between 2000 and 2005. As this category still represented one in two LCVs used by professional entities in 2010, this trend cannot quite be interpreted as an early sign of a phasing out of that other light category. It does, however, corroborate the perspective of a progressive shift of professional LCVs towards heavier vehicles. Indeed, while vehicles in excess of 2.5 tonnes amounted to 30.5% of the professional LCV fleet in 2000, their share rose to 41.9% in 2010.

It would seem that the LCV fleet of private households is experiencing a similar shift towards heavier vehicles, albeit with a certain timelag on professional LCVs. Vehicles in excess of 2.5 tonnes, which were just 14.5% of the fleet in 2000, had already risen to 23.5% by 2010.

| User category | Distribution of LCVs in use (1) aged 20 years or less across AGW categories | | |
|---|---|---|---|
| | 2000 | 2005 | 2010 |
| Private households | | | |
| *< 1.5 t.* | *55.0%* | *41.0%* | *29.5%* |
| *1.5-2.5 t.* | *30.5%* | *41.2%* | *47.0%* |
| *2.6-3.4 t.* | *9.3%* | *12.3%* | *17.4%* |
| *3.5 t.* | *5.1%* | *5.6%* | *6.1%* |
| Professional users (2) | | | |
| *< 1.5 t.* | *31.6%* | *13.6%* | *10.2%* |
| *1.5-2.5 t.* | *37.9%* | *50.3%* | *47.9%* |
| *2.6-3.4 t.* | *15.5%* | *19.6%* | *24.4%* |
| *3.5 t.* | *14.9%* | *16.3%* | *17.5%* |

*LCV: Light Commercial Vehicle; AGW: Authorised Gross Weight*
*Note: 1. Excluding vehicles about to be sold, or vehicles for which no questionnaire has been returned. 2. Including companies (private and public, all sizes, self-employed, etc.), public administrations, and non-profit organisations and associations.*

**Table 5.10: Distribution of LCVs across AGW categories for different user categories (SOeS, LCV surveys)**

### Professional LCVs are almost half the age of private LCVs, and continue to modernise

As evidenced in Table 5.11, professional LCVs were already 1.6 times younger than their private counterparts in 2000. Since they continued to modernise at a faster pace, the age gap increased to 1.8, both in 2005 and in 2010 (considering only vehicles aged 20 years or less in 2010, for the sake of comparability with results from previous surveys).

Indeed, the age of professional LCVs consistently decreased over the decade, losing 0.09 year (or 1.1 month) on average with each passing year. The age of private household LCVs on the other hand was more fluctuating, gaining 1.7 month per year on average between 2000 and 2005, but then losing 2.6 months on average per year between 2005 and 2010.

| User category | Average age of LCVs in use [1] aged 20 years or less | | |
|---|---|---|---|
| | 2000 | 2005 | 2010 |
| **Private households** | **11.1** | **11.8** | **10.7** |
| **Professional users** | **6.8** | **6.4** | **5.9** |
| Companies [2] | 6.7 | 6.3 | 5.8 |
| Public administrations | 8.4 | 7.5 | 6.9 |
| Non-profit org. and assoc. | 8.2 | 7.8 | 7.3 |

*LCV: Light Commercial Vehicle*
*Notes: 1. Excluding vehicles about to be sold, or vehicles for which no questionnaire has been returned. 2. Including private and public, all sizes, self-employed, etc.*

**Table 5.11: Average age of LCVs by user category (SOeS, LCV surveys)**

When considering all LCVs without any age limit, we observe in 2010 an even wider gap between professional LCVs (6.6-year old on average) and private LCVs (13.1-year old on average), suggesting that professional users tend to dispose of their older vehicles whereas private households would seem to use them until they wear out. Figure 5.1 gives a more detailed view of the age distribution of LCVs in 2010, whether professional or private.

As far as professional LCVs are concerned, we observe that the newest vehicles were over-represented in the professional fleet: 46% of all professional LCVs were 4 years old or less in 2010, whereas only 10% were 15 years old or more. We further observe a disruption in the age distribution above 4 years: each of the 4 newest cohorts amounted to at least 9% (up to 13%) of the total fleet, whereas older cohorts amounted to 6% or less. This disruption corresponds to a point when a significant proportion of professional users would sell their vehicles to other, non-professional users. As a matter of fact, under Article R323-22 of the French Highway Code,[6] LCVs are subject to a first mandatory technical roadworthiness inspection four years after their entry into service, and then every two years afterwards.[7] The technical inspection is also mandatory

[6] Available from: http://legifrance.gouv.fr/affichCode.do?idSectionTA=LEGISCTA000006177155&cidTexte=LEGITEXT000006074228&dateTexte=20140615

[7] The technical roadworthiness inspection has been mandatory since 1992 for commercial vehicles with an AGW up to 3.5 tonnes, pursuant to Decree No. 91-369 (15 April 1991) amending certain provisions of the French Highway Code. Available from: http://legifrance.gouv.fr/jopdf/common/jo_pdf.jsp?numJO=0&dateJO=19910417&pageDebut=05055

with each transfer of ownership. In addition, LCVs are required to have an *annual* technical check on their emissions of local pollutants, starting four years after their initial registration.[8] So the significant size difference between the 4-year old and the 5-year old professional LCV cohorts (respectively 299,000 vehicles and 192,000 vehicles) may be a result of professional users optimising the costs of technical inspections (overall costs of the productivity loss due to vehicle downtime during the inspection, the maintenance and repair operations required to pass the inspection, as well as inspection fees themselves) over the period of possession of the vehicle. The 4-year threshold would furthermore correspond to the shortest depreciation period authorised by French tax laws, thus maximising the tax-deductible depreciation of vehicle assets in professional LCV fleets (see Chapter 3).

The age distribution of private household LCVs in 2010 was very different from that just described for professional LCVs. Indeed, it appears that private households used very few LCVs under 3 years of age (less than 4% of the total). 49% of all vehicles were between 7 and 15 years old in 2010. Unlike professional users, private households would appear not to dispose of older vehicles: 37% of the LCVs they used in 2010 were 15 years old or more.

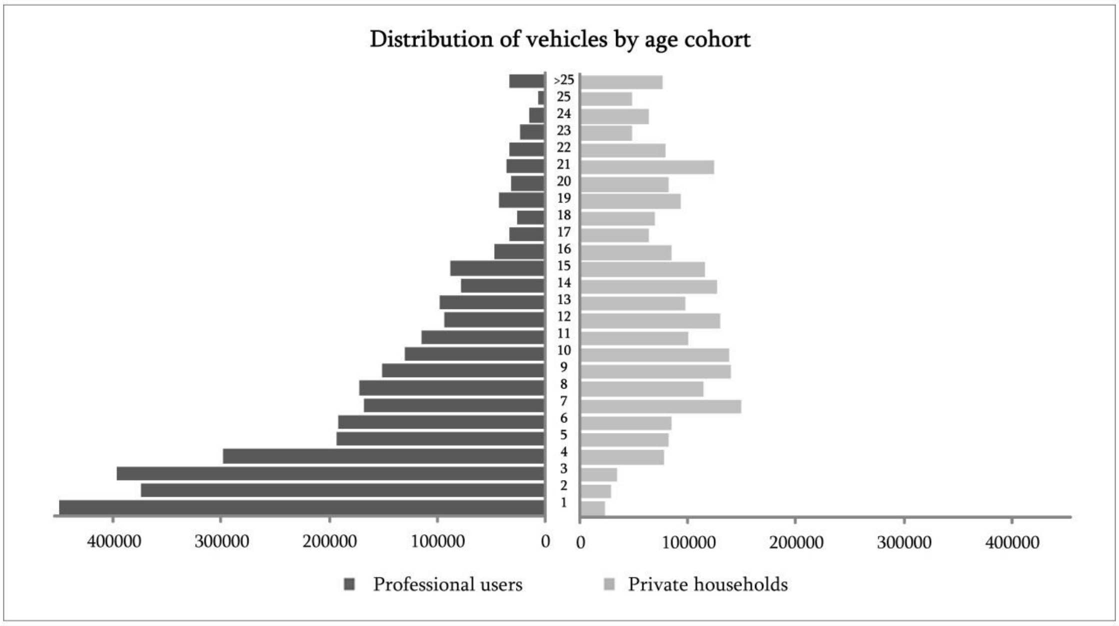
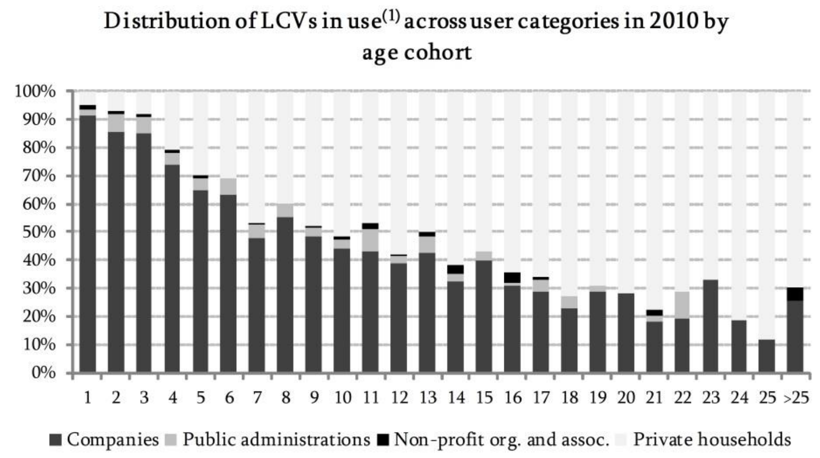



**Figure 5.1: Detailed distribution of LCVs by age cohort for different user categories (SOeS, 2010 LCV survey)**

[8] The annual technical check-up of emissions of local pollutants for light commercial vehicles has been mandatory since January 2000.

Figure 5.2 offers another illustration of how professional users are almost exclusive users of the most recent LCVs, and how they progressively lose their dominant position in the LCV fleet as private households increase their share among older vehicles. While this is not a strictly linear process, we can note for the record that the first age cohort for which private households recorded a higher share than professional users in 2010 was the 10-year old cohort.




*Note: 1. Excluding vehicles about to be sold, or vehicles for which no questionnaire has been returned.*

**Figure 5.2: Distribution of LCVs across user categories by age cohort (SOeS, 2010 LCV survey)**

**Professional LCVs have led other changes in the LCV fleet, as illustrated by the rising shares of passenger-car derivatives and diesel-powered LCVs**

Just as professional LCVs have played the lead role in increasing vehicle weight or modernising the fleet, they also appear to lead other changes relating to vehicle features. In particular, they contributed to setting the following two trends in the LCV fleet: *i)* the taking up of passenger-car derivatives as an alternative to ordinary vans, and *ii)* the almost complete phasing out of all engine types other than diesel. In section 5.4, we will further analyse the role of tax schemes in creating these two specific trends in the professional LCV fleet. In this section, we will limit the analysis to broad considerations on the magnitude of the changes observed and on the specific situation of professional LCVs as compared with their private counterparts.

Available cross-tabulations from the 2000 and 2005 LCV surveys did not allow us to discriminate between professional and private users when analysing the mix of vehicle body types in the LCV fleet. Thus, Table 5.12 presents the overall development in the mix of vehicle body types, regardless of user categories. We observe a twofold increase in the share of passenger-car derivatives between 2000 and 2010, from 12% to 23% of total LCVs, at the expense of ordinary vans, the share of which declined from 80% to 67% over the same period.

The proportion of 'other' vehicle body types also rose, although to a lesser extent compared with passenger-car derivatives: it went up from 8% in 2000 to 10% in 2010. This could indicate increasing specialisation in the LCV fleet. Most current vehicle body types – but also most rapidly increasing – in this 'other' category, are tipper lorries (the rear platform of which can be raised at the front end to enable the load to be discharged by gravity) and flatbed lorries (with a flat platform for their body).

| Vehicle body type | Total LCVs [(1)] aged 20 years or less by vehicle body type (000 units - *as a % of total*) | | | | | |
|---|---|---|---|---|---|---|
| | 2000 | | 2005 | | 2010 | |
| Ordinary vans | 3,983 | *80%* | 4,026 | *73%* | 3,470 | *67%* |
| Passenger-car derivatives | 602 | *12%* | 994 | *18%* | 1,180 | *23%* |
| Other body types [(2)] | 400 | *8%* | 479 | *9%* | 602 | *10%* |
| **All body types** | **4,985** | ***100%*** | **5,499** | ***100%*** | **5,785** | ***100%*** |

*LCV: Light Commercial Vehicle*
*Notes: 1. Including all LCVs, in use and others. 2. Including tipper lorries, flatbed lorries, tanker lorries, livestock lorries, etc. with an AGW under 3.5 tonnes.*

**Table 5.12: Distribution of total LCVs by vehicle body type (SOeS, LCV surveys)**

Figure 5.3 and Table 5.13 permit closer observation of the mix of vehicle body types for LCVs in use in 2010. The first observation is that passenger-car derivatives have not always been part of the LCV fleet: the oldest vehicles with this body type were less than 20 years old in 2010. Their rising share in total LCVs over the years may be the result of a progressive shift away from ordinary vans. Intuitively, this would be consistent with the possible uses of these generic vehicle body types, as well as with the size and weight ranges they come in.

In addition, since the main rationale behind the existence of passenger-car derivatives is tax incentives targeting *professional* users, it is logical to assume that their original introduction into the LCV fleet was originally attributable to professional uses. And indeed, we observe for 2010 that professional users were well ahead of private households in the adoption of passenger-car derivatives: 23% of their fleet had by then switched from ordinary vans to passenger-car derivatives, as compared with just 17% of private households.

The larger proportion of 'other' vehicle body types among professional LCVs (12% as compared with 8% for private households) should come as no surprise. Indeed, these vehicles (including tipper lorries, flatbed lorries, tanker lorries, livestock lorries, etc.) are generally designed to meet professional rather than private needs. They seem to be particularly popular with public administrations as well as non-profit organisations and associations (respectively, 21% and17% of LCVs used by these categories in 2010).

Looking separately at each category of vehicle body type separately, we observe that ordinary vans in 2010 were quite evenly distributed between professional users and private households (56%/44%). However, there was a two-to-one ratio of passenger-car derivatives used by professional users, as compared with those used by private households (66%/34%). And the same ratio held for the 'other' vehicle body type category (67%/33%).

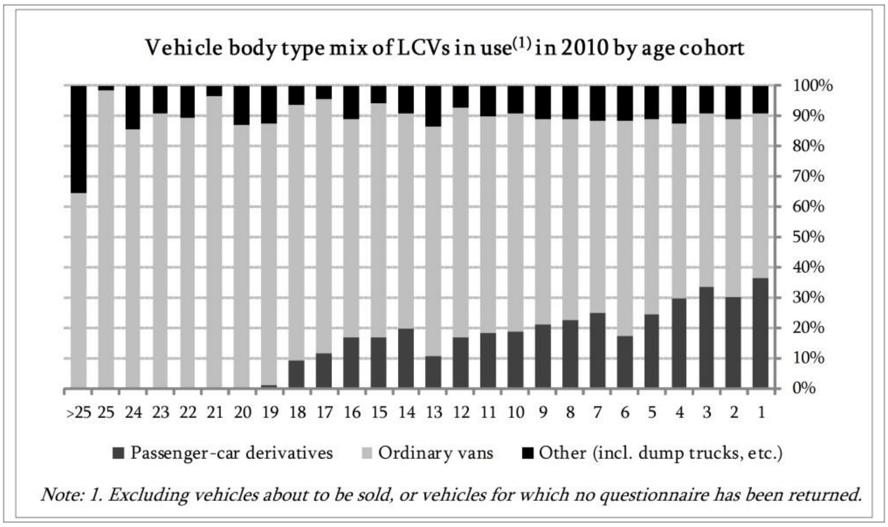



**Figure 5.3: Passenger-car derivatives and ordinary vans among LCVs by age cohort (SOeS, 2010 LCV survey)**

| User category | LCVs in use (1) by body type in 2010 (000 units - *as a % of total LCVs used by the user category*) | | | | | |
|---|---|---|---|---|---|---|
| | Ordinary vans | | Passenger-car derivatives | | Other (2) | |
| **Private households** | **1,701** | ***75%*** | **383** | ***17%*** | **192** | ***8%*** |
| **Professional users** | **2,176** | ***66%*** | **750** | ***23%*** | **396** | ***12%*** |
| Companies (3) | 1,988 | *65%* | 711 | *23%* | 337 | *11%* |
| Public administrations | 154 | *68%* | 25 | *11%* | 48 | *21%* |
| Non-profit org. and assoc. | 35 | *58%* | 15 | *25%* | 10 | *17%* |
| **All user categories** | **3,877** | ***69%*** | **1,133** | ***20%*** | **588** | ***10%*** |

*LCV: Light Commercial Vehicle*
*Notes: 1. Excluding vehicles about to be sold, or vehicles for which no questionnaire has been returned. 2. Including tipper lorries, flatbed lorries, tanker lorries, livestock lorries, etc. with an AGW under 3.5 tonnes. 3. Including private and public, all sizes, self-employed, etc.*

**Table 5.13: Detailed distributions of LCVs by vehicle body type for different user categories (SOeS, 2010 LCV survey)**

Another notable trend in the French LCV fleet over recent decades has been the continuous rise in the proportion of diesel-powered vehicles (incidentally, not unlike what can be observed in the passenger-car fleet).

Looking back at the last 3 LCV surveys, we note a robust increase in the proportion of professional LCVs that were diesel-powered, from an already high level of 85% in 2000 up to an even higher level of 95% in 2010 (the scope is here limited to vehicles aged 20 years or less for the sake of comparability across surveys). Among professional users, companies seem to play the leading role: their LCV fleet was 96% diesel-powered in 2010.

Private household LCVs seem to follow the same trend as their professional precursors: 91% were diesel-powered in 2010, already close to the proportion of diesel-powered vehicles among professional LCVs just 5 years earlier.

Public administrations have not yet shifted to diesel to the same extent as companies or private households. However, they might rapidly bridge the gap: only 59% of their LCVs were diesel-powered in 2000, but this ratio had risen to 78% by 2010, which was close to the proportion of diesel-powered vehicles among private household LCVs just 5 years earlier.

| User category | Diesel-powered LCVs in use (1) aged 20 years or less (000 units - *as a % of total LCVs in use by the user category*) | | | | | |
|---|---|---|---|---|---|---|
| | 2000 | | 2005 | | 2010 | |
| **Private households** | 1,139 | *69%* | 1,576 | *81%* | 1,674 | *91%* |
| **Professional users** | **2,536** | ***85%*** | **2,916** | ***93%*** | **3,024** | ***95%*** |
| Companies (2) | 2,389 | *86%* | 2,725 | *94%* | 2,808 | *96%* |
| Public administrations | 105 | *59%* | 139 | *72%* | 167 | *78%* |
| Non-profit org. and assoc. | 59 | *71%* | 52 | *83%* | 49 | *95%* |
| **All user categories** | **3,675** | ***79%*** | **4,493** | ***88%*** | **4,699** | ***94%*** |

*LCV: Light Commercial Vehicle*
*Notes: 1. Excluding vehicles about to be sold, or vehicles for which no questionnaire has been returned. 2. Including private and public, all sizes, self-employed, etc.*

**Table 5.14: Diesel-powered LCVs for different user categories (SOeS, LCV surveys)**

A more detailed analysis of the energy mix of LCVs by age cohort in the 2010 LCV survey allows us to trace the gradual phasing out of petrol-powered LCVs (see Figure 5.4). Amongst vehicles 25 years old or more in 2010, 50% still had petrol engines, but this proportion rapidly drops to approximately 10% among vehicles fifteen years old or less, then 5% among vehicles aged 10 or less, then again 3% among vehicles aged 4 or less.

As has already been mentioned, the role of tax schemes in creating such trends in the professional LCV fleet, and consequently in the overall LCV stock in France, will be further examined in Section 5.4.

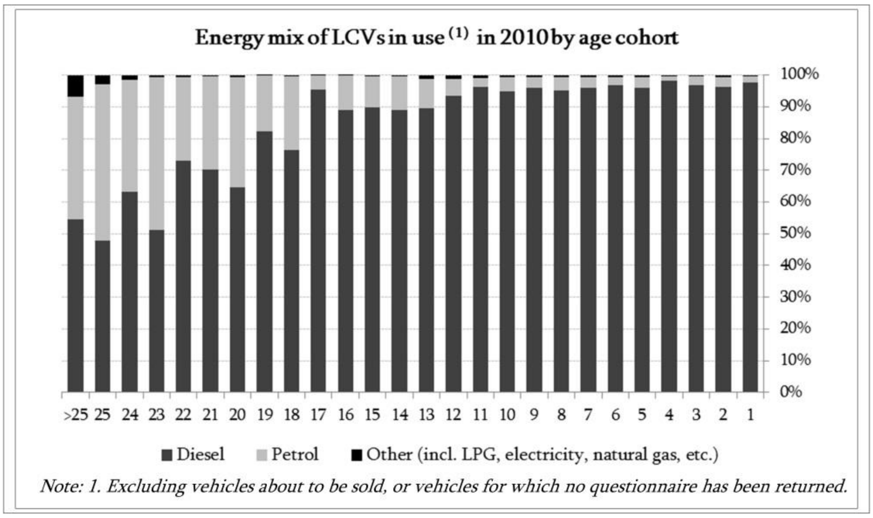



**Figure 5.4: Energy mix of LCVs by age cohort (SOeS, 2010 LCV survey)**

### 5.4.2 Towards more in-depth knowledge of the use patterns of professional LCVs

**Professional LCVs cover on average 80% more distance annually than private LCVs, but their average mileage is on a downward trend**

Table 5.15 displays the differences in average annual mileage of LCVs across user categories. Between 2000 and 2010, the average annual mileage of professional LCVs remained very high though declining from 18,700 km in 2000 to 18,000 km in 2010. Companies have been the most intensive users of LCVs, with annual mileages usually 700 km above the average for professional users. However, they led the decline in the average annual mileage of professional LCVs (-0.4% per year over the period).

On the other hand, public administrations and non-profit organisations and associations tend to make more limited use of their LCVs. Public administrations record the lowest annual mileages per vehicle. Nonetheless, it is interesting to note that they are the only category of users whose average annual vehicle mileage increased (by 17%) over the period, from 8,000 km in 2000 to 9,400 km in 2010 which, combined with the limited growth in the LCV fleet of public administrations (+1.7% per year between 2000 and 2010, as opposed to +5.4% per year in the 1980s and +2.8% per year in the 1990s), may mark the first steps in a process of streamlining the LCV fleet.

Private households recorded fairly stable average annual vehicle mileages, though at levels well below those of company LCVs: between 10,000 km and 10,500 km.

| User category | Average annual mileage (1) of LCVs in use (2) aged 20 or less ('000 km) | | |
|---|---|---|---|
| | 2000 | 2005 | 2010 |
| **Private households** | **10.5** | **10.0** | **10.5** |
| **Professional users** | **18.7** | **18.4** | **18.0** |
| Companies (3) | 19.5 | 19.1 | 18.7 |
| Public administrations | 8.0 | 9.6 | 9.4 |
| Non-profit org. and assoc. | 13.2 | 12.3 | 12.4 |
| **All user categories** | **15.7** | **15.2** | **15.3** |

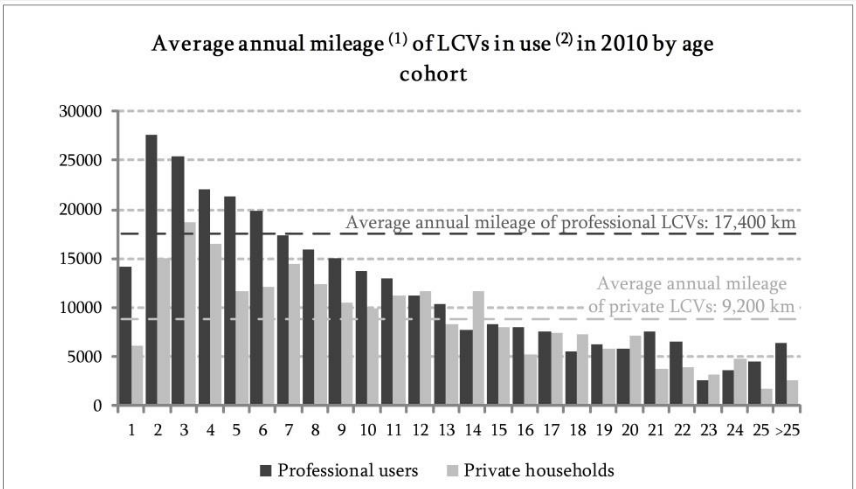
*LCV: Light Commercial Vehicle*
*Notes: 1. Based on declared annual distances (a vehicle purchased on Nov.1 will be associated with the distance driven from Nov.1 to Dec.31). 2. Excluding vehicles about to be sold, or vehicles for which no questionnaire has been returned. 3. Including private and public, all sizes, self-employed, etc.*

**Table 5.15: Average annual mileage of LCVs for different categories of users (SOeS, LCV surveys)**

The 2010 LCV survey allows more in-depth analysis of the use of LCVs in relation to their age. Figure 5.5 illustrates that the differences in annual mileage between professional LCVs on the one hand and private LCVs on the other hand mainly occurs in the first 10 years of vehicle life. Indeed, in the early years of the fleet, private LCVs generally cover 20% to 50% fewer kilometres annually compared with their professional counterparts. This gap however decreases as vehicles go past their tenth year (which is also the threshold above which professional LCVs are left with a minority share in the overall LCV fleet in use, as Figure 5.2 recalls).

It therefore appears that the higher average annual mileages recorded by professional users mainly result from intensive use of the most recent vehicles. Indeed, it is estimated that during the first 5 years of vehicle life, professional users covered 24,700 km per year on average (year 1 was left out of the calculation because of the method of data collection, which gives partial mileage for the first calendar year of possession, as explained in the footnote to Figure 5.5), as compared with 14,900 km for private households (40% less). For vehicles aged over 10 years however, the average annual mileage of professional LCVs was 8,700 km, as compared with 7,100 km for private households, which brings the difference between the two user categories down to 19%.

Focusing on professional LCVs, it appears that the two activity sectors with the most intensive use of *recent* vehicles are: *i)* wholesale trade, accommodation and food services (29,100 km per year on average over the first 5 years), and *ii)* transport and storage (28,200 km per year). Manufacturing, extracting and other industries come third (26,800 km per year). All age cohorts considered, the transport and storage sector has the most intensive use of vehicles, with an average of 23,100 km travelled per year.




*Notes: 1. Based on declared annual distances (a vehicle purchased on Nov.1 will be associated with the distance driven from Nov.1 to Dec.31). 2. Excluding vehicles about to be sold, or vehicles for which no questionnaire has been returned.*

**Figure 5.5: Average annual mileage of LCVs by age cohort for different categories of users (SOeS, 2010 LCV survey)**

Altogether, professional LCVs accounted for 74% (58 billion km) of the total annual mileage (79 billion km) of the LCV fleet in France in 2010 (see Table 5.5).

### LCVs covering less than 100 km per day account for 55% of the total mileage of professional LCVs; those covering more than 150 km per day account for 27%

Figure 5.6 illustrates the cumulative weight, in the total mileage of LCVs in use in 2010, of vehicles ranked by their usual daily mileage.

We observe that LCVs covering less than 20 km per day on a usual day accounted for only 6% of the total mileage of professional LCVs in 2010, and almost four times as much (23%) of the total mileage of private LCVs that same year. Besides, LCVs covering between 20 and 50 km per day on a usual day accounted for 17% of the total mileage of professional LCVs, and twice as much (35%) of the total mileage of private LCVs. Hence, LCVs covering less than 50 km per day accounted for a much higher share of the total mileage of private LCVs compared with that of professional LCVs (58% vs 23%). It is however interesting to note that the distribution of total LCV mileage in public administrations was much closer to that of private households: LCVs covering less than 50km per day accounted for 57% of their total mileage.

Both for professional and for private LCVs, vehicles covering between 50 and 100 km accounted for approximately a quarter of their total mileage: 22% for the former, 26% for the latter.

The category of vehicles covering more than 100 km but less than 150 km per day on a usual day of use is particularly interesting to observe when considering the adoption of innovations such as battery electric vehicles (BEVs). Indeed, the range of BEVs currently on the market generally stands somewhere between these two levels, so this particular category of vehicles could be highly sensitive to range limitations. With this in mind, LCVs covering between 100 and 150 km per day accounted for 18% of the total mileage of professional LCVs in 2010, and 10% of the total mileage of private LCVs.

Finally, we will note that more than a quarter (27%) of the total mileage of professional LCVs (and 6% of the total mileage of private LCVs) was attributable to vehicles covering more than 150 km per day on a usual day of use. These vehicles are likely to remain outside the prospective market for BEVs for the foreseeable future.

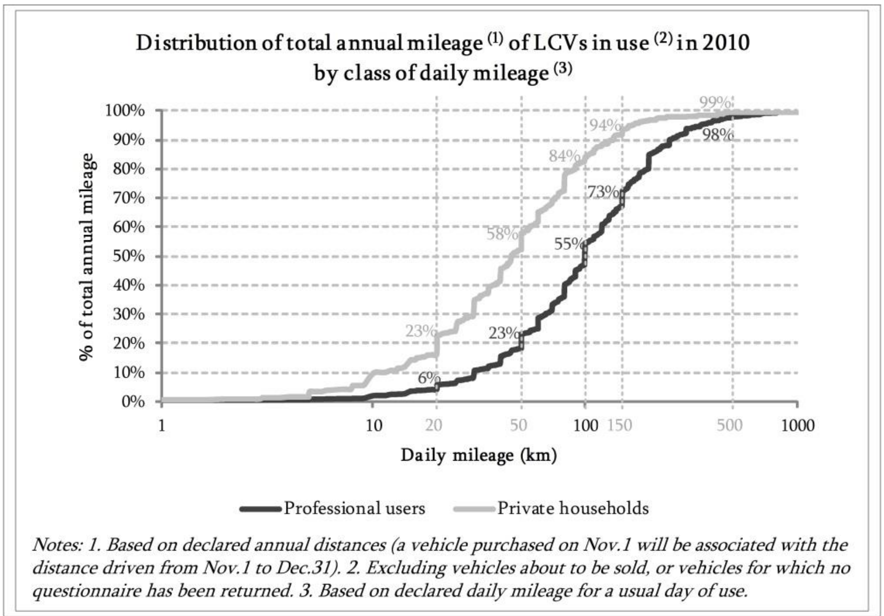



**Figure 5.6: Distribution of total LCV mileage by class of daily mileage for different categories of users (SOeS, 2010 LCV survey)**

### More than one third of the total mileage of professional LCVs occurs in urban areas, and up to 60% for public administrations

As illustrated in Table 5.16, the distribution of professional LCV mileage across the types of area where the journey occurred (urban, road, motorway, closed user site) does not differ much from that of private LCVs. 37% of the mileage of professional LCVs in 2010 occurred in an urban environment, as compared with

41% for private LCVs. However, professional users covered twice as much LCV mileage on motorways as did private households (18% of professional LCV total mileage, as compared with 9% for private LCVs).

Among professional users, public administrations display specific patterns of LCV use across area types: 60% of their LCV mileage in 2010 occurred in an urban environment, and only 4% on motorways. This would seem consistent, on the one hand, with the concentration of public administrations' activities in urban areas, and on the other hand with the low average annual mileage of their vehicles (see Table 5.15).

| User category | Distribution of mileage of LCVs in use (1) in 2010 across types of area *(as a % of total mileage of the user category)* | | |
|---|---|---|---|
| | Urban | Motorway | Other (2) |
| **Private households** | **41%** | **9%** | **50%** |
| **Professional users** | **37%** | **18%** | **45%** |
| Companies (3) | 37% | 19% | 44% |
| Public administrations | 60% | 4% | 36% |
| Non-profit org. and assoc. | 29% | 18% | 53% |
| **All user categories** | **38%** | **16%** | **46%** |

*LCV: Light Commercial Vehicle*

*Notes: 1. Excluding vehicles about to be sold, or vehicles for which no questionnaire has been returned. 2. Including road, closed user site, etc. 3. Including private and public, all sizes, self-employed, etc.*

**Table 5.16: Distribution of LCV annual mileage across area types for different categories of users (SOeS, 2010 LCV survey)**

### The second most important purpose of use of professional LCVs, after the transport of freight or other goods (80% of vehicles), is commuting (22%)

For the sake of our analysis of the purposes of use of professional LCVs, we defined 5 broad categories of purposes based on the 12 refined categories that were available in the 2010 LCV survey. Of these 5 broad categories, 3 are professional purposes, namely: *i)* transport of freight and/or other goods, *ii)* transport of staff and/or other people, and *iii)* other professional purposes; and 2 are personal purposes, namely: *iv)* commuting, and *v)* other personal purposes. For private LCVs, users were asked a different set of questions about the purposes of their use of LCVs, and were presented a different set of purposes as possible answers. We will therefore retain in this analysis the following 2 broad categories of purposes which allow for comparison with professional LCVs: *i)* commuting, and *ii)* other personal purposes (including trips to school/study, shopping, leisure, etc.).

The main *raison d'être* of professional LCVs, as recalled in the introduction of this chapter, is to move goods, be they production tools (e.g. construction equipment) or end products (e.g. parcels or groceries). As evidenced in Table 5.17, this is well reflected in the high proportion of vehicles used for purposes of transporting freight and/or other goods: 80% of all professional LCVs in 2010, and up to 87% for the LCV fleet of public administrations.

Among other professional purposes of use, the transport of staff or other people (e.g. customers) stands out as fairly significant: 15% of all professional LCVs recorded this kind of use in 2010, and up to 20% for LCVs run by public administrations.

Personal purposes of use are even more significant in LCV use by professional users: 22% of all professional LCVs were used for commuting in 2010. Public administrations are the least concerned with this kind of use: only 6% of their LCVs were ever used for commuting. This proportion is much higher for companies, with 23% of their LCV fleet being used for commuting purposes in 2010.

Private users of LCVs were asked a different set of questions about the purposes of their trips. Because of this, the only possible comparison with professional LCVs lies in the proportion of vehicles used for commuting. We observe that 41% of private LCVs were used for that purpose in 2010. This brings together the two issues of professional mobility, on the one hand, and mobility using private LCVs on the other hand, although we will not pursue this analysis any further in the current work.

| User category | Professional purposes of use | | | Personal purposes of use | |
|---|---|---|---|---|---|
| | *as a % of LCVs used [1] by the user category in 2010* | | | | |
| | Transport of freight and other goods [2] | Transport of staff and other people | Other professional purposes | Commute | Other personal purposes |
| **Private households** | - | - | - | ***41%*** | ***92%*** |
| **Professional users** | ***80%*** | ***15%*** | ***11%*** | ***22%*** | ***4%*** |
| Companies [3] | *79%* | *15%* | *11%* | *23%* | *4%* |
| Public administrations | *87%* | *20%* | *11%* | *6%* | *2%* |
| Non-profit org. and assoc. | *75%* | *22%* | *8%* | *12%* | *8%* |

*LCV: Light Commercial Vehicle*

*Notes: 1. Excluding vehicles about to be sold, or vehicles for which no questionnaire has been returned. 2. Transport of freight includes transport on own account and transport for hire or reward; transport of goods includes transport of tools and other work equipment, transport of rubble and other waste, removals, etc. 3. Including private and public, all sizes, self-employed, etc.*

**Table 5.17: Purposes of use of LCVs for different categories of users (SOeS, 2010 LCV survey)**

**Professional LCVs display highly segmented use patterns**

A more thorough analysis of the purposes of use of professional LCVs reveals rather markedly *segmented use patterns*.

First of all, 70% of all professional LCVs in 2010 were *exclusively* used for *one* particular purpose among the 5 five broad categories of purposes we defined for this analysis. Looking at such LCVs with an *exclusive use pattern*, it appears that in 2010 the transport of freight and other goods ranked first, with 53% of all professional LCVs, as compared with 5% for commuting as an exclusive purpose of use, or 3% for transporting staff or other people as an exclusive purpose of use.

The segmentation of the use patterns of professional LCVs still stands when the subcategories of purposes are analysed, for instance by discriminating the transport of freight (whether on own account or for hire) from the transport of goods other than freight (such as tools and other work equipment, rubble and other waste, etc.). Indeed, we observe that 14% of all professional LCVs in 2010 were used with the exclusive purpose of transporting freight, and 38% are used with the exclusive purpose of transporting goods other than freight. Therefore, we can infer that nearly all professional LCVs that were characterised, in a first-order analysis, by an exclusive purpose of transporting freight and goods (for the record, 53% of all professional LCVs), further turned out to be exclusively dedicated *either* to transporting freight *or* transporting other goods.

Returning to the first-order analysis (i.e. the 5 broad categories of purposes), we observe that 23% of all professional LCVs in 2010 combined two different purposes of use. As an illustration of such mixed uses, 12% of all professional LCVs were used both for transporting freight and other goods, and for commuting. Similarly, 8% of all professional LCVs were used for transporting freight and other goods, and also for transporting staff and other people. Only 5% of all professional LCVs were used for 3 different purposes or more.

Focusing on the proportion of professional LCVs which presented mixed use patterns for the year 2010, we observe that commuting was a common additional purpose of use on top of one (or several) professional purpose(s) of use which would more likely be considered the primary purpose(s) of use. Indeed, of the 23% LCVs which mixed 2 different purposes of use, more than half (13%) were used for commuting in addition to either transporting freight and/or other goods or transporting staff and/or other people. Moreover, virtually all of the 5% of LCVs which mixed 3 or more purposes of use included commuting in their use patterns.

These observations on the different types of use patterns for professional LCVs close this section on the main findings from the LCV surveys on the use of LCVs by professional users. The next section focuses on how LCV surveys can help to highlight the role of tax schemes in creating structuring trends in the development of the professional LCV fleet.

## 5.5 Insights into the effects of taxes on the LCV fleet: two case studies

As already mentioned, national tax schemes that apply to corporate car fleets are deemed to play an important part in shaping LCV fleets. According to CCFA (2013), they could underlie the differences among European countries with regard to the diffusion of LCVs in their respective LV markets (close to 16% of new light-vehicle sales in France in 2010, as compared with 6% in Greece or 20% in Norway).

In France, tax conditions are usually further considered to account for the following two trends in the professional LCV market: *i)* the taking up of passenger-car derivatives as an alternative to small ordinary vans; and *ii)* the progressive phasing out of all engine types other than diesel.

This section provides some additional insights into the specific features of passenger-car derivatives on the one hand, and diesel-powered LCVs on the other hand, with a view to highlighting the role of tax schemes in creating the abovementioned trends in the professional LCV market.

### 5.5.1 LCVs derived from passenger cars

As already mentioned in Chapter 3 and developed in the introduction to this chapter, passenger-car derivatives are a particular LCV body type, which results from the conversion of a passenger car body type into a commercial vehicle, and which owes its particular success in France to the significant difference in tax treatment between corporate passenger cars, on the one hand, and corporate light-duty vehicles, on the other hand.[9]

As was illustrated in Table 5.13 and Figure 5.3, passenger-car derivatives have captured increasing shares of the LCV market, starting around 1990 (the oldest of these vehicles were 20 years old in 2010), to reach a 23% share of professional LCVs used in 2010 (0.750 out of 3.322 million vehicles) and a 17% share of private households' LCVs (0.383 out of 2.276 million vehicles).

**Passenger-car derivatives increasingly compete with ordinary vans for the lightest weight categories[10]**

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[9] See Chapter 7 for further information on the tax schemes applicable to light commercial vehicles in corporate car fleets in France.

[10] Data in this paragraph refer to all LCVs, whether in use or otherwise, aged 20 years or less.

Passenger-car derivatives are the direct and exclusive competitors with ordinary vans in the lightest AGW categories (up to 2.5 tonnes). Indeed, small ordinary vans and passenger-car derivatives together represent 97% to 99% of all LCVs under 1.5 tonnes in AGW (equally in 2000, 2005 and 2010), and 96% to 98% of all LCVs between 1.5 and 2.5 tonnes in AGW (equally in 2000, 2005 and 2010). However, while passenger-car derivatives are almost invariably lighter than 2.5 tonnes in AGW (99% of them in 2000, 2005 and 2010), ordinary vans have models in all AGW categories (24% of them were heavier than 2.6 tonnes in 2000, 30% in 2005 and 38% in 2010).

Table 5.18 illustrates how passenger-car derivatives benefited from the progressive shift of ordinary vans towards heavier AGW categories, which has left them representing an increasing share of LCVs under 2.5 tonnes. While the total number of ordinary vans in the AGW category under 1.5 tonnes decreased by 77% between 2000 and 2010 (-1.281 million vehicles), the number of passenger-car derivatives in that category increased by 28% over the same period (+0.087 million vehicles). Furthermore, in the next AGW category (from 1.5 to 2.5 tonnes), passenger-car derivatives grew much more rapidly than ordinary vans over the decade (+167% or 0.481 million vehicles for the former, as compared with +29% or 0.394 million vehicles for the latter).

In 2010, therefore, passenger-car derivatives accounted for 50.8% of the LCV fleet under 1.5 tonnes, and 29.6% of the LCV fleet between 1.5 and 2.5 tonnes. As already mentioned in Section 5.3, professional users have played a leading role in the uptake of passenger-car derivatives in the overall LCV fleet: these vehicles already represented 66% of the professional LCV fleet under 1.5 tonnes in 2010, and 35% of the professional LCV fleet in the next AGW category (as compared with 41% and 21% respectively for the LCV fleet of private households).

| AGW category | Share of passenger-car derivatives in total LCVs aged 20 years or less by AGW category | | |
|---|---|---|---|
| | 2000 | 2005 | 2010 |
| < 1.5 t. | 15.4% | 21.1% | 50.8% |
| 1.5-2.5 t. | 16.6% | 27.3% | 29.6% |
| 2.6-3.4 t. | 0.6% | 1.2% | 1.3% |
| 3.5 t. | 0.0% | 0.0% | 0.0% |
| All AGW categories | 12.1% | 18.1% | 26.1% |

*LCV: Light Commercial Vehicle; AGW: Authorised Gross Weight*

**Table 5.18: Market share of passenger-car derivatives in total LCVs by AGW category (SOeS, LCV surveys)**

### Passenger-car derivatives cover higher mileages than ordinary vans[11]

Table 5.19 illustrates the distributions of annual mileages of ordinary vans on the one hand, and passenger-car derivatives on the other hand, from 2000 to 2010. The lack of detailed data for 2000 and 2005 prevented us from discriminating the small ordinary vans (AGW up to 2.5 tonnes) and heavier vans. We should therefore bear in mind that the following comparisons are not based on homogeneous perimeters in terms of vehicle weight.

Passenger-car derivatives tend to record much higher mileages than ordinary vans. Indeed, while low-mileage categories (10,000 km annually and lower) represented more than 41% of ordinary vans in 2000, they were only 18% of passenger-car derivatives. At the opposite end of the mileage scale, the highest-mileage category (over 25,000 km) represented only 18% of ordinary vans in 2000, as compared with more than 42% as far as passenger-car derivatives were concerned. Interestingly, the intermediate mileage categories (from 10,000 km to 25,000 km) represented around 40% of both ordinary vans and passenger-car derivatives in 2000.

Both vehicle body types saw an overall shift towards lower annual mileages between 2000 and 2010, which was particularly significant for passenger-car derivatives. Indeed, low-mileage categories were up by 7 points for ordinary vans in 2010 compared to 2000, and they were up by 19 points for passenger-car derivatives over the same period. Symmetrically, but to a lesser extent, the highest-mileage category was down by 2 points for ordinary vans and by 16 points for passenger-car derivatives in 2010 compared to 2000. This development could be the result of a combination of the following two underlying trends: *i)* an overall downwards shift in average annual LCV mileages (see Table 5.15), and *ii)* an extension of the competition between passenger-car derivatives and ordinary vans beyond the initially predominant high-mileage categories, down to the lower-mileage categories, as the former captured more and more shares of the LCV market under 2.5 tonnes in AGW (see Tables 5.18 and 5.19).

[11] Unless otherwise specified, data in this section refer to LCVs in use only.

| Distribution of LCVs in use (1) aged 20 years or less across annual mileage categories (2) | 2000 | | 2005 | | 2010 | |
|---|---|---|---|---|---|---|
| | Ordinary vans | Pass.-car derivatives | Ordinary vans | Pass.-car derivatives | Ordinary vans | Pass.-car derivatives |
| *< 5 000 km* | *19.9%* | *7.7%* | *22.8%* | *8.9%* | *23.4%* | *16.4%* |
| *5 000 - 10 000 km* | *21.4%* | *10.2%* | *23.5%* | *12.9%* | *24.4%* | *20.6%* |
| *10 000 - 15 000 km* | *18.7%* | *14.5%* | *18.9%* | *17.8%* | *13.8%* | *13.1%* |
| *15 000 - 20 000 km* | *12.5%* | *14.5%* | *11.0%* | *17.3%* | *12.9%* | *13.1%* |
| *20 000 - 25 000 km* | *9.4%* | *10.5%* | *8.9%* | *13.5%* | *9.2%* | *9.7%* |
| *≥ 25 000 km* | *18.1%* | ***42.6%*** | *14.9%* | ***29.6%*** | *16.3%* | ***27.0%*** |

*LCV: Light Commercial Vehicle*
*Notes: 1. Excluding vehicles about to be sold, or vehicles for which no questionnaire has been returned. 2. Based on declared annual distances (a vehicle purchased on Nov.1 will be associated with the distance driven from Nov.1 to Dec.31).*

**Table 5.19: Annual mileage distributions of ordinary vans and passenger-car derivatives (SOeS, LCV surveys)**

Looking deeper into the 2010 LCV survey results, we could use the detailed database files to discriminate the small ordinary vans and the heavier ones. We could therefore compare passenger-car derivatives with ordinary vans in the same ranges of vehicle weight (i.e. with AGWs up to 2.5 tonnes).

As illustrated in Table 5.20, all user categories travelled higher mileages with passenger-car derivatives in 2010 than they did with small ordinary vans. Indeed, average annual mileages were approximately 60% higher for the former vehicle body type than for the latter: 70% higher in the case of private households, and still 40% higher in the case of professional users.

We note that the average annual mileage found in the 2010 LCV survey for *passenger-car derivatives used by private households* (13,800 km) is similar to, though slightly higher than, the average annual mileage for *passenger cars* assessed by national statistics (12,800 km) (see Table 5.1). Since private households represent the vast majority of the total users of passenger cars in France, such close average annual mileages might point to similar use patterns for both these types of vehicles when used by private households.

As far as professional users are concerned, we note particularly intensive use of passenger-car derivatives by companies (the 0.710 million vehicles travelled 20,900 km annually on average in 2010, which was 35% higher than the average mileage of the small ordinary vans used by companies). This would point to differentiated use patterns for passenger-car derivatives on the one hand, and small ordinary vans on the other hand, when used by companies. We note that passenger-car derivatives ranked first in annual mileage among the major vehicle body types used by companies in 2010; they were, in fact, third only to temperature-controlled vans (0.025 million vehicles travelling 26,000 km annually on average) and vehicles with roller shutter side doors (0.004 million vehicles travelling 24,800 km annually on average).

In contrast with companies, public administrations recorded much lower average annual mileage for their passenger-car derivatives (the 0.024 million vehicles travelled 9,900 km annually on average in 2010, which was 19% higher than the average mileage of their small ordinary vans). Passenger-car derivatives ranked second, in annual mileage, among the major vehicle body types used by public administrations: dumper trucks (0.024 million vehicles used by public administrations) ranked first with a little over 10,000 km annually on average.

| User category | Average annual mileage (1) of LCVs in use (2) in 2010 | |
|---|---|---|
| | Small ordinary vans (3) | Passenger-car derivatives |
| **Private households** | **8.1** | **13.8** |
| **Professional users** | **14.8** | **20.5** |
| Companies (4) | 15.5 | 20.9 |
| Public administrations | 8.4 | 9.9 |
| Non-profit org. and assoc. | 8.0 | 16.2 |
| **All user categories** | **11.3** | **18.2** |

*LCV: Light Commercial Vehicle*
*Notes: 1. Based on declared annual distances (a vehicle purchased on Nov.1 will be associated with the distance driven from Nov.1 to Dec.31). 2. Excluding vehicles about to be sold, or vehicles for which no questionnaire has been returned. 3. Excluding vehicles with an AGW of 2.6 tonnes or more. 4. Including private and public, all sizes, self-employed, etc.*

**Table 5.20: Average annual mileage of small ordinary vans and passenger-car derivatives for different user categories (SOeS, 2010 LCV survey)**

### Passenger-car derivatives are more recent than ordinary vans

Since passenger-car derivatives were introduced into the LCV fleet in France around 1990, it makes little sense to compare their average age with that of comparable ordinary vans (with AGWs up to 2.5 tonnes) in 2000 and 2005. However, in 2010, the oldest passenger-car derivatives reached 20 years of age, thus bringing some relevance to the comparison from that stage onwards.

As illustrated in Table 5.21, passenger-car derivatives were on average half the age of small ordinary vans in 2010 (37% more recent for those used by private households; 51% more recent for those used by professional users). The more detailed age distributions presented in Figure 5.7 show that this gap in the average age of small ordinary vans on the one hand, and passenger-car derivatives on the other hand, is partly the result of a late introduction of the latter (after 1990), and partly the result of the accelerated rise in their market share of small professional LCVs over the recent years.

Indeed, as illustrated in Figure 5.7, passenger-car derivatives represented 55% of small professional LCVs (including passenger-car derivatives and ordinary vans with AGWs up to 2.5 tonnes) aged 4 years or less in 2010, whereas they represented 35% of small professional LCVs aged between 5 and 8 years, and 24% of those aged between 9 and 12 years.

| User category | Average age of LVCs in use in 2010 (1) | |
|---|---|---|
| | Small ordinary vans (2) | Passenger-car derivatives |
| **Private households** | **14.3** | **9.0** |
| **Professional users** | **8.1** | **4.0** |
| Companies (3) | 8.0 | 3.9 |
| Public administrations | 8.2 | 4.8 |
| Non-profit org. and assoc. | 15.8 | 5.3 |
| **All user categories** | **11.4** | **5.7** |

*LCV: Light Commercial Vehicle*
*Notes: 1. Excluding vehicles about to be sold, or vehicles for which no questionnaire has been returned. 2. Excluding vehicles with an AGW of 2.6 tonnes or more. 3. Including private and public, all sizes, self-employed, etc.*

**Table 5.21: Average age of small ordinaryvans and passenger-car derivatives for different user categories (SOeS, 2010 LCV survey)**

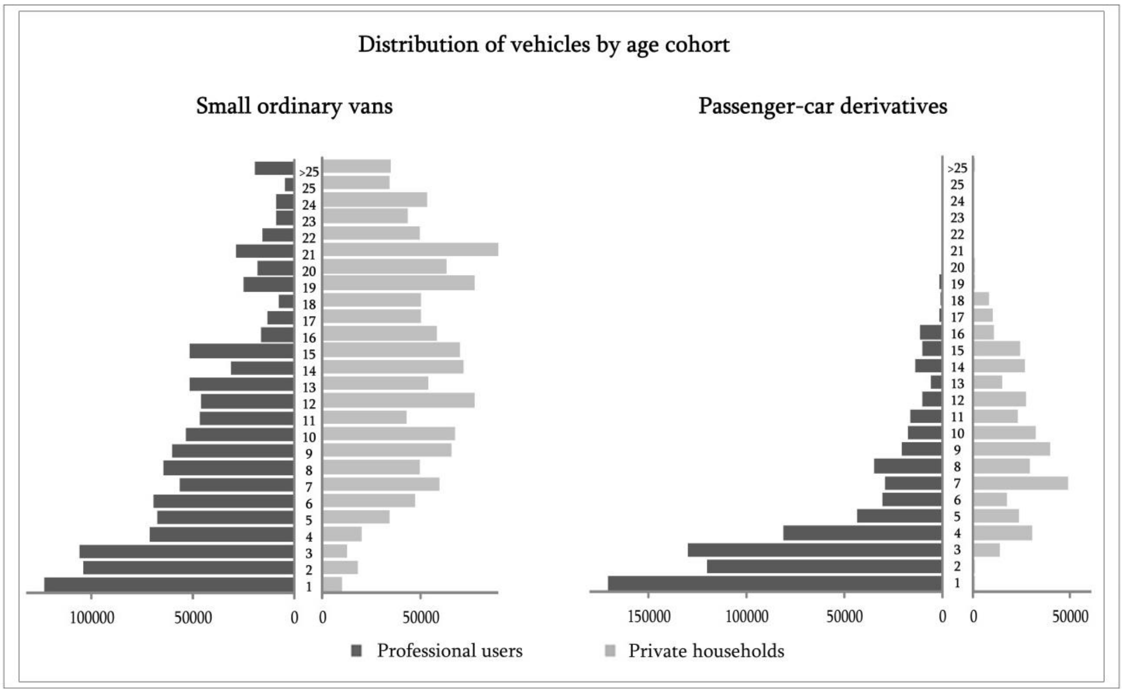


**Figure 5.7: Distribution of small ordinary vans and passenger-car derivatives by age cohort for different user categories (SOeS, 2010 LCV survey)**

### 5.5.2 Diesel-powered LCVs

As was illustrated in Table 5.14 and Figure 5.4, diesel-powered LCVs have captured increasing shares of the LCV market, thus leading to an almost complete phasing out of their most direct competitors, namely the petrol-powered vehicles. They reached a 94% share of total professional LCVs used in 2010 (3.127 out of 3.322 million vehicles) and an 85% share of total private households' LCVs (1.933 out of 2.276 million vehicles). Basically, their share in total LCVs in use was 95% or higher for all cohorts up to 11 years of age in 2010.

As already mentioned, the phasing out of petrol-powered vehicles has been a rather rapid process. Indeed, in 2010, vehicles aged 25 or more still presented a 50% share of petrol engines, but this proportion drops to approximately 10% among vehicles aged 15 or less, then 5% among vehicles aged 10 or less, then again 3% among vehicles aged 4 or less.

**Diesel-powered LCVs are half the age of petrol-powered vehicles**

Table 5.22 illustrates that diesel-powered LCVs were, on average, half the age of petrol-powered LCVs in 2010: 8.5 years for the former, as compared with 17.0 for the latter. This ratio held for professional users (6.3 years on average for diesel-powered vehicles, as compared with 12.9 years for petrol-powered ones) and, although somewhat dampened, for private households (12.0 years, as compared with 19.2 years).

Such an important gap in the average age of diesel-powered vehicles and petrol-powered vehicles could be the direct result of the progressive phasing out of petrol as a fuel for LCVs in France. This would likely have an impact on the average mileage travelled by the two categories of vehicles, for indeed older LCVs tend to travel lower mileages than more recent ones.

| User category | Average age of LVCs in use (1) in 2010 | |
|---|---|---|
| | Petrol-powered vehicles | Diesel-powered vehicles |
| **Private households** | **19.2** | **12.0** |
| **Professional users** | **12.9** | **6.3** |
| Companies (2) | 12.9 | 6.2 |
| Public administrations | 11.6 | 6.7 |
| Non-profit org. and assoc. | 20.3 | 8.4 |
| **All user categories** | **17.0** | **8.5** |

*LCV: Light-commercial Vehicle*
*Notes: 1. Excluding vehicles about to be sold, or vehicles for which no questionnaire has been returned.*
*2. Including private and public, all sizes, self-employed, etc.*

**Table 5.22: Average age of petrol LCVs and diesel LCVs for different categories of users (SOeS, 2010 LCV survey)**

### Diesel engines have conquered the LCV market from the top AGW categories down to the lightest ones

Diesel has long been the preferred fuel for large goods vehicles in France and in many European countries. Although its success on the LCV market is more recent, it had already reached a 79% market share in 2000 and rose to 94% in 2010.

Table 5.23 shows that the dieselisation of the LCV fleet at first mainly affected the heaviest AGW categories. Indeed, in 2000, already 94% of LCVs in excess of 2.5 tonnes were diesel-powered. This proportion yet rose to 98% in 2005, and 99% in 2010. The category of LCVs with AGWs between 1.5 and 2.5 tonnes developed the same kind of dieselisation pattern, with a time lag of just a few years: the share of diesel went from 90% in 2000 up to 95% in 2005, and 96% in 2010. Finally, the lightest category (with AGWs lighter than 1.5 tonnes) is the last one retaining a significant share of petrol engines. Yet, the share of petrol-powered LCVs went from 39% in 2000 down to 33% in 2005, and 25% in 2010.

| AGW category | Share of diesel-powered LCVs in LCVs in use (1) aged 20 years or less by AGW category | | |
|---|---|---|---|
| | 2000 | 2005 | 2010 |
| < 1.5 t. | 60.2% | 64.3% | 73.6% |
| 1.5-2.5 t. | 89.9% | 95.0% | 96.1% |
| 2.6-3.4 t. | 92.4% | 96.5% | 98.7% |
| 3.5 t. | 95.3% | 98.9% | 99.5% |
| All AGW categories | **79.2%** | **88.3%** | **93.8%** |

*LCV: Light Commercial Vehicle; AGW: Authorised Gross Weight*
*Note: 1. Excluding vehicles about to be sold, or vehicles for which no questionnaire has been returned.*

**Table 5.23: Market share of diesel-powered LCVs in LCVs in use by AGW category (SOeS, LCV surveys)**

### Diesel LCVs travel higher mileages than petrol LCVs, but the energy mix gets less sensitive to annual mileage

Table 5.24 shows that diesel-powered vehicles travelled annually 2.8 times as much as petrol-powered vehicles on average in 2010: 2.3 times as much on average as far as private households were concerned (10,000 km as compared with 4,300 km), and 3.4 times as much on average as far as professional users were concerned (18,100 m as compared with 5,400 km).

At first reading, this gap in average annual mileage between petrol-powered vehicles on the one hand and diesel-powered vehicles on the other hand could seem consistent with the difference in tax treatment between the two fuels, just like what can be observed more generally in France on the light-vehicle market. However, it may be noted that the annual mileage gap we observe for LCVs is wider than that observed for passenger cars. Indeed, according to national statistics, diesel-powered passenger cars in France travelled on average 1.8 times as much as petrol-powered cars in 2010 (15,800 km as compared with 8,700 km) (SOeS, 2011a). This could point to the fact that tax schemes which target LCVs and give diesel an increased competitive edge over petrol, significantly displace the breakeven average annual mileage between the two fuels.

| User category | Average annual mileage (1) of LCVs in use (2) in 2010 (000 km) | |
|---|---|---|
| | Petrol-powered vehicles | Diesel-powered vehicles |
| **Private households** | **4.3** | **10.0** |
| **Professional users** | **5.4** | **18.1** |
| Companies (3) | 5.3 | 18.7 |
| Public administrations | 6.1 | 9.8 |
| Non-profit org. and assoc. | 3.1 | 12.1 |
| **All user categories** | **5.4** | **15.0** |

*LCV: Light Commercial Vehicle*
*Notes: 1. Based on declared annual distances (a vehicle purchased on Nov.1 will be associated with the distance driven from Nov.1 to Dec.31). 2. Excluding vehicles about to be sold, or vehicles for which no questionnaire has been returned. 3. Including private and public, all sizes, self-employed, etc.*

**Table 5.24: Average annual mileage of diesel and petrol LCVs for different user categories (SOeS, 2010 LCV survey)**

Looking more closely at the energy mix of LCVs in use in 2010, we observe that the breakeven point in average annual mileage between diesel engines and petrol engines is already rather low, and yet keeps moving downwards. Indeed, as illustrated in Table 5.25, even LCVs traveling less than 5000 km annually had been converted to diesel for 90% of them by 2010. More precisely yet, 80% of LCVs traveling less than 5000 km annually and aged between 10 and 20 years in 2010 were diesel-powered whereas this proportion rose to 92% for LCVs traveling less than 5000 km annually and aged less than 10 years. Thus, the more recent the vehicles, the less sensitive to annual mileage the choice of engine type would appear to be.

| Vehicle average annual mileage class (1) | Energy mix of LCVs in use (2) in 2010 | | | |
|---|---|---|---|---|
| | LCVs aged 1 to 10 yrs. | | LCVs aged 10 to 20 yrs. | |
| | Petrol | Diesel | Petrol | Diesel |
| < 5 000 km | *6.8%* | ***92.0%*** | *19.0%* | ***80.1%*** |
| 5 000 - 10 000 km | *5.2%* | *93.9%* | *8.5%* | *91.0%* |
| 10 000 - 15 000 km | *5.1%* | *94.2%* | *7.3%* | *92.1%* |
| 15 000 - 20 000 km | *0.4%* | *99.3%* | *3.8%* | *95.2%* |
| 20 000 - 25 000 km | *0.5%* | *99.2%* | *0.0%* | *99.9%* |
| ≥ 25 000 km | *0.3%* | *99.6%* | *7.9%* | *91.4%* |
| **All mileage classes** | ***3.0%*** | ***96.5%*** | ***11.2%*** | ***88.1%*** |

*LCV: Light Commercial Vehicle*
*Notes: 1. Based on declared annual distances (a vehicle purchased on Nov.1 will be associated with the distance driven from Nov.1 to Dec.31). 2. Excluding vehicles about to be sold, or vehicles for which no questionnaire has been returned.*

**Table 5.25: Energy mix of LCVs by annual mileage class (SOeS, 2010 LCV survey)**

The information presented in Table 5.26 would tend to confirm this observation. Although the most recent petrol LCVs displayed higher average annual mileages than the older ones (8,100 km annually on average for petrol LCVs aged less than 10 years in 2010, as compared with 4,700 km annually on average for the older ones), the gap in average annual mileage between petrol LCVs and diesel LCVs was wider for the most recent age classes.

Looking at professional LCVs for instance, diesel-powered vehicles aged 5 years or less in 2010 travelled on an annual average 2.3 times as far as their petrol-powered counterparts. This ratio falls to 2.0 for vehicles aged between 5 and 10 years, and 1.5 for vehicles aged between 10 and 15 years.

| Vehicle age class | Average annual mileage (1) of LCVs in use (2) in 2010 (000 km) | | | |
|---|---|---|---|---|
| | All users | | Professional users | |
| | Petrol | Diesel | Petrol | Diesel |
| 1 - 5 yrs. | 8.6 | 21.3 | 9.7 | 22.2 |
| 5 - 10 yrs. | 7.7 | 14.9 | 8.6 | 17.1 |
| 10 - 15 yrs. | 5.1 | 10.8 | 7.0 | 10.7 |
| 15 - 20 yrs. | 7.1 | 6.6 | 4.3 | 7.2 |
| > 20 yrs. | 3.3 | 4.5 | 5.9 | 5.7 |
| **All age classes** | **5.4** | **15.0** | **7.3** | **18.1** |

*LCV: Light Commercial Vehicle*
*Notes: 1. Based on declared annual distances (a vehicle purchased on Nov.1 will be associated with the distance driven from Nov.1 to Dec.31). 2. Excluding vehicles about to be sold, or vehicles for which no questionnaire has been returned.*

**Table 5.26: Average annual mileage of diesel LCVs and petrol LCVs by age class (SOeS, 2010 LCV survey)**

### 5.5.3 Discussion

Our analysis of the effects of tax stimuli targeted at corporate LCVs on the diffusion of novelties in the wider LCV fleet has revealed several kinds of effects, which we will now discuss:

1) *A possible triggering effect*: As illustrated in the passenger-car derivative case study, tax policies, when they have significant effects on the costs of fleets, have the power to bring about innovations in the system. The passenger-car derivative, which is considered as a product in its own right in the catalogues of automotive manufacturers, was invented in the early 1990s as a way of avoiding heavy taxation on corporate passenger cars.
2) *Various ripple effects on the corporate market*: The passenger-car derivative case study has illustrated that, once on the market for corporations to buy, the new product can have a life of its own, can compete with incumbent products, and capture new market segments. In this specific case, it would be interesting to assess the market shares that passenger-car derivatives have taken from ordinary vans, but also from passenger cars *per* se. This case study also pointed to the possibilities for a new segmentation of use patterns to emerge following the introduction of a new vehicle type.
3) *The diffusion effect from the corporate market to the household market*: Because of the structure of the LCV market, whereby households only access vehicles on the second-hand market, new products adopted by corporate fleets also spread to the household market, with a time lag of a few years. Then again, on this other market, 'new' products will compete with incumbent products, capture some market segments, and possibly give rise to a new segmentation of use patterns. This could be observed for both the passenger-car derivative and the diesel engine.
4) *The risk of lock-in and other possible inefficiencies*: The diesel engine case study is an interesting example of a situation where tax policy gives such a competitive edge to the 'novelty' over incumbent products, that the former becomes the new dominant product on the market. The risks in such a situation are manifold. Technological lock-in (in which we include considerations such as technical skills, or cultural values, relating to the technological paradigm) can be problematic over the mid- to long-term, the two case studies having revealed a relative *inertia* in the system, even in the presence of strong incentives. Yet, in the shorter run, other inefficiencies can arise from the fact that the new dominant product is bound to conquer markets for which it is not fully relevant. The conversion to diesel of the LCV fleets of public administrations (with an average annual mileage of 9,400 km, 60% of which are driven in urban areas), is a good illustration of such possible inefficiencies.

## 5.6 Conclusion

Although their results had never been used specifically to investigate the use of light commercial vehicles in corporate car fleets, our investigation has revealed the significant added value of French national LCV surveys as a source of information on this very special (and rather misunderstood) component of the mobility system in general, and of the corporate mobility portfolio in particular.

While LCVs are most spontaneously associated with corporate activities, we found that more than one in three LCVs in France were in fact used by private households, thereby highlighting the diversity of the mobility needs that LCVs can address. The remaining two-thirds of LCVs fit better the common representation of LCVs as 'working tools' for business activities: they are used by all kinds of corporations – including companies, public administrations and non-profit organisations and associations (the former account for more than 90% of all professional LCVs) – and across all sectors of the economy. As of 2010, the two activity sectors with the greatest number of LCVs in use were, first, construction (with almost one fourth of all professional LCVs), and second, wholesale trade, accommodation and food services. Interestingly, the use of LCVs in these two sectors would most probably fall under the definition of transport 'on own account' (see Chapter 3 for a detailed definition). The transport and storage sector, on the other hand, only accounted for 7% of professional LCVs in France as of 2010. Looking at fleet-to-workforce ratios, the construction sector still ranked first, together with agriculture, with close to 5 LCVs per 10,000 jobs in the sector. The transport and storage sector ranked fourth, with a ratio of 1.6 LCVs to 10,000 jobs.

Looking at the development of the *new-LCV* market through recent LCV surveys, we found evidence of a rather mature market, on which corporate entities accounted for 95% of all purchases. A first corollary of this special market structure for new LCVs was that corporate LCVs were much more recent than private LCVs (respectively, 6.6 years and 13.1 years on average, as of 2010) – half of them were actually no older than 4 years. In fact, the 4-year threshold marked a notable disruption in the corporate LCV fleet, when a significant share of professional users would sell their vehicles to other, non-professional users. Interestingly, this 4-year threshold corresponds to both the shortest possible depreciation period for LCVs (under French accounting laws) and the intensification of technical roadworthiness inspections and pollution check-ups for LCVs (under the French Highway Code), suggesting optimising behaviour on the part of corporations.

Another corollary of the all-professional market for new LCVs is that corporate LCVs act as *exclusive trend-setters* for the wider LCV stock in France, meaning that all major changes in the LCV stock in France (e.g. introduction of new vehicle body types, new drivetrains) would have to occur *through the* *corporate LCV fleet*. Indeed, every year, corporate entities would renew about 12% of their total fleet of LCVs, part of which would then be sold on the second-hand market to households (or other corporate entities) after being used for a few years. This particular diffusion pattern could be verified, through the LCV surveys, for several different vehicle features. For instance, professional LCVs have led the shift of the LCV fleet towards heavier vehicles. They are also responsible for the progressive adoption of passenger-car derivatives as an alternative to ordinary vans, as well as the almost complete (and rather rapid) phasing out of all engine types other than diesel.

On the issue of LCV use patterns, we found in the LCV surveys evidence that corporate LCVs were used quite intensively (around 18,000 km per year on average as of 2010, as compared with 10,500 km for private LCVs), despite a slight decline over the last decade. Corporate LCVs were most intensively used during their early years, especially in the sectors of wholesale trade, accommodation and food services, and transport and storage (approximately 28-29,000 km per year in the first 5 years for these 2 sectors). Such intensive use however appeared compatible with rather short daily distances travelled. Indeed, LCVs that covered less than 100 km per day accounted for more than half the total annual mileage of professional LCVs in France, or 32 billion km, which could be a very promising basis for the introduction of alternative technologies with limited range such as battery-electric vehicles. Besides, more than one third of the total mileage of corporate LCVs occurs in urban environment, thereby strengthening the benefits to be expected from the adoption of cleaner vehicles.

Having shed light on the instrumental role corporate LCVs could play in the introduction of new vehicle features in the larger LCV fleet in France, we ultimately used the LCV survey results to gain further insights into the potential effects of taxes on the dynamics of the spread of novelties in the larger LCV fleet *through* the corporate LCV market. We highlighted several sorts of such effects, which can combine with one another, including: triggering effects (whereby tax incentives bring about brand new products on the market), various ripple effects on the corporate market (e.g. increased competition, new segmentation of use patterns), diffusion effects from the corporate market to the household market (through the second-hand market), and possible lock-in effects and other inefficiencies.

Having observed such significant effects of (tax) policies on corporate car fleets and the larger mobility system, the question now arises of the opportunity of deliberately leveraging corporate car fleets to foster the adoption of automotive innovations in France. This will be the focus of the third and last part of this dissertation.

# *Part III*

# *Driving change in corporate car fleets*

# Chapter 6
# Fleet management and the adoption of innovations: An exploratory approach

## 6.1 Introduction

### 6.1.1 Background

As already mentioned in Chapter 2, companies are major contributors to the overall *demand* for mobility in France (through, for instance, employees' daily commute, freight transport and logistics, long-distance business travel), as well as significant contributors to the *funding* of the urban public transport system (through the VT tax scheme and through the mandatory employer contribution to the costs incurred by their employees for commuting by public transport).[1] That is why they have been identified by policy-makers as key players in the targeted change towards more sustainable mobility.

Yet, as of 2014, the French policy framework to enforce or encourage mobility management by companies was still rather loose, even in areas such as the Paris region or the Bouches-du-Rhône *département* (which contains the

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[1] For the record, in 2012, companies contributed 6.9 billion EUR in VT ('*Versement Transport*') tax revenues nationwide, thereby funding almost half the costs of urban public transport in France (GART, 2014). They further contributed 0.8 billion EUR in employer contributions to public transport costs for the Paris region alone in 2012 (source: http://www.stif.org/organisation-missions/volet-economique/financement-transports-publics/financement-transports-franciliens-442.html).

City of Marseilles), where corporate mobility plans were mandatory for all large company sites. Thus, we could find little evidence, whether in the academic literature or elsewhere, of corporations – even those legally required to implement corporate mobility plans – that had developed a comprehensive approach to mobility management.

The concept of 'corporate mobility management' is often reduced to a list of tools within a corporate mobility plan, such as: the promotion of 'soft modes' (e.g. walking, cycling), public transport and alternative car technologies and uses (e.g. alternative-fuel vehicles, car-sharing, ride-sharing, eco-driving courses), new or alternative work practices (e.g. telecommuting, videoconferencing), the optimisation of goods transport, etc. Yet, our view is that mobility management should not be restricted to a simple menu of ready-made portfolios of mobility solutions for reducing individual car use. Rather, we would describe corporate mobility management as a *complex process* driven by a combination of *strategic interests* ranging from operational and economic efficiency to brand image, aiming at the optimisation of a set of *output variables* (e.g. accessibility, mobility costs), and subject to *external influence* (e.g from the regulator, the customer base). We further believe that mobility management is a combination of various *interrelated sub-processes* (e.g. fleet management, long-distance travel management) and involves *interactions between various levels* inside the organisation (e.g. the individual level, the department level, the site level, the corporate level). Figure 6.1 provides a schematic representation of corporate mobility management processes.

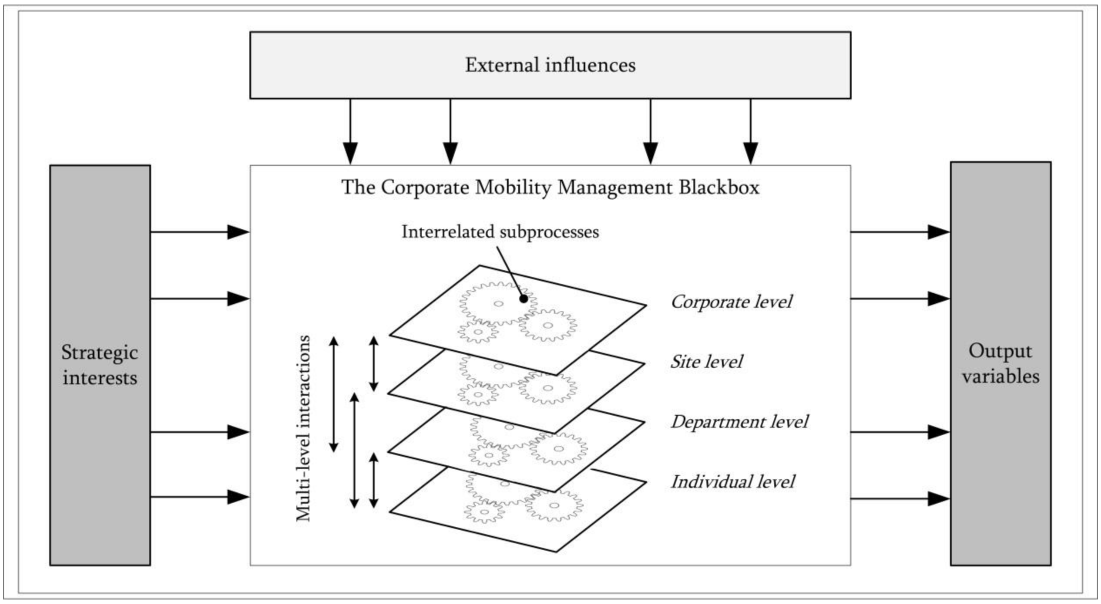



**Figure 6.1: A schematic representation of corporate mobility management**

On the basis of such a representation of corporate mobility management, therefore, we consider fleet management to be one cog in the machinery of mobility management, or rather a sub-process in the larger mobility management process, driven by a subset of corporate strategic interests, aiming at the optimisation of a subset of output variables, etc.

### 6.1.2 Statement of the problem

The academic literature provides scarce and rather fragmented information on the processes that guide mobility and/or fleet management by corporations. Yet, understanding these processes is key to assessing the potential role corporations could play in the transition towards a more sustainable mobility system, and to drawing operational policy conclusions accordingly.

As far as corporate car fleets are concerned, it is most likely that a transition to sustainability would require, among many other changes, the adoption of innovative technologies or services (see Chapter 1 for further development on this point). Based on the current level of knowledge about the processes that guide the acquisition and use of automobiles by corporations, French prospective analysts, like policy-makers and car manufacturers, lack reliable insights into the potential demand for such automotive innovations on this market segment. Therefore, they cannot accurately appraise the possible leverage effect that corporate car fleets might have on the diffusion of innovations in the French automotive fleet.

### 6.1.3 Purpose of the survey

In an attempt to start bridging the knowledge gap on corporate mobility management and fleet management processes, we decided to initiate an exploratory survey with a threefold purpose. First, to provide some qualitative insights into the corporate mobility management policies and processes of large organisations, including in particular: *i)* the various output variables of the mobility management process monitored (and optimised) by the corporation, and *ii)* the combination of strategic interests driving the mobility management process.

The second aim of our exploratory survey was to provide further insights (mostly qualitative) into the decision-making processes involved in fleet management, focusing on the stakeholders in the decisions and the various tools developed to support their respective actions and/or organise their interactions.

Ultimately, the survey was designed to provide some insights into the uptake of innovations by corporate car fleets, through analysing the barriers to, and drivers of, the adoption of such innovative technologies and services as electric vehicles and car-sharing.

### 6.1.4 Method

Building on previous qualitative research by American and British researchers on fleet decision-making processes (see Section 6.2 for further detail), we endeavoured to explore the mobility management and fleet management processes of corporate car fleets in France through face-to-face, semi-structured interviews, in order to produce a sensitive analysis of the issues at stake. The survey included 44 interviews with decision-makers involved in the mobility management and/or fleet management processes of 22 large organisations in the Paris region.

In order to account for the strong *collective* dimension of mobility and fleet management processes in large organisations, we decided to interview a wide range of decision-makers, including fleet and transport managers, but also representatives from the departments in charge of procurement, sustainable development, human resources, logistics, etc.

It should be noted that, when analysing fleet management processes, we deliberately chose to take a dual perspective, investigating the decisions relating to vehicle *acquisition* (through purchase, leasing, or otherwise) on the one hand, and those relating to vehicle *use* on the other hand. However, not only did we make a static analysis of each of these two types of decision-making processes, their respective stakeholders and usual tools as of the date of the survey, we also analysed the interactions between them, paying special attention to the combined *dynamics* of change in these two areas of fleet management.

Last, to explore how corporate car fleet managers consider innovations for adoption, we focused on two different kinds of innovations that showed good potential at the time of the survey, judging from professional journals (*Flottes Automobiles*, *L'Automobile&L'Entreprise*) and special reports by the mainstream press (*Le Monde*, *Le Figaro*, *Les Echos*, *La Tribune*, *Le Parisien*): battery-electric vehicles (BEVs) on the one hand (with a core technological content), and car-sharing solutions on the other hand (with a core service content).

### 6.1.5 Outline of the chapter

The chapter is structured into three main parts and a conclusion. First, we provide further details on the methodology used in the design of our exploratory survey of the mobility and fleet management processes of large organisations in the Paris region (Section 6.2). Then, we present some of the key qualitative findings of our survey, drawing attention to: *i)* the overall lack of maturity of mobility management processes in large organisations, *ii)* the complexity of decision-making processes for vehicle acquisition, and *iii)* the ongoing progress in fleet use optimisation (Section 6.3). Then, we discuss the outlook for electric vehicles and car-sharing services in corporate car fleets, analysing the barriers to, and drivers of, their adoption, and reporting on some of the 'good practices' revealed by our survey (Section 6.4). In the conclusion (Section 6.5), we discuss the added value and limitations of our results in light of the state of knowledge of corporate mobility and fleet management processes in the academic literature.

# 6.2 Methodology for an exploratory investigation

## 6.2.1 Exploratory surveys on fleet decision-making processes in academic literature

Following a series of studies aimed at assessing commercial fleet demand for alternative-fuel vehicles (AFVs) in the United States and California (see US EPA, 1994; Golob *et al.*, 1994; Golob *et al.*, 1997), Nesbitt and Sperling primarily undertook an exploration of fleet behaviours with regard to the purchase and use of light-duty vehicles. They argued that a behavioural (organisational) approach was needed to understand the discrepancy between the projected impacts of policy measures in favour of the adoption of AFVs for fleets (such as AFV purchase mandates in the early 1990s) and the actual penetration of these vehicles.

Using information collected from one-on-one interviews and focus groups with individuals involved in their organisations' fleet management and purchase decisions, they deconstructed several misconceptions (which they refer to as 'myths') in the common understanding of the purchase behaviour of light-duty vehicle fleets (Nesbitt and Sperling, 1998). One especially widely-accepted hypothesis that they found to be overstated was that fleets conduct careful and rational analyses of the life-cycle costs of new vehicles.[2] Instead, the authors suggested that the selection of new vehicles for fleets is often based on past experience. They identified three main criteria applied by fleets in a two-step decision-making process: first, the criteria of *i) suitability* (whether the vehicle can perform adequately in its intended application) and *ii) experience* (with the vehicle and/or manufacturer), are used in forming the final choice set; then, the final selection appears largely to be based on *iii) purchase cost*. A schematic diagram of the two-step, three-criterion vehicle choice process is presented in Figure 6.2.

[2] See Nesbitt and Sperling's myth No.3, out of 7: '*Hypothesis 3 Detailed cost accounting by fleets favours AFVs in purchase decisions*' (Nesbitt and Sperling, 1998).

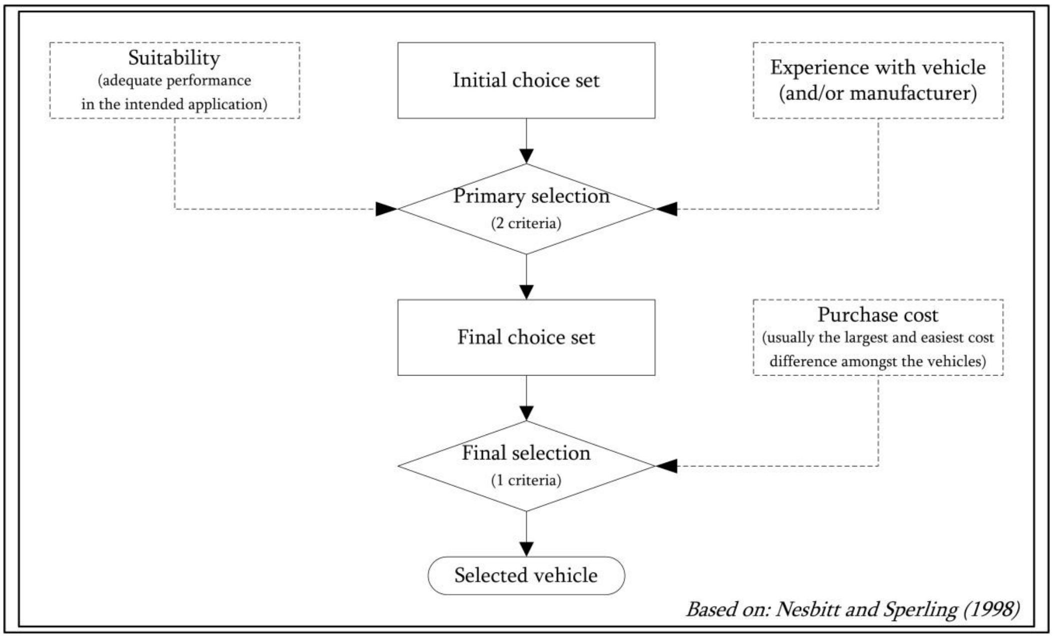
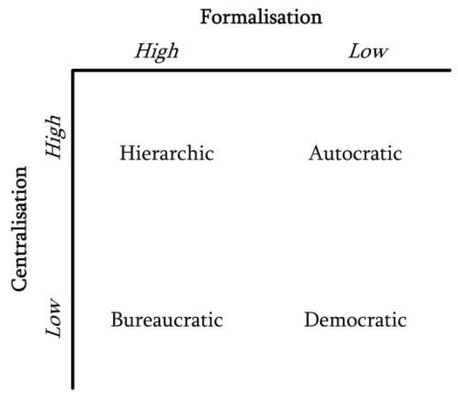



**Figure 6.2: Nesbitt and Sperling's two-step vehicle selection process**

The same authors further elaborated their organisational approach to the purchase behaviour of corporate car fleets by developing a framework for characterising and categorising the decision-making processes employed by organisations when purchasing new fleet products (Nesbitt and Sperling, 2001). They proposed a typology of organisations in terms of two contextual dimensions of their decision-making processes with regard to fleet matters, namely: *i) centralisation* (i.e. the number of people involved in fleet decisions, and their autonomy in decision-making) and *ii) formalisation* (i.e. the extent to which rules and procedures guide decision-making processes). The four possible configurations of fleet decision-making structures are illustrated in Figure 6.3.

On the basis of this typology, the authors could then put forward recommendations on how both commercial strategies and public policies aimed at the promotion of AFVs could be adjusted to take account of the specific features of the four types of fleets. Amongst other results, the authors noted that *hierarchic fleets* (highly formalised, highly centralised) might be the most likely to adopt alternative-fuel vehicles through reasoned choices based on both economic and non-economic considerations, provided that such vehicles presented '*attributes that appeal[ed] to both fiscally-minded fleet managers and image-conscious executives*'.




*Source: Nesbitt and Sperling (2001)*

**Figure 6.3: Nesbitt and Sperling's typology of fleet decision-making**

Nesbitt and Sperling's pioneering approach laid the groundwork for a new line of research seeking a deeper understanding of fleet purchasing behaviour(s). Following their lead, Hutchins and Delmonte (2012) investigated the potential for EV adoption by corporate car fleets in the UK (where they represented 57% of new car registrations in 2010), focusing on fleet managers' attitudes and the perceptions (e.g. knowledge of EVs, knowledge of charging, perceived benefits and drawbacks associated with adoption of EVs in fleets) underpinning their decision-making. Drawing on 20 interviews, they found that the typology proposed by Nesbitt and Sperling (2001) was valid in describing corporate behaviours relating to the purchase of EVs for car fleets, and that different EV marketing strategies should therefore be used to target organisations on the basis of the typology of their decision-making processes relating to corporate car fleets.

Although this research has shed new light on the management processes involved in fleet acquisition decisions, it says little about the management processes involved in decisions related to fleet operations.

### 6.2.2 Design and methodology of our exploratory survey

Building on the results of previous research (Nesbitt and Sperling, 2001; Hutchins and Delmonte, 2012), it was decided that the *collective dimension of fleet decisions* would be taken into account right from the design of the survey. In order to explore the processes that guide companies' acquisition, management and use of automobiles from different perspectives, we decided to interview decision-makers involved in fleet decisions at various levels and in different positions in their respective organisations:

> *'We had hypothesized, and it was confirmed in the interviews and focus groups, that most previous AFV [alternative-fuel vehicles] fleet market studies were flawed in assuming that the fleet manager alone would make all the*

> *decisions pertaining to the acquisition of alternative fuel vehicles. Because of the importance of such purchase decisions, in terms of the number of people affected, the resources involved, and the precedents set, we found that several individuals from the same organization generally play substantive roles in the AFV purchase decision, especially in the initial purchases.'*
>
> Nesbitt and Sperling (2001)

> *'Purchase decisions were often made by a range of different people including senior managers, transport managers, finance teams and procurement departments'.*
>
> Hutchins and Delmonte (2012)

Thus, not only did we target fleet or transport managers, but we also sought to collect information from representatives of the departments responsible for procurement, sustainable development, human resources, logistics, etc.

**Interview procedure and topic guide**

Considering the variety of possible perspectives on fleet decisions, we thought that it might be fruitful to consider exploring a wide range of areas with each participant. We anticipated, however, that flexibility would be needed when conducting interviews, so that we could skip some topics with which the participant would not feel comfortable, but also have more in-depth discussions on certain topics of specific interest to the participant. This need for a combination of extensive coverage and flexibility prompted the choice of semi-structured, face-to-face interviews for this exploratory survey.

*Face-to-face interviews:* Considering the exploratory nature of this survey, it was decided that interviews should be administered face-to-face whenever possible, in order to ease the discussion between the researcher and the participant. Also, whenever relevant, we aimed to take advantage of the trip to the participant's workplace to visit the facilities and look over the fleet innovations (for instance, car-sharing systems or electric vehicles). When face-to-face interviews could not easily be arranged, interviews could be administered over the phone.

*Semi-structured interviews:* A topic guide was drawn up, covering four main areas:

1) Descriptive data on the organisation and the participant: organisation status (public, private, etc.), nationality, registration number, sector(s) of activity, turnover and staff (total and in France); participant's position in the organisation, sex, age and place of residence.
2) Qualitative data on the organisation's general policy on mobility, including: existence of a mobility manager position, implementation of a Workplace Travel Plan (WTP), and ICT policy.
3) Quantitative and qualitative data on the organisation's automotive fleet, including: fleet size, structure (passenger car *vs.* light commercial

vehicle; 'perk' car *vs.* service car), use patterns, procurement process (car policy, tenders, etc.), management process (maintenance, insurance, reporting, etc.), and prospects for change.

4) Qualitative data on some of the specific uses of automobiles and their futures trends, including: taxi, short-term rental, long-term rental, car-sharing, and electric mobility.

Altogether, the topic guide covered 190 discussion items. It was expected, however, that only some of these items would be explored during a given interview, if for no other reason than that no participant could be qualified to speak on all the subjects considered. It was therefore anticipated that each interview would last between 1 hour ½ and 2 hours.

**Selection of organisations**

Our selection of organisations to be included in the survey followed a two-step process which we summarise in Figure 6.4.

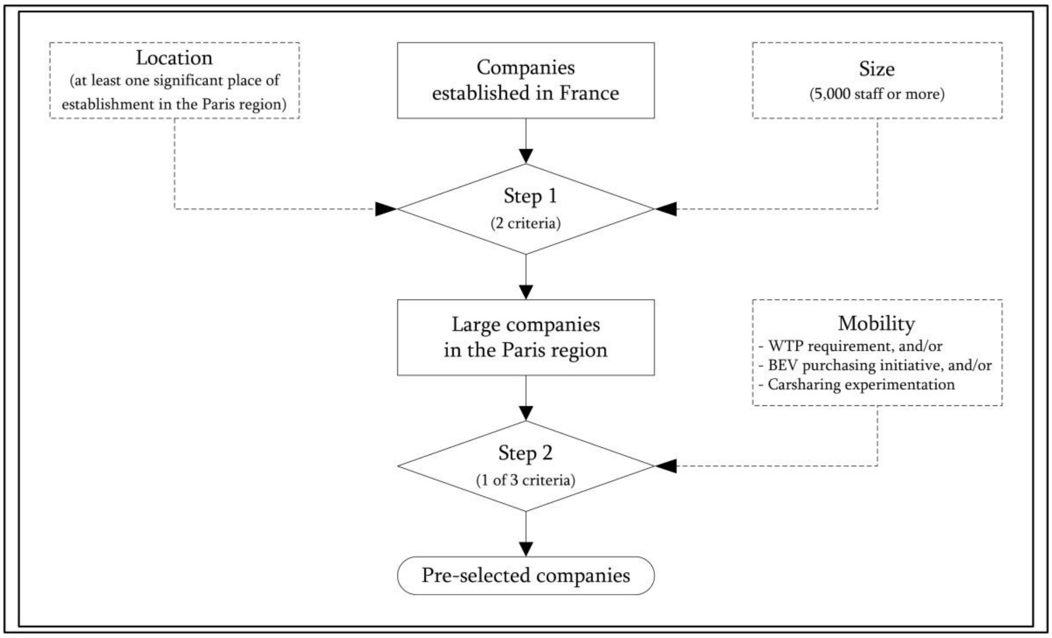



**Figure 6.4: Our two-step process to select organisations**

*Step 1 – The location and size criteria:* We decided that the survey would focus on large organisations located in the Paris region. To be more specific, our geographical criterion stated that organisations in the sample should have at least one significant business location in the 'Paris region' (i.e. in the *Île-de-France* region, which is composed of eight administrative districts (*départements*) including the City of Paris, 3 districts in the inner suburbs and 4 districts in the outer suburbs). This criterion was mainly justified by practical considerations of accessibility (bearing in mind that we favoured face-to-face interviews over telephone interviews). We also reasoned that this criterion would facilitate comparison between mobility patterns within a given territory. In addition, our size criterion stated that the organisations in the sample should employ 5,000 staff or more, so as to be ranked as 'large companies' (in French, '*grande entreprise*') under the official French classification.[3] This criterion was decided on the assumption that large companies are likely to make use of a wide variety of mobility solutions. We further assumed that large companies would have adequate resources (human and financial) to make informed decisions about their mobility options.

*Step 2 – The mobility criteria:* We further based our selection of organisations on criteria related to mobility or, rather, innovation in mobility as it might be perceived by the general public. Thus, we decided that the organisations in sample should meet *at least one* of the following three conditions:

1) *Workplace Travel Plan (WTP)*: We selected organisations having one or more business locations in the Paris region under a legal obligation to set up and implement a WTP (in French, PDE, short for '*Plan de Déplacements d'Entreprise*'). The legal requirement for WTP in the Paris region is set under a 2008 decree[4] that made WTPs mandatory for more than 300 major traffic generators (see Chapter 2 for a detailed presentation of WTP requirements in the Paris region).
2) *Public-private joint BEV-purchasing initiative:* The joint BEV-purchasing initiative led by La Poste Group and coordinated by the French central public procurement office, UGAP ('*Union des Groupements d'Achats Publics*'), resulted in October 2011 in a purchase order for nearly 19,000 BEVs to serve in the fleets of 20 public and private organisations.
3) *Car-sharing:* By a thematic review of publications intended for the general public as well as specialist publications, we were able to identify

[3] The official classification for companies in France is defined under the following regulation: *Décret n° 2008-1354 du 18 décembre 2008 relatif aux critères permettant de déterminer la catégorie d'appartenance d'une entreprise pour les besoins de l'analyse statistique et économique*. Available from: http://www.legifrance.gouv.fr/affichTexte.do?cidTexte=JORFTEXT000019961059.

[4] *Arrêté interpréfectoral n°2008-1926-1 du 30 octobre 2008 relatif à la mise en œuvre du Plan de Protection de l'Atmosphère et à la réduction des émissions de polluants atmosphériques en Île-de-France*. Available from: http://www.driee.ile-de-france.developpement-durable.gouv.fr/IMG/pdf/AP_PDE_30oct08_cle564a1c.pdf.

organisations experimenting with car-sharing (either in-house or external schemes) to meet their employees' mobility needs.[5]

This two-step selection process for organisations generated a list of approximately 60 potential targets, which at that stage encompassed organisations from a wide range of economic sectors, including: transport, energy, ICT, construction, banking, consulting and retail.

*Selection biases:* The set of criteria used to select organisations was likely to induce various biases. First, we anticipated that the mobility features of the organisations in the sample would be influenced by the specific transport characteristics of the Paris region (e.g. density of the public transport network, low car ownership rate) although some organisations in the sample might have significant establishments outside the Paris region. Second, because of the large size of the organisations selected, we anticipated that large fleets would be over-represented in our sample, with the result that the decision-making processes would be likely to be fairly highly formalised. Also, due to the conditions we set for the mobility-related selection criteria, we assumed that the pre-selected organisations would be leaders in the uptake of mobility innovations and we deliberately decided to take advantage of this bias to help us outline future trends in the introduction of innovations into corporate car fleets.

**Recruitment of individual participants**

Using our shortlist of organisations, we recruited individual participants amongst decision-makers likely to be involved in the processes for the acquisition, management and use of the company's automotive fleet.

*Positions targeted:* Our literature review prompted us to consider the following types of positions as potentially involved in fleet decision-making processes: procurement (or purchasing, usually supervised by finance departments), fleet management (usually supervised by general management), sustainable development (in some cases supervised by corporate social responsibility departments), and human resources. Where relevant, we also targeted positions in logistics and/or mobility management (few of the pre-selected companies had such departments), as well as positions in innovation and/or strategy (such departments are not usually involved in fleet decisions unless fleets are potential targets for the company's own products).

*Recruitment procedure:* People in the above-mentioned types of positions are known to be '*difficult to recruit for research purposes as they are typically busy and need to see clear benefits before agreeing to participate in research*' (Hutchins and Delmonte, 2012). In order to reach as many fleet decision-makers as possible, we used personal approaches by research staff *and* we identified

[5] See Chapter 8 for a discussion of potential corporate demand for car-sharing .

potential targets in the press (general and specialised) and on professional social networks. In order to maximise the willingness to participate, we initiated contact through emails that were *i)* personalised and *ii)* position-oriented. In addition, we branded our survey as a 'benchmarking exercise', as we thought this this kind of process would be more appealing to people in operational positions, and we offered from the outset to share the results of the survey with all interested participants.

*Participation rate:* Initial contact via personalised email yielded 25 participants. Additional participants were recruited by word of mouth among fleet decision-makers (13 participants) as well as following a number of feedback reports on provisional results at conferences or in *ad hoc* working groups (6 participants). Out of the 126 potential participants we identified in the 60 targeted organisations, 44 actually participated in the survey (representing 22 organisations). A final participation rate of 35% appears to be quite high compared to recent similar research (≈2% for Hutchins and Delmonte, 2012), suggesting that a targeted, persistent recruitment procedure could be more suitable to this type of exploratory survey than across-the-board emailing based on purchased contact lists. It should, however, be acknowledged that the recruitment of participants was a very time and energy intensive procedure. Indeed, all in all, more than 200 emails were sent to potential participants over a 17-month period (from April 2012 to September 2013) in order to *i)* initiate contact, *ii)* send reminders to non-respondents, *iii)* persuade reluctant respondents to participate, and *iv)* schedule interviews. Because of the low priority participants assigned to this survey in their schedules, several interviews had to be postponed for weeks or even months.

*Recruitment biases:* We anticipated that the procedure for recruiting individual participants would induce various biases. First, we assumed that the self-selection bias would likely increase the selection bias towards organisations with leadership in mobility innovation. Second, we recognised that our recruitment procedure was likely to induce a bias because not all positions in an organisation would necessarily have *i)* the same intensity of email use, or *ii)* the same exposure in the press. This bias was, however, somewhat balanced by the fact that we recruited almost half the participants (19 out of 44) by word of mouth among fleet decision-makers or through direct contact in conferences and/or working groups. Word-of-mouth recruitment was particularly helpful for the inclusion of fleet managers and logistics managers in our sample. Interestingly, we found that human resource managers were most difficult to recruit, not merely because of their lower press exposure, but more generally because of confidentiality restrictions, which they claimed would prevent them from taking part in our research.

**Sample**

Following our pre-selection of organisations and recruitment of participants, our sample consisted of 22 organisations and 44 participants (between 1 and 5 participants for each organisation, depending on the success of our recruitment procedure). Figures 6.5 and 6.6 provide overviews of the main characteristics of the organisations and participants in the sample.

*Main characteristics of the organisations in the sample:* Out of the 22 organisations, 9 were companies listed on the CAC40 stock market index[6] and 2 more were affiliates of CAC40 companies. The remaining 11 entities were either private (eight in all, 4 French and 4 foreign) or public (three, all French). Confirming the expectation that selected organisations would be large entities, the mean headcount in France for the 22 entities was 44,150, with a minimum of 1,500 and a maximum of 158,000.

Finally, the number of major sites – defined as those employing 100 people and more – in the Paris region ranged from 1 to 50 for a given organisation, with a mean number of 8 major sites per organisation. The organisations in the sample had four main sectors as their core business: automobile (2), transport (4), energy (8), and ICT (5). Other activities represented in the sample included construction, administration and consulting. Regrettably, none of the pre-selected organisations with activities in banking, pharmaceuticals or retail could be included in the survey, due to lack of response from their targeted representatives.

*Main characteristics of the participants in the sample:* Out of the 44 participants interviewed, 30 were men (with an approximate mean age of 48) and 14 were women (with an approximate mean age of 41). Although top-level managers and middle managers were well represented in our sample (14 participants in total, all men), first-level management was prominent (29 participants, 16 men and 13 women). The geographical scope of responsibility of the participants was mostly local or national (16 participants each), but 12 interviewees were responsible for a geographical zone covering more than one country.

Most participants were involved in fleet management (13 cases) or purchasing (12 cases) as their *main activity*. However, some participants held positions in general services (9), sustainable development (6), human resources (3) or strategy (2). In the interests of simplification, participants whose functions were labelled as 'logistics' (2) or 'mobility management' (2) or 'services to employees' (1) were grouped in the 'general services' category.

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[6] The CAC40 index reflects the performance of the 40 largest equities listed in France, measured by free-float market-capitalisation and liquidity.

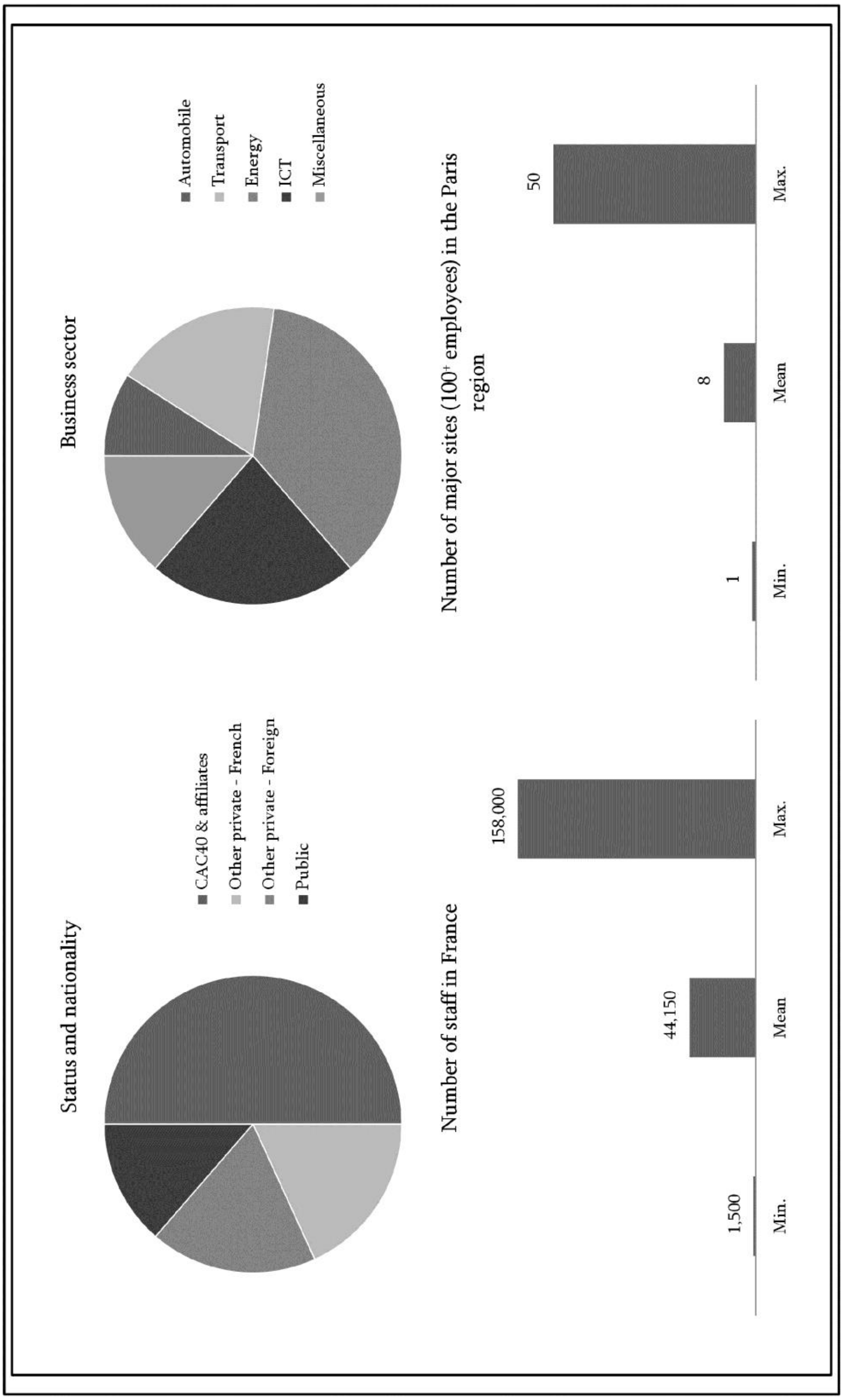


Figure 6.5: The sample of organisations at a glance

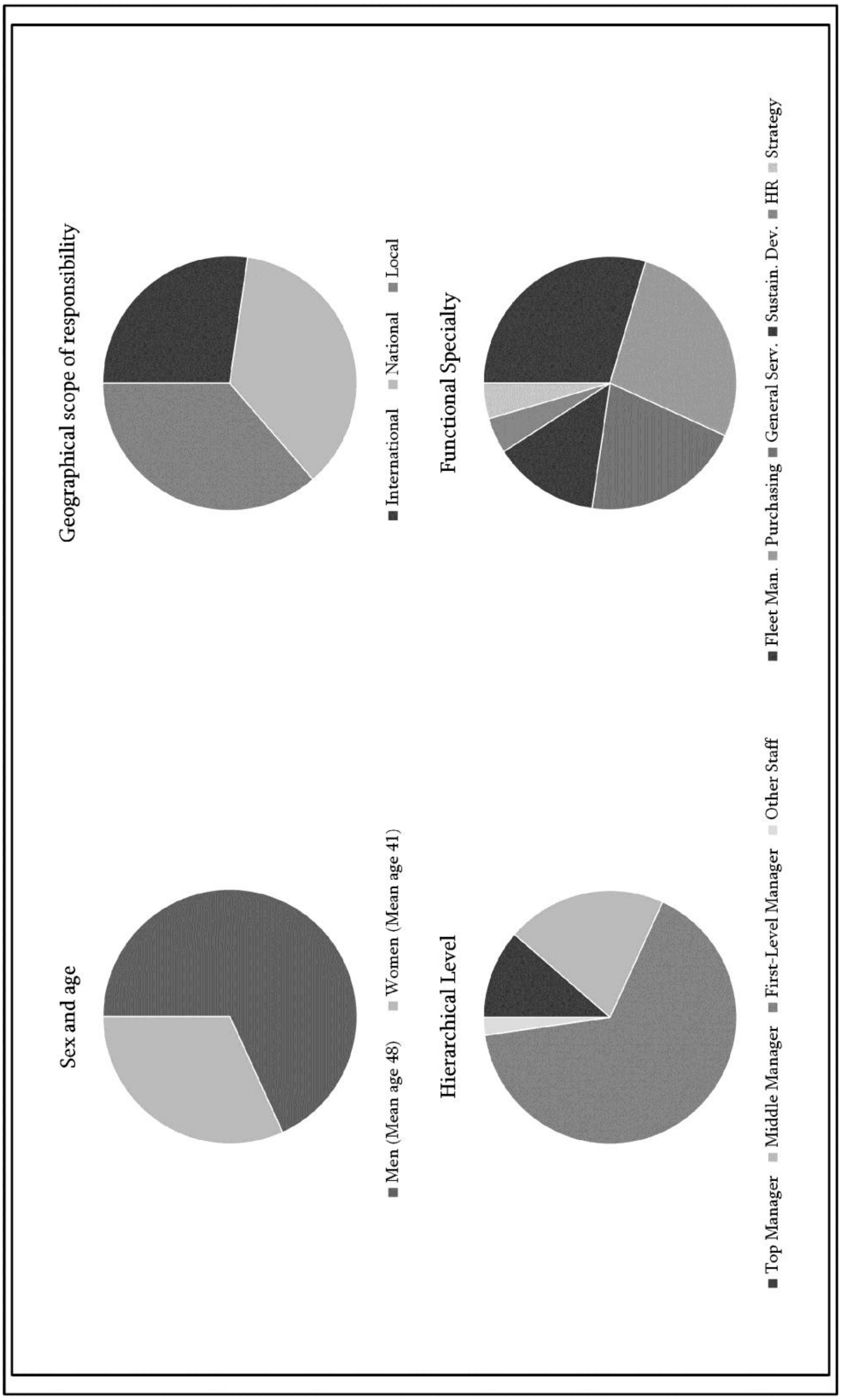


**Figure 6.6: The sample of participants at a glance**

*Main characteristics of the fleets in the sample (see Figure 6.7):* The total number of light-duty vehicles (LDVs) in our sample was close to 163,000 (as some fleets were international, we did not consider the total number of vehicles in those fleets, but limited our survey to vehicles registered in France),[7] although we were unable to collect data on fleet size for 3 of the 22 organisations surveyed (all 3 were mainly involved in industrial production activities, in various business sectors). The number of LDVs within a given fleet varied from 55 to 39,365, with a mean value of 8,577 and a median value of 1,293. Fleet sizes were distributed as follows: *i)* 6 fleets consisted of less than 999 light vehicles registered in France, *ii)* 6 other fleets had between 1,000 and 9,999 vehicles, and *iii)* 7 fleets had more than 10,000.

Across the 22 organisations in our sample, the ratio of fleet size to employee headcount varied widely, from 1 vehicle per 2 employees, up to 1 per 145. Although it was at first glance difficult to identify a general pattern in the penetration of LDVs into the organisations surveyed based on the available data,[8] we postulate that the organisations can be categorised into the following 4 clusters: *i)* organisations involved in service activities and/or infrastructure management activities, whatever their business sector, appear to make the most regular use of corporate vehicles (a linear regression based on 8 observations in this cluster estimated a ratio of 1 vehicle to 2.3 employees with a coefficient of determination close to 0.89); *ii)* organisations involved in industrial production activities appear to have fairly inelastic demand for corporate vehicles (all 4 organisations in this cluster had fleets ranging from 500 to 1000 vehicles, regardless of their employee headcount); *iii)* very large organisations appear to be a case apart, since only a complex combination of factors could account for the size of their fleets – the diversity of their activity portfolio alone is a source of complexity (the 5 organisations with 100,000 employees or more, had dozens, if not hundreds, of different registered business names); finally, *iv)* organisations whose sole place of business is the dense centre of a metropolitan area appear to have little use for corporate vehicles compared with similar organisations located elsewhere (the only 2 organisations with 100% of their French staff located in the Paris region, and half or more in inner Paris, although their main activities were services and infrastructure, had 40 to 80 times fewer vehicles per employee than those in the first cluster).

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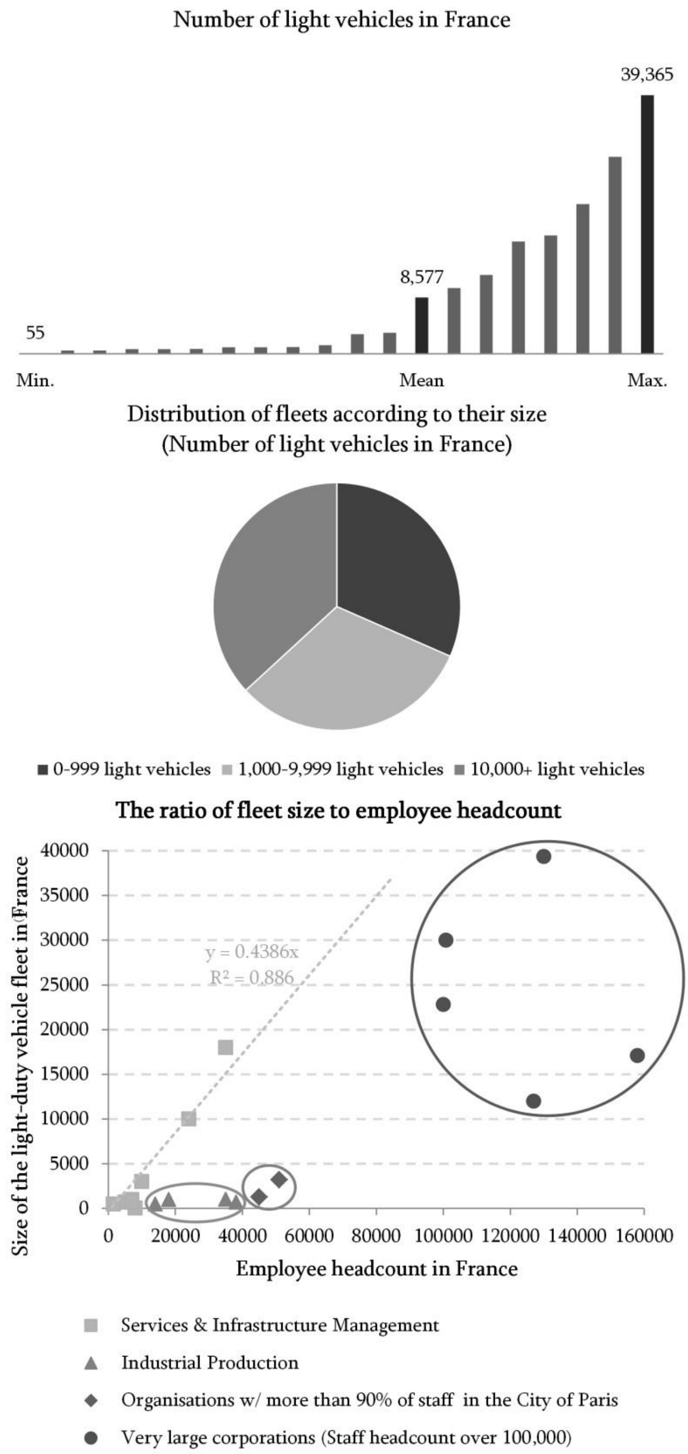
[7] Although this survey was not intended for statistical purposes, we would point out that our sample represented close to 3% of the total corporate light-duty vehicle fleet of companies in France in 2012 (about 6 million vehicles, as assessed in Chapter 3).

[8] Neither the business sector, nor the size of organisation seemed, as such, relevant in explaining the size of the light-duty vehicle fleet.




*Note : 1. Including passengger cars and light commercial vehicles, including service vehicles and official cars.*

Figure 6.7: The sample of fleets at a glance

## 6.3 Key findings on mobility and fleet management processes

Below, we present some of the main findings from our survey on the following three topics: *i)* the overall mobility management processes, *ii)* the decision-making processes guiding the management of fleet acquisition (and renewal), and *iii)* the decision-making processes guiding the management of fleet operations.

### 6.3.1 Mobility management processes vary in their maturity among large organisations

One of the four main areas covered by the topic guide that we used to administer the survey dealt with the organisation's general policy on mobility. The topics discussed included: the policy(ies) on short-distance and long-distance mobility, the existence of a mobility manager position, the implementation of a Workplace Travel Plan (WTP), the policy on mobility allowances or compensation for transport costs, the policy on the use of taxi and short-term lease cars, the policy(ies) on ride-sharing and car-sharing, the policy on telecommuting, the policy on audio-conferencing and video-conferencing, the policy on ICT devices, etc. With the information collected on these topics through the 44 interviews, we were able to draw up the following description of mobility management processes in the organisations surveyed.

**A retrospective interpretation of the various dimensions (or 'output variables') of mobility management**

Although it was not a direct topic of our interview guide, the interviewees provided many retrospective elements as to how the policy(ies) on mobility in their respective organisations had developed over time. Based on their accounts, something of a pattern seemed to emerge as to how the various dimensions of mobility had been gradually integrated into the general process of mobility management. Below, we endeavour to reconstruct a narrative of how mobility management got to become a complex, multi-dimensional process addressing various needs, concerns and challenges in the organisation.

*From accessibility to attractiveness:* It seems that the earliest dimension of mobility that was considered by organisations was the *actual physical ability to move people and goods*. Mobility was then perceived as an essential need from the standpoint both of the company and of its employees. At first, mobility management may have consisted mainly in facilitating business travel through: *i)* contracts with service suppliers (to lease cars, buy train or plane tickets, etc.), *ii)* an increasing use of mileage allowances (to cover the expenses incurred by employees when using their private car for professional purposes), and, in some cases, *iii)* the supply of in-company vehicle fleets. However, it would seem that, fairly quickly, on top of these considerations, which could qualify as *accessibility-driven*, new considerations, which turned out to be more *attractiveness-driven*, were progressively taken into account by the companies in tackling mobility. Anchored in collective labour agreements or statutory provisions, new *mobility benefits* were introduced, which were devised by companies as *an integral part of their policy for attracting and retaining quality employees* (particularly amongst senior managers and skilled manpower). This prompted companies to become involved not only in business travel, but also in daily commuting. This new step in mobility management gave rise, for instance, to dedicated shuttle buses for employees – primarily, factory workers – working in premises a long way from major urban areas. The allocation of company vehicles to top executives, or even senior officers, for both their professional and personal needs, may have developed on similar grounds.

*From safety to comfort:* Later on, notably under the influence of the workplace health and safety committees (in French, CHSCT for '*Comité d'Hygiène, de Sécurité et des Conditions de Travail*'), safety became another major policy goal of mobility management by companies. Companies that conducted thorough mobility risk assessments implemented various road safety strategies to reduce the risks incurred by their employees, such as: road risk prevention training for professional and/or intensive drivers, long-distance travel by train instead of car, etc. Most of the organisations surveyed considered they had achieved an adequate level of control over road safety risks through sustained efforts in this domain. In a similar vein, but to a lesser degree, employee comfort was also set as a target for improvement, more particularly for sales or customer service activities.

*Concerns about the environmental impacts of mobility:* In the past decade, in a context of growing environmental concerns amongst both their regulators and customers, organisations had displayed increasing awareness of the environmental impacts of their mobility, a move encouraged by the 2007 'Grenelle Environment Round Tables'. Many interviewees reported: *i)* attempts to develop ride-sharing platforms on their Intranet sites for employees in selected workplaces, and *ii)* campaigns to foster the use of newly-equipped audio-conferencing or video-conferencing facilities. Fewer organisations had achieved real breakthroughs in telecommuting (usually from 1 to 3 days a week) or telepresence video-conferencing (which is the highest refinement of video-telephony). In most cases however, interviewees reported that environmental policies drawing on the complementarities between physical mobility and the use of ICT (which some interviewees referred to, respectively, as *real mobility* and *virtual mobility*) had only limited success. The three reasons most frequently given by interviewees for this limited success were the following: *i)* the deployment of new ICT equipment did not address a well identified need of employees, *ii)* it was not supported by adequate policies (awareness campaigns, etc.), and *iii)* it was disconnected from traditional mobility policies and management schemes. Overall, very few of the environmental policies mentioned by the interviewees seemed to match in outcome the prevalent concerns about the environmental impacts of mobility within the company. The main exception to this rule seemed to be $CO_2$ emission levels from the fleets, for which most interviewees reported tangible improvements over the recent years. Although in some cases policies aimed at reducing the environmental impacts of mobility appeared to be strongly anchored in a wider policy of corporate social responsibility, many an interviewee expressed disillusion or even cynicism about environment-driven mobility management measures on the ground that they were at best '*green-washing measures*' or else '*cost-saving measures in disguise*'.

*A recent focus on the economic dimension:* It would appear that, over time, mobility expenditure had come to the forefront in the mobility management processes of the organisations we surveyed. Many interviewees reported that this trend had become even more pronounced since the outset of the global economic crisis in 2008. Indeed, increasingly strained economic conditions led many organisations to establish targets to control or even reduce mobility costs. In most cases, however, the target of enforced cost-cutting plans was exclusively 'travel' expenses ('travel' generally refers to occasional long-distance business trips), disregarding potential savings in everyday local mobility.

**A poorly-managed economic dimension of mobility**

Despite their reportedly predominant focus on costs, at the time of the survey mobility management processes displayed a poor level of accuracy with regard to the economic dimension. First of all, the interviews revealed that in most cases, long-distance 'travel' and local mobility were treated as entirely separate matters. An example of this was the cost-reduction targets established by organisations in recent years, which, as already noted, focused on 'travel' expenses while paying little attention to potential savings on local mobility expenses. On examination of such partial cost-cutting strategies, it appeared that the difference in treatment between 'travel' expenses and local mobility expenses was most probably the result of a difference in *data availability*.

For so-called 'travel' expenses, cost consolidation most commonly relied on standard reporting procedures imposed on external travel service providers. Expenses on employee mileage allowances were usually aggregated for accounting purposes, as they are, up to a certain limit, tax deductible charges. For taxi and short-term car leasing expenses, whether or not the organisation had a clear view on consolidated costs depended on the prevailing service procurement and expense reimbursement procedures. To put it clearly, when the taxi or short-term car rental services were paid for by the employees and later refunded to them on presentation of expense claims, the company would usually not be able to aggregate the related expenses. Alternatively, when the same services were covered by outline purchase agreements with a limited number of selected suppliers, the company would be able to get partially-aggregated figures (such as the number of rental days, annual expenditures, etc.) from its suppliers and then consolidate these figures at company level.

Quite disturbingly, however, we found that hardly any of the organisations surveyed had aggregated the various expenses relating to their automotive fleet (vehicle acquisition, maintenance, fuel, insurance, etc.) into a discernible cost category, let alone consolidated them at company level. However, two interviewees from different organisations, which both had significant automotive fleets in France (in both cases, more than 1,000 vehicles and, in average, 3 vehicles for every 10 staff), gave fairly precise rankings of fleet costs in their respective company's expense list. For these organisations, fleet costs ranked very high, just after wages and real estate, in one case ahead of 'travel' expenses, while coming a close fourth (after 'travel' expenses) in the other case. The reasons for the consolidation of fleet costs being such a difficult, and therefore rare, exercise were largely twofold.

First of all, there was *no homogeneous definition* of the total costs incurred by the company as a result of the acquisition and use of its automotive fleet (see Chapter 3 for a detailed account of how the concept of Total Costs of Ownership, or TCO, has become increasingly common in the professional literature). Besides, as explained earlier for mobility costs, *data availability* would appear to be a key factor influencing the feasibility of cost consolidation at company level.

In practice, for those organisations that would lease vehicles rather than purchasing them outright, elementary cost reporting mechanisms based on long-term rental company datasets enabled a rudimentary concept of TCO to be developed based on the cumulative prices of: *i)* the leasing service, and *ii)* the ancillary services (all optional) that would be included in the leasing contract (insurance and/or maintenance and/or spare vehicle and/or winter tyres and/or fuel card and/or carwash card and/or toll card, etc.). Such calculation of the fleet's TCO would however be dependent on the scope of the leasing contract and would therefore fail to meet the theoretical requirement that all fleet-related costs be accounted for in the fleet TCO. Moreover, when an organisation had separate contracts with two or more long-term rental companies, it would usually receive heterogeneous datasets from these companies, thereby preventing information being consolidated into a comprehensive dataset that could describe the whole fleet's features and costs. Finally, the granularity of information would not usually allow for cost consolidation at the various useful levels (not only national, but also for each branch, each production site, etc.). Organisations that purchased vehicles rather than leasing them would sometimes be even less well-equipped to discuss TCO, unless they had implemented robust in-house reporting mechanisms.

It should be noted that several interviewees acknowledged that their organisation might have overlooked significant sources of savings as a result of this lack of consolidation of mobility expenses in general and fleet expenses in particular. All in all, although a few interviewees seemed familiar with the concept of Total Costs of Mobility (TCM), we found little evidence that this concept would be operative in the near future.

### Characterising the maturity of mobility management processes

Looking back at the various dimensions of mobility that were reported to have been progressively integrated into mobility management processes, we could identify four categories of *underlying strategic interests* that were likely to drive the mobility management processes of organisations:

1) *Operational efficiency:* The two main aspects of operational (technical) efficiency considered by companies when dealing with mobility were *accessibility* on the one hand, and *safety* on the other hand.
2) *Economic efficiency:* Whether dealt with on an *ad hoc* basis or through a more systematic approach, the effective *reporting and monitoring* of the costs of mobility proved to have become increasingly central to mobility management processes.
3) *Brand image with customers:* Measures targeting the *environmental impacts* of mobility (through the deployment of videoconferencing facilities or the acquisition of lower-emission fleets) were frequently reported to fall into this category.
4) *Brand image with employees: Benefits in kind* and, to a lesser extent, *comfort* seemed to be integral parts of the policy of organisations to attract and retain quality employees. On a few occasions, measures aiming to introduce innovation into the company's mobility policy (through the adoption of electric vehicles or in-company car-sharing solutions) were also designed as part of a wider innovative organisational culture.

Having listed strategic interests of such diverse kinds, it should be noted that it could not be easily assessed on the basis of the interviews, which organisations, if any, had been able to develop over time a global, *mature* approach to mobility management, such that they would incorporate all of the above-listed strategic interests into well-balanced mobility management processes. We will henceforth consider that the relative *maturity* of a mobility management process should precisely be assessed against the ability of the organisation to make mobility-related decisions that integrate and weigh its various strategic interests.

It should also be noted that for most of the organisations surveyed, the workplace travel plan was construed as a tool for the diagnostic analysis and auditing of daily mobility patterns (with a main or exclusive focus on the daily commute of employees), rather than a tool for action on those patterns. Some exceptions could be observed, usually with firms involved in the transport sector.

## 6.3.2 Decision-making processes for car fleet acquisition are complex

Now focusing on management processes that target the automotive fleet in particular, rather than the mobility system in general, we will first examine the structure of decision-making for fleet acquisition issues. For the record, in the organisations surveyed, fleet acquisition may take the form of either outright purchase or long-term rental of vehicles. Both these procurement strategies for fleet acquisition will hereafter be treated in a single approach.

In the following, we shed light on several characteristics of the decision-making processes for car fleet acquisition that were revealed by the interviews and that expressed a considerable degree of complexity.

**Highly diverse in-company stakeholders**

A quick scan of the decision-making processes for fleet acquisition described by the interviewees shows the great variety of stakeholders involved within the organisation.

*A variety of functional specialties:* The list of functions or skills possibly involved in the decision-making processes for fleet acquisition included: *i)* purchasing/procurement, *ii)* fleet management, *iii)* human resources, *iv)* finance, *v)* facilities management, *vi)* mobility management, *vii)* logistics, *viii)* sustainable development, *ix)* strategy, *x)* employee services, as well as *xi)* the Board of Directors, *xii)* the various possible user departments (e.g. sales, customer services) and *xiii)* the individual end-users (professional drivers, employees eligible for a company vehicle, etc.). Workplace health and safety committees (in French, CHSCT) and trade unions were also mentioned as potential stakeholders, but we will leave aside their lobbying role to focus on more explicit interventions by departments such as human resources or 'employee services', both of which take into account the influence of health committees and trade unions when drafting policies on fleet acquisition.

It should, however, be noted that the above-listed functions did not always appear as such in the organisational charts of the organisation surveyed. Indeed, in some instances, sustainable development would not be labelled so explicitly but would rather be considered an integral part of CSR (Corporate Social Responsibility; in French, RSE for '*Responsabilité Sociale d'Entreprise*'). Likewise, logistics, facilities management, mobility management and employee services could, in some instances, be incorporated into broad 'general services' departments. Fleet management could arbitrarily be supervised by 'general services', facilities management, logistics, or even human resources, when it was not managed by a dedicated department. Incidentally, the different possible supervising links for fleet management, which were a product of the organisation's history, would appear to have some influence on actual fleet management practices.

Moreover, for a given interviewee, the automotive fleet could either be an exclusive aspect or one of many aspects in the job description. In the latter scenario, the other aspects dealt with by the interviewee could appear quite unconnected with fleet issues. As an illustration, we interviewed a procurement manager who was responsible for three purchasing categories at company level, namely: fleet, standard office supplies and furniture, and intellectual property products and services. Similarly, many a local fleet manager we interviewed would also have facilities management tasks or secretarial support tasks in their job description. The diversity of the roles handled by a given interviewee would appear to affect the level of *expertise* and *personal commitment* this interviewee would display on fleet acquisition issues, unless otherwise swayed by previous experience.

*A variety of geographical scopes of responsibility:* In view of the size of the organisations (and fleets) we surveyed, decisions about automotive fleet acquisition often involved decision-makers at different geographical scales, whether local, national or international. This was particularly true for the 'fleet management' and 'purchasing/procurement' functions mentioned above.

Many of the organisations surveyed employed centralised procurement processes whereby a lead purchasing manager, with specific expertise in fleet purchasing, would manage the procurement process for this purchase category. The lead purchasing manager would coordinate a network of contact persons responsible for procurement at local level (i.e. for one particular site or for a cluster of sites), most of whom would not be fleet specialists. Thus, in such a fleet acquisition process, local purchasing contact persons could be in charge of fleets ranging from 1 to 100 vehicles, while the lead purchasing manager would supervise the organization's entire fleet (up to several tens of thousands of vehicles), in one or more countries.

*A variety of hierarchical levels:* As evidenced by the sample of our interviewees, fleet acquisition decisions would likely involve members of the staff from all hierarchical classes in the organisation, namely: *i)* top-level management, *ii)* middle management, *iii)* first-level management, and *iv)* other staff. Depending on the organisations, final fleet acquisition decisions would usually be made at either top-level or middle-level. Middle-level and first-level managers would more likely be involved in identifying local fleet needs, on the one hand (decision-support process), and in implementing fleet acquisition decisions, on the other hand. However, the interviews revealed that the initiative for adopting new products and services or for implementing new fleet acquisition procedures could come from *any level of management*, although maximum leverage and effectiveness would tend to lie in the hands of higher levels.

*Combining functions, geographical scopes and hierarchical levels:* The variety of possible combinations of functions, geographical scopes and hierarchical levels among the stakeholders involved in fleet acquisition results in highly diverse, heterogeneous decision-making processes across the organisations surveyed. In fact, the complexity perceived by the external observer is even greater, as the interactions among stakeholders, and particularly the distribution of bargaining power, are *i)* not fully transparent (because not all decision rules and procedures are explicit, and/or because various behavioural and contextual factors can influence interpersonal cooperation), and *ii)* most likely subject to dynamic change (due to some functional or geographical reorganisation, for instance, or along with the implementation of new decision-support procedures and tools).

**The organisation's toolbox for fleet acquisition decisions**

The interviews revealed that some of the main functions involved in the decision-making process for fleet acquisition (e.g. procurement, fleet management, human resources, finance) were likely to have developed one or more management tool(s) in order to handle the complexity of their interactions with the other stakeholders in the process. We will now give further details on two of the tools we found were most commonly used in the organisations we surveyed, namely: *i)* calls for tenders, and *ii)* car policies.

*Call for tenders and outline purchase agreements:* Purchasing/procurement departments in large organisations seemed to have extended the practice of calls for tenders (also called 'invitations to tender', or 'calls for bids') to their fleet acquisition processes. The reasons given for using these tendering procedures were mainly twofold: *i)* they were viewed as the best way of guaranteeing the *quality* of purchased products and services (through open, international bidding, and formalised, homogeneous lists of requirements/specifications); *ii)* they would ensure good *price competitiveness* (the consolidation of volumes attracting significant discounts). Such procedures would be typical of highly formalised and centralised decision-making structures.

While implementing very formal tendering procedures for their fleets, the organisations might still have chosen to be either very restrictive in their pre-selection of products, or, on the contrary, very open. Depending on this strategic choice, it would follow that individual fleet purchases would be more or less constrained in terms of vehicle type, drivetrain, options, equipment, etc.

When it was decided that the fleet acquisition process should be centralised, purchasing departments would commonly have opted for outline purchase agreements. Such agreements are not actual purchase orders, but they enable some terms and conditions – such as price, quantities, discounts, etc. – to be fixed over a defined period of time (usually between 1 and 5 years, as far as fleet purchases are concerned). Thanks to the pre-negotiation of part of the purchase contract terms, day-to-day purchasing would usually be facilitated (for instance through reduced delivery lead times), but also better monitored.

It should be noted that, although they could bring great benefits to the organisations, tender procedures and outline purchase agreements were reported to be quite burdensome. Indeed, for those fleets that had chosen to lease their vehicles, rather than buying them outright, two tendering procedures would be launched: one for the selection of car manufacturers, and another for the selection of long-term rental companies. Criteria for the selection of car manufacturers would include: *i)* portfolio of models, *ii)* geographical coverage, *iii)* standard residual values of cars, and *iv)* discounts. Criteria for the selection of long-term rental companies would include: *i)* portfolio of makes (to match the selection of car manufacturers), *ii)* leasing costs, and *iii)* ancillary services (maintenance, insurance, tyre management, etc.).

For fleets with a limited number of vehicle types, the double tendering procedures would often culminate in the signing of tripartite agreements with the selected car manufacturer (in this case, there would likely to be only one car manufacturer selected per vehicle type, e.g. one for passenger cars, one for light commercial vehicles) and the selected long-term car rental company(ies) (usually between 1 and 3).

For very large, more complex fleets (up to 10 vehicle types: urban passenger car, saloon, passenger minivan, minibus, commercial minivan, commercial van, etc.) with acquisition processes covering the needs of several countries (the most frequent example was France-Belgium-Netherlands-Luxembourg), the double tendering procedures could be much more elaborate. Due to national specificities in terms of vehicle supply (different manufacturers are unevenly distributed in different countries), tax schemes (e.g. corporate vehicle tax schemes, environmental tax schemes), and patterns of vehicle use, international tendering procedures would then produce a shortlist of car manufacturers (up to 5) and another shortlist of long-term rental companies (up to 3) for the whole fleet. The selection process would then proceed at national level for a better reflection of national preferences. Figure 6.8 illustrates the complex tendering procedures described by one interviewee in charge of purchasing for a multinational corporation with a fleet of 700 passenger cars in France.

Incidentally, the interviews revealed that some large, complex fleets chose to launch separate tendering procedures for different types of vehicles, e.g.

official cars ('perk' cars) *vs.* service vehicles, or passenger cars *vs.* light commercial vehicles.

By contrast with such formalised procedures, one particular organisation, with a fleet of 10,000 light vehicles in France, chose to negotiate mutually agreeable contracts with its fleet providers (two car manufacturers and three long-term rental companies). This procedure allowed the organisation to set extremely precise and demanding specifications. In particular, very elaborate cost criteria (e.g. TCO, for Total Costs of Ownership, including both the cost of acquisition and operating costs) could thus be taken into account. It should be noted that this procedure entailed a need to centralise very detailed information on the various patterns of vehicle use. Indeed, a detailed TCO approach requires the collection of data, for each type of vehicle use pattern, on mileage, load, etc.

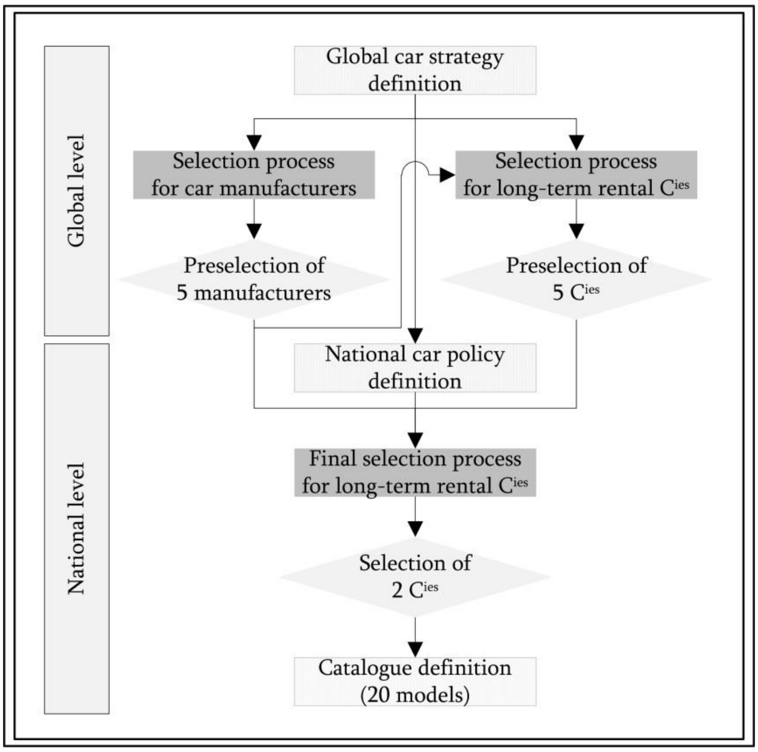



**Figure 6.8: A schematic representation of a complex, international tendering procedure for fleet acquisition (700 passenger cars in France)**

*Car policies:* Human Resources (HR) departments in large organisations have developed a management tool designed to formalise the rules and conditions for allocating car benefits to employees.[9] Car policies would therefore appear to be

[9] By 'car benefits' we mainly refer to 'official cars' (also called 'perk cars'), which can be used for both private and professional purposes, although some car policies would also

typical of formalised, centralised fleet acquisition processes. They could be construed as a synthesis of the expectations and vested interests of the various stakeholders involved in the fleet acquisition process, in particular those of human resource departments (which consider that car benefits could play a key role in attracting and retaining quality employees), finance departments (which want to keep down the total costs of fleet ownership), and CSR departments (which want to ensure that the fleet complies with corporate policies on social and environmental issues). Because of the significant impact of national legislation on the costs of car benefits to organisations (see Chapter 3 for further information), car policies would not usually be consolidated at international level.

Several interviewees agreed to disclose their organisation's car policy documents. These documents most usually included three sections: *i)* eligibility, *ii)* car selection, and *iii)* rights and duties. The 'eligibility' section would identify the different positions and/or categories of staff in the organisation (from 2 to 10 categories) who could apply for a car benefit. The section on 'car selection' would identify, for each eligible category of staff, the category of vehicle that could be applied for. It would also set criteria for each category, such as typical makes and models, car allowance amounts, purchase prices (and/or 'list' prices, even for leased vehicles), leasing costs, mileage allowance, duration of leasing contracts, mandatory equipment (such as air conditioning, in-car entertainment, GPS, Bluetooth car kit, cruise control, metallic paint, colours, etc.), maximum budget authorised for additional options or accessories, emission ceilings, etc. The section on the 'rights and duties' of the recipient of a company car would determine, for each category, whether or not the vehicles could be used for personal as well as professional purposes, and whether or not other family members could drive the vehicle outside business hours. It would also clarify how vehicle fringe benefits would be calculated in accordance with national legislation. It would then list the ancillary benefits and services associated with the company vehicle, as well as their terms and conditions. Most common ancillary benefits and services included: maintenance and repair, insurance, fuel card, winter tyres, and car wash. The car policy could also include a clause on the 'end of contract option to buy'. Finally, the 'rights and duties' section would clarify the organisation's policy on accidents ('collision damage excess', etc.), and on road traffic offences (payment of fines, civil and criminal liability, etc.). Usually the car policy would stipulate that the recipient of a company car is expected to treat his/her car '*en bon père de famille*' (i.e. safely and prudently,

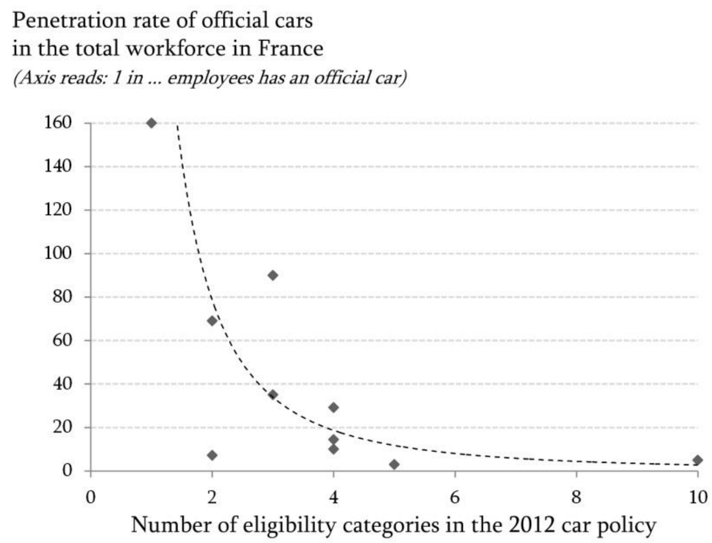
guide the allocation of 'service vehicles' (see Chapter 3 for detailed definitions of these concepts).

with due diligence, as a 'good father' would treat his family). Table 6.1 illustrates the common structure and content of company car policy documents.

| Section | Eligibility | Car selection | Rights and duties |
|---|---|---|---|
| Content | Eligible **staff categories** (2 to 10), e.g.:<br>- Board of Directors<br>- Top-level management<br>- Middle management<br>- First-level management<br>- Sales officers<br>- Couriers<br>- Official chauffeurs<br>- Maintenance technicians<br>- Etc. | 1. Cross-reference table (eligible **staff/vehicle** categories), e.g.:<br>- Sales officers ➔sedan<br>- Couriers ➔duty minivan<br>2. For each category:<br>- Typical makes and models<br>- Maximum **car allowance** and/or leasing cost and/or purchase price and/or "list" price<br>- Mileage allowed<br>- Duration of leasing contracts<br>- Mandatory equipment (e.g. air conditioning, radio player, GPS, Bluetooth car kit, cruise control, metallic paint, colour)<br>- Add. options/accessories<br>- **Emission ceilings**<br>- Etc. | 1. Rules for professional and **private** uses<br>2. Rules for use by relatives<br>3. Rules for calculating the vehicle **fringe benefits**<br>4. Ancillary benefits and services, e.g.:<br>- Maintenance and repair<br>- Insurance<br>- **Fuel card**<br>- Winter tires<br>- Car wash<br>- Etc.<br>5. Buy-option at contract-end<br>6. Policy on accidents and road traffic offences<br>- Insurance and accident damage excess<br>- Payment of fines<br>- Civil and criminal liability<br>- Etc. |

**Table 6.1: Structure and content of a typical car policy document**

Of the 22 organisations surveyed, 13 reported having developed a consolidated car policy at corporate level for their official car fleet in France. The smallest fleet covered by such a consolidated car policy had 30 vehicles, while the largest had 7,000. A single car policy could include the fleets of up to 800 different registered business names of a single corporation. We could establish a link between the *penetration rate* of official cars into the total workforce (defined as the ratio of the total number of official cars in France to the total headcount of the workforce in France) on the one hand, and the *degree of vertical differentiation* in the car policy itself (defined as the number of eligible categories specified in the car policy) on the other hand. Figure 6.9 illustrates how the 'democratisation' of official cars in some organisations (5 organisations had more than 1 official car for every 20 employees) goes hand in hand with more vertically differentiated car policies.




*Note: Of the 13 organisations which reported having developed a consolidated car policy at corporate level for their official car fleet in France, 2 are missing from this graph: 1 did not provide the number of eligibility categories in its car policy (penetration rate was 1 official car for 21 employees in France), and 1 was excluded to make the graph more readable (penetration rate was 1 for 1550, only 1 eligibility category).*

**Figure 6.9: The link between official car 'democratisation' and vertical differentiation in car policy**

### 6.3.3 Learning paths to fleet use optimisation

Still on the issue of the processes involved in the management of corporate car fleets, we will now examine decision-making processes for issues relating to fleet operations (rather than fleet purchase behaviours).

**Developing a typology for car fleet use patterns**

The first significant finding of our survey with regard to fleet operations was that the logic of fleet use patterns differs greatly according to whether it was service vehicles that were considered or official cars (or 'perk' cars). We therefore identified the distinction between these two categories as the first layer of a raw typology of car fleet use patterns.

It should be noted that the labelling of these two categories of corporate vehicles lacked consistency from one organisation to the other: official cars (which we defined as vehicles that could be used for both personal and professional purposes) could be labelled alternatively as 'statutory vehicles' or 'perk cars' by some interviewees, while service vehicles (which we defined as vehicles that could be used exclusively for professional purposes) could be labelled as 'professional vehicles', or else 'company vehicles'. Although such a variety of terms might appear confusing at first glance, there seemed in fact to be little or no confusion between the vehicles which were to be used for strictly professional purposes, and those which could be used for private purposes. In practical terms, the information on the distribution of the vehicles of a particular fleet between service vehicles, on the one hand, and official cars on the other hand, was readily available for most of the organisations we surveyed (the information could be collected for 147,000 vehicles of the 163,000 in the sample). As illustrated in Figure 6.10, 82% of the corporate vehicles we could classify in either category were used as service vehicles, and 18% were used as official cars.

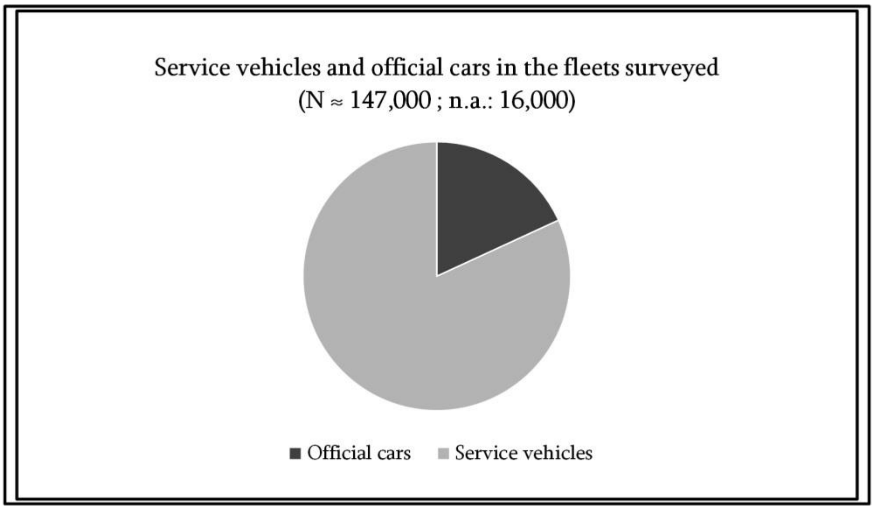



**Figure 6.10: Discriminating service vehicles from official cars among the vehicles in sample**

We further noted that the nature of the information required to optimise fleet operations was quite different between these two vehicle categories. Below, we sketch two separate analytical frameworks within which fleet operations could be described and, if need be, optimised:

1) For *service vehicles*, the main keys to the understanding and optimisation of fleet operations would appear to be: *i)* whether the vehicles were assigned to an exclusive driver or part of a pool; *ii)* whether the vehicles would be used for routine rounds (e.g. postal services), variable rounds (e.g. express delivery, maintenance of infrastructure networks) or one-off missions (e.g. visit to customer, meeting at headquarters); *iii)* whether the vehicle would usually cover a limited or extensive geographical range; *iv)* whether or not parking facilities were available at the workplace(s); *v)* whether the vehicle would be parked at night in a company facility or at the employee's residence (even though no personal use of the vehicle was allowed); and *vi)* whether maintenance, tyre management and other vehicle services were provided by in-house services or outsourced.

2) For *official cars*, the main keys to the understanding and optimisation of fleet use would appear to be: *i)* the whole range of use patterns, for both private and professional purposes, and for both routine and occasional trips (in many cases, the choice of the official car was based on the once-yearly family holiday trip); *ii)* the explicit or hidden incentives and obstacles to car use (which could lie in the availability and cost of parking at the workplace, on the policy on personal fuel and/or toll expense claims, etc.); and again *iii)* the management – whether or not outsourced – of maintenance, tyres and other vehicle services.

We could make several interesting observations based on these analytical frameworks. First of all, as far as service vehicles were concerned, we noted significant discrepancies in the intensity of vehicle use: the 7 fleets of vehicles used for technical assistance and other on-site interventions (e.g. for construction sites, network maintenance) could cover between 18,500 km and 75,000 km per year (30,000 km on average across 8 different fleets);[10] whereas the vehicles used in pools or in corporate car-sharing fleets (e.g. for inter-site journeys or the occasional visit to a customer or supplier) could cover between 7,500 km and 31,500 km per year (16,000 km on average across 4 fleets); the vehicles used for local in-house logistics and courier services could cover between 10,000 km and 15,000 km per year (12,500 km on average across 7 fleets); and finally the vehicles used as shuttles on closed sites (1 fleet in our sample) could cover as little as 2,500 km per year. We furthermore noted that the intensity of vehicle use could be quite sensitive to the geographical range of fleet operations. As an illustration, one particular corporation with an 18,000-vehicle fleet used for technical interventions on a nation-wide network recorded average annual mileage of 18,500 km for its service vehicle fleet at a national level, while the average annual mileage was only half as high (9,000 km) in the Paris region, and 4,500 km in the City of Paris.

Moreover, as far as official cars were concerned, we noted quite intensive vehicle use, ranging from 14,000 km per year to 40,000 km per year (24,500 km on average across 11 fleets). Due to the level of aggregation of the available data, we could not identify a geographical effect on the intensity of use. We noted, however, that the use of official cars was even more intensive when the organisations would cover the fuel expenses incurred by employees for private journeys. Indeed, all but one official car fleet that did not cover private fuel expenses recorded average annual mileages of 22,000 km or less.[11] Conversely,

[10] The average values across fleets are not weighted by vehicle counts.

[11] The only exception is a fleet of 7,000 official cars with an approximate annual mileage of 30,000 km even though private fuel expenses are not covered by the organisation.

all official car fleets that did cover private fuel expenses (usually up to a fixed limit, e.g. 10,000 additional kilometres per year on top of professional mileage) displayed average annual mileages above that threshold. It therefore appeared to us that there was a strong correlation between the intensity of official car use and the extent to which organisations would cover their employees' private fuel expenses.

**Overcoming the shortcomings of poor information on fleet use and fleet costs**

The second significant finding of our survey with regard to fleet operations was that the quality of information available to decision-makers was generally deemed unsatisfactory.

*Information shortfalls:* Many participants, whether they were purchase officers or fleet managers, whether they had local or national responsibilities, stated that they did not have access to all the relevant data they would have needed to make informed decisions about fleet operations. As had already been pointed out with regard to the information on mobility costs or car fleet costs (see subsection 6.3.1), data availability seemed to play a key role in the effective capacity of organisations to manage and optimise their fleet operations.

*Coping strategies:* In most cases, we observed that organisations were not far along the path of implementing effective tools to monitor the use and costs of their fleet. Two main coping strategies could then be adopted to overcome the lack of information: *i)* rough, aggregated, *ex-post* indicators on fleet use and fleet could be used to monitor trends in fleet use and fleet costs over the medium- to long-term; and *ii)* trial-and-error approaches could be used to make short- and medium-term adjustments in fleet operations (e.g. re-dispatching of vehicles with too high or too low a daily mileage).

*Learning paths:* On top of the above-mentioned coping strategies, we were able to observe that most of the organisations surveyed had gradually adopted the crucial conceptual building blocks and the most common tools and processes of fleet management. Starting a few years back, these organisations would have launched elementary reporting and monitoring processes based on the monthly data provided by the long-term rental companies in order to track their fleet's size, structure, age, mileage, fuel use, emissions, etc. Cost accounting processes were also instigated using the long-term rental companies' proprietary tools although, as was discussed in subsection 6.3.1, these tools had multiple limitations: *i)* failure to provide exhaustive reporting on costs, *ii)* difficulty in merging datasets from different suppliers, and *iii)* failure to consolidate fleet costs at all relevant levels (not only globally and nationally, but also for each branch, production site, etc.). Some organisations had developed their own fleet management software in the 1990s (from scratch or based on an existing solution), but in-house software would usually have ceased working after a few years because of insufficient upgrading and/or maintenance. On the other hand, the interviews pointed to a growing use of externally-sourced fleet management software (such as WinFlotte®, or InfoParc®). These tools would usually perform the following three basic functions: *i)* consolidation of data from all external sources (long-term rental companies, fuel suppliers, etc.), *ii)* elementary administrative and financial management (register of vehicles and designated users, soft copy of car policy and vehicle catalogue, etc.), and *iii)* data extractions and reporting for fleet decision support (on costs, mileage, $CO_2$ emissions, linkage with accounting software, etc.). It was, however, not uncommon to see different software being used by different affiliates within the same organisation, hampering the process of consolidating fleet management at the wider organisation level. Moreover, some organisations using CMMS (Computerised Maintenance Management System; in French: GMAO, for '*Gestion de Maintenance Assistée par Ordinateur*') software for their fleet brought up the fact that the lack of interoperability between fleet management software and CMMS software was prejudicial to the overall efficiency of the fleet management processes (a given vehicle would usually have a separate avatar in each software and all vehicle use data would have to be duplicated). Finally, it was pointed out by the interviewees on several occasions that external fleet management software could only be '*as good as the data you feed it with*'. Thus, unless the organisations had sufficient resources to feed the fleet management software with relevant data from all stakeholders (long-term rental companies, fuel suppliers, end-users, maintenance workshop, etc.), the software would only deliver partial information on fleet use and fleet costs.

*Some pioneering approaches:* More than one in three organisations we surveyed had launched a pilot or large-scale programme to deploy monitoring and/or tracking technologies. The economic rationale behind the introduction of such technologies in the fleet management process could derive from any combination of the following five main functions we identified:

1) Monitoring devices could be used by fleet managers for *technical reporting* (information on mileage, incidents and breakdowns) in order to plan ahead for vehicle maintenance and limit vehicle downtime;
2) Monitoring devices could also be used by fleet managers for *operational reporting* (information on mileage, average speed, time in traffic jam) in order to plan ahead for vehicle routing and dispatch;
3) Monitoring devices could provide *real-time feedback to drivers* on fuel use and accelerometry data with a view to fostering individual eco-driving practices and lessening fuel expenses;
4) GPS devices could be used by drivers for *individual navigation* with a view to optimising single trips or complex missions (e.g. avoiding traffic jams);

5) Tracking devices could be used by fleet managers for *real-time vehicle geolocation* in order to achieve dynamic, real-time optimisation of routing and dispatch.

Several interviewees also mentioned possible gains in operating expenses through a reduction in fuel fraud (which usually entails the use of company fuel cards to cover fuel expenses incurred for private purposes). But participants tended to remain reticent about the scale of fuel fraud and the response of their respective organisations, arguing that these were highly sensitive topics.

On top of reductions in operating costs, further benefits were expected from monitoring and tracking technologies in terms of safety (avoiding breakdowns, locating vehicles in trouble), capital costs (downsizing the operating fleet, reducing the need for replacement vehicles), emission cuts, etc.

However, the introduction of monitoring and/or tracking technologies in fleet management processes seemed to encounter a number of obstacles. The most frequently mentioned was the reluctance of trade unions to implement technologies that might encroach on employees' privacy. It was reported to us on several occasions that human resource departments would warn of the risk of a conflict with trade unions to discourage the implementation of these technologies. Whenever an organisation had decided to pursue the deployment of such solutions, it was reported that making the necessary declarations to the CNIL (French data protection authority) could be a cumbersome process. Another obstacle mentioned by interviewees was the cost of the technologies. One participant also mentioned the cost of vehicle downtime incurred as a result of retrofitting (i.e. equipping existing fleet vehicles with the new technology). Finally, it seemed that interviewees were still concerned that vehicle monitoring and tracking technologies lacked maturity, thereby exposing them to the risk of obsolescence. In the absence of appropriate technological standards, they felt that there was no guarantee of interoperability between the various systems brought to the market by manufacturers, long-term rental companies and independent suppliers.

**What is at stake in the development of fleet operation management expertise?**

As already discussed, over the short- to medium-term, the development of fleet operation management expertise could be key to the optimisation of fleet operations, through advance planning of vehicle routing and dispatch or of vehicle maintenance and associated downtime, or yet the large-scale implementation of eco-driving practices.

Over the longer term, it should be further noted that the development of fleet operation management expertise could also be essential in providing all the information relevant to the decision-making processes involved in managing fleet acquisition (and renewal). It is indeed our understanding that a deeper knowledge of the operational needs of the fleet users –in terms of vehicle types, drivetrain technology, options and additional equipment – would be instrumental in increasing the overall efficiency of fleet purchase decision-making processes. In particular, it would enable more accurate prior assessment of the overall costs of vehicle ownership, through the introduction of TCO criteria into tendering procedures for fleet acquisition, as well as into company vehicle policies.

## 6.4 Insights into the uptake of innovations by corporate car fleets

In what follows, we use the information collected through our survey to explore how innovations are considered for adoption by corporate car fleets. We focus our discussion on two different kinds of innovations which showed good potential at the time of the survey, judging from professional journals and special reports by the general press: on the one hand, battery-electric vehicles (subsections 6.4.1 to 6.4.3); on the other hand, car-sharing solutions (subsection 6.4.4).

### 6.4.1 Main barriers to the uptake of BEVs by fleets

The results presented earlier showed that the prospects for fleet optimisation – from the perspectives of both purchase behaviours and daily operations – would very much depend on the solutions that corporations could find to tackle the complexity of the decision-making processes associated firstly with car fleet acquisition, and secondly with the shortcomings of information on fleet use and fleet costs.

When discussing the prospects for EV adoption by corporate car fleets, the interviews revealed that such *internal* challenges could turn into real barriers. Indeed, because of the lack of prior experience with such vehicles, the decision-making process for the acquisition of EVs would be even more sensitive to the preliminary assessment of their operational suitability and economic viability (see Figure 6.2). In many organisations however, neither of these criteria could be assessed with much confidence for lack of sufficient familiarity with EVs.

On top of these internal barriers to the uptake of EVs in corporate car fleets, the survey also pointed to certain *external* barriers stemming either from the regulatory framework or the supply-side conditions. On the regulatory side, the barriers most frequently mentioned were: *i)* the lack of standardisation in charging infrastructure and equipment, *ii)* the difficulties in implementing the so-called ‘right to charge’ policy in leased facilities (derived from the Second

Grenelle Act[12]), *iii)* the lack of clarity in the regulations on charging safety in tertiary sector buildings, or yet *iv)* the lack of clarity in the tax framework with regard to the benefits-in-kind provided to employees in the form of a charging terminal at their home. On the supply side, the barriers most frequently mentioned were: *i)* the immaturity of the electro-mobility system (reservations were expressed on a wide range of topics, from battery technology to vehicle resale value), *ii)* the inadequacy of the public charging infrastructure (there were reservations about the number of public charging points, the lack of information on the availability of public charging points, the conditions for accessing the public charging service, or yet the type of charge available – whether standard, semi-fast or fast), *iii)* the lack of reliable information on vehicle range and vehicle maintenance, and *iv)* the cost disadvantage of EVs – especially light commercial EVs – considering the high levels of discount applied by car manufacturers on their conventional counterparts bought by key accounts.

### 6.4.2 Main drivers of the adoption of BEVs by fleets

Notwithstanding the above-listed internal and external barriers to the uptake of BEVs by fleets, it should be mentioned that EVs were often presented in a positive light by those organisations with prior experience of them. The arguments in favour of the introduction of EVs in corporate car fleets could be ranked as follows, from most prevalent to least prevalent in our survey results:

1) *Brand image with customers:* EVs were deemed to have a positive impact on the organisation's brand image with regard to environmental performance (by reducing carbon footprint and local pollutant emissions, helping to meet CSR commitments, etc.). Additionally, some of the organisations that were stakeholders in the developing electro-mobility system contended that the adoption of EVs in their own fleets would help to disseminate the culture of electro-mobility among potential clients of their EV-related products or services. Finally, many

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[12] *Loi n°2010-788 du 12 juillet 2010 portant engagement national pour l'environnement*, Art.57. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000022470434.

See also the implementing decree: *Décret n° 2011-873 du 25 juillet 2011 relatif aux installations dédiées à la recharge des véhicules électriques ou hybrides rechargeables dans les bâtiments et aux infrastructures pour le stationnement sécurisé des vélos.* Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000024400356.

organisations deemed that the adoption of EVs in their fleet would give them an opportunity to stand out as leaders in innovation.

2) *Economic efficiency:* Many organisations reported that EVs compared favourably with conventional vehicles based on a Total Costs of Ownership approach, because of lower operating costs (fuel and maintenance). It was also reported that EVs would reduce the exposure of organisations to fuel price volatility. Finally, the relatively high upfront costs of EVs were perceived as an incentive to the pooling of fleet resources (through car pools or car-sharing schemes).
3) *Operational efficiency:* The perceived operational advantages of EVs over conventional vehicles were couched in terms of technical performances (reliability of the electric engine, effectiveness of engine braking, etc.), and/or driving pleasure and comfort (vehicle responsiveness, noise reduction, absence of vibration, interior finish).
4) *Brand image with employees:* Several organisations reported that the introduction of EVs into their fleets would help them embed sustainability and/or innovation in their organisational culture.

### 6.4.3 Some good practices with regard to BEVs in fleets

Out of the 22 organisations in our survey, 11 had taken part in the joint BEV-purchasing initiative led by La Poste Group and coordinated by the French central public procurement office, UGAP (*Union des Groupements d'Achats Publics*), which in October 2011 resulted in a purchase order for nearly 19,000 BEVs to serve in the fleets of 20 public and private organisations (UGAP and La Poste, 2011).[13] These 11 organisations would account for 4,000 of the 19,000 BEVs included in the joint purchase order (La Poste Group alone ordered 10,000 BEVs, thereby representing more than half of the total vehicles ordered).

By the time of the survey, close to 500 EVs had already been delivered to the organisations in our sample involved in this joint BEV-purchasing initiative. These organisations would therefore have practical experience of EVs. Some of them would even have already taken specific measures to facilitate the deployment of EVs as service vehicles. For instance, it was interesting to observe that a few organisations had anticipated the deployment of EVs in their fleet by systematically identifying the vehicle use patterns best adapted to EVs, which entailed careful consideration of the trade-off between, on the one hand, the

[13] The organisations that took part in the 2011 joint BEV-purchasing initiative were: ADP, Air France, AREVA, Bouygues, EDF, Eiffage, ERDF, France Télécom Orange, GDF, Suez, Suez Environnement, GrDF, GRTgaz, La Poste, RATP, SNCF, SPIE, VEOLIA, VINCI, SAUR, and UGAP.

limited vehicle range of EVs and, on the other hand, the increasing cost advantage of EVs with high-mileage use patterns. Moreover, several organisations had already launched large-scale training campaigns for eco-driving, and many other were seriously considering following suit. These organisations considered that training in eco-driving would enable drivers to handle the battery range constraint better, from both the operational and psychological perspectives (the latter referring to the so-called 'range anxiety' experienced by drivers who have recently switched to EVs). Also, eco-driving was deemed most effective when combined with risk prevention training.

Interestingly, a few organisations in our sample reported encouraging their employees to choose an EV as their official and/or private vehicle. In the former case, they might for instance tolerate vehicle leasing fees in excess of the conventional upper limit set in the car policy. In the latter case, they might temporarily lend EVs from the corporate fleet to employees who had expressed an interest in testing the vehicles. One organisation had also set up an interest-free loan scheme to help its employees purchase EVs. Finally, several organisations would provide their employees with informational content on EVs (about technology, market opportunities, tips and tricks, etc.) through monthly newsletters or via a dedicated community on the corporate social network.

Most organisations that had practical experience of EVs acknowledged that testing the vehicle was key to its adoption. It should, however, be noted that the emphasis placed on the role of practical testing seemed double-edged. Indeed, very few experimental schemes reported to us seemed to have been designed on sufficient scale (in particular, some EVs had been deployed in small-scale corporate car-sharing schemes which would most likely fall short of expectations because they could not reach critical mass). Furthermore, even when the experimental schemes were successful, the lack of appropriate operational feedback programmes would usually make it difficult to disseminate – let alone duplicate – good practices.

### 6.4.4 Insights into the adoption of car-sharing by organisations

Out of the 22 organisations surveyed, 11 had endeavoured to include car-sharing in their mobility portfolio, either through an in-house car-sharing fleet (10 organisations in the sample had equipped at least one site with such a fleet) or through contracting with a public car-scharing scheme (1 organisation in the sample had contracted with Autolib in the Paris region, 1 with Citlib in Grenoble). For the record, this high proportion is a direct result of the criteria we set in our methodology for the selection of organisations to be surveyed.

The two main benefits that were expected by organisations from adding car-sharing to their portfolio of corporate mobility solutions, were: *i)* the potential reductions in taxi, short-term rental and work-related car expense claims; and *ii)* the potential downsizing of the service vehicle fleet. Several organisations, however, also couched the deployment of their respective car-sharing schemes as an opportunity to offer their employees an additional mobility solution that would be efficient, innovative and environment-friendly. Interestingly, in one of these organisations in particular, the car-sharing scheme was managed by a department labelled 'employee services'.

**The design of in-house car-sharing experiments**

It should be noted that, in most organisations concerned, car-sharing experimentation was still in its infancy at the time of the survey. Indeed, only 4 of the 10 in-house corporate car schemes we surveyed had been operating for more than a year. Interestingly, 3 of these 4 schemes were among the largest car-sharing schemes in the sample, with 3 or more sites covered (up to 12 sites for the earliest scheme), and 20 or more vehicles in operation (up to 60 vehicles for the earliest scheme). All other schemes would usually include 1 or 2, and in any case no more than 5, vehicles in operation, located on 1 or 2 sites.

The question of the relevant *scale of experimentation* for in-house car-sharing schemes was reported to be crucial in the effective use of car-sharing vehicles by employees for their work-related trips. Indeed, below a certain threshold, or '*critical size*', in-house car-sharing schemes would usually fail to fulfil their intended purpose(s) due to *i)* the scheme's lack of visibility in the portfolio of mobility solutions, and/or *ii)* a poor service level (too few vehicles would make the service unavailable most of the time). Therefore, the organisations that had implemented an in-house car-sharing scheme without a robust prior assessment of the critical size for such a scheme, would usually struggle to extend the initial experiment to a full-scale corporate car-sharing scheme. As a matter of fact, none of the 3 largest car-sharing schemes in operation in the organisations surveyed had started with a very small number of vehicles. Whether the original decision was taken for political or economic reasons, or both, all 3 of those schemes had been launched on a voluntary basis.

However, the question of the relevant scale for experimental in-house car-sharing schemes should not be considered independently of other important questions. In particular, the question of the *available alternatives* appeared to be of the essence. Indeed, when a particular organisation implemented its car-sharing scheme based on the prerequisite that the total car fleet should be reduced by 15% in just 3 years, it ensured the gradual adoption of the car-sharing scheme by its targeted users (in this case, the organisation's major sites would dispose of 3 service vehicles for each vehicle added to their car-sharing fleet, and a car-sharing service could only be launched on a new site with a minimum of 3 vehicles at its starting point). Conversely, several organisations, which had neither set fleet downsizing objectives, nor implemented disincentive policies against the use of taxis, short-term rental vehicles or personal cars, would usually record low levels of use of the car-sharing fleet (less than 1 outing per vehicle per day).

In addition, the question of the relevant scale for in-house car-sharing schemes should be considered alongside the question of the *access policy*. In the earliest, largest scheme (5 years in operation and about 60 vehicles at the time of the survey), access to the car-sharing scheme was restricted to designated staff members. This restriction resulted in an average ratio of 15 to 20 eligible users per vehicle in this particular car-sharing fleet. The organisation in question had recorded an average of about one outing per vehicle per day during the month prior to the survey, for a little over 4 different effective users per vehicle. Another organisation, with a car-sharing service of around twenty vehicles which had been in operation for about a year at the time of the survey, had chosen not to restrict access to its car-sharing fleet. That organisation recorded an average of one outing per vehicle per day, although there were around 50 subscribers per vehicle, pointing to the fact that most subscribers were only occasional users. A 4-vehicle car-sharing fleet with 2 years of operation at the time of the survey had also chosen a policy of inclusion with regard to access to the car-sharing fleet. Despite the limited number of vehicles, this fleet recorded an average of 1.5 outings per vehicle per day, with approximately 25 subscribers per vehicle (one tenth being frequent users of the service). These observations point to the influence of the access policy, whether inclusive or exclusive, on the effective adoption of the car-sharing scheme by employees.

Finally, it should be noted that the interviews also suggested that, regardless of the size of the car-sharing fleet, the available alternatives, or the nature of the access policy, all in-house car-sharing schemes that were eventually recognised as 'success stories' first went through a *phasing-in period* before reaching a satisfactory level of use. Thus, all organisations beginning experiments with car-sharing should expect gradual adoption, and make plans for their assessment programme accordingly, all the while bettering their odds at success by checking for *i)* the critical size of the fleet (aiming at an appropriate visibility of the service, and a better service level), *ii)* the priority given to the car-sharing solution over alternative solutions (e.g. taxi, short-term rental or employees' personal cars), and *iii)* the access policy.

**Recent developments**

Two notable developments in the corporate car-sharing fleets in our sample were: *i)* the rising proportion of electric vehicles in corporate car-sharing fleets; *ii)* the extension of corporate car-sharing services for employees to meet their private mobility needs on evenings and weekends on a cost-recovery basis.

*EVs in corporate car-sharing fleets:* Electric vehicles made up close to 50% of the car-sharing fleets we surveyed. At least 4 of the 10 in-house car-sharing fleets were exclusively electric, but most were exclusively conventional or mixed the two types of drivetrains. The earliest scheme, which had been in operation 5 years at the time of the survey, first started exclusively with conventional vehicles, but later gradually introduced electric vehicles. The organisation's objective was that the fleet should convert almost completely to electric drivetrains over a 3-year period (it was already up to 40% at the time of the survey). An analysis based on all the vehicles at 2 car-sharing sites over a 2-year period had shown that 40% of vehicle bookings were for trips not exceeding 10 km, and 95% for trips not exceeding 50 km.

The survey revealed that the mutual benefits and disadvantages of EVs and car-sharing were deemed asymmetrical. On the one hand, in terms of *economic efficiency*, it was a view shared by several interviewees concerned that car-sharing schemes were most favourable to the introduction of EVs into corporate car fleets. This was based on the observation that the high upfront costs and low operating costs of such vehicles acted as incentives to pool fleet resources. In terms of *brand image with customers*, the use of EVs in car-sharing fleets was deemed to increase brand visibility and generate positive public exposure.

On the other hand, in terms of *operational efficiency*, EVs were deemed to add some complexity to the management of a corporate car-sharing fleet. Indeed, although most of the trips using the car-share vehicles of the organisations surveyed were compatible with the limited range of EVs, the repeated use of vehicles on a given day was likely to impose specific constraints on EVs unless they could access fast-charging facilities, if need be, between two trips. Thus, managing a car-sharing fleet including EVs would have to take account of battery charging requirements on top of the usual vehicle management requirements. However, the use of EVs would remove the constraint of managing vehicle refuelling by fleet management staff or by vehicle users themselves. Finally, it was not clear whether EVs were a positive or a negative asset in corporate car-sharing schemes in terms of *brand image with employees*. Depending on the official rationale given for deploying the car-sharing scheme in the first place, and on its positive or negative wording in particular, EVs could be perceived as a source of greater difficulties in using and/or managing the car-sharing scheme, or, on the contrary, they could be perceived as a factor that increased the attractiveness of the car-sharing scheme because of their innovative and environmental qualities.

*Extension of corporate car-sharing services to the private trips of employees on evenings and weekends:* 4 out of the 10 in-house car-sharing fleets in the organisations surveyed had extended, or were considering extending, the car-sharing service to the private mobility needs of employees on a cost-recovery basis. In several cases, the decision to open the car-sharing scheme to private trips on evenings and weekends was only conditional on overcoming insurance-related hurdles.

From the perspective of *economic efficiency*, such an extension of car-share services was seen as an opportunity to turn the car-sharing fleet into a profit centre, thereby bringing the organisation further economic benefits (in addition to reducing expenses on taxis and short-term rental).

Furthermore, from the perspective of *brand image with employees*, the extension of car-sharing services to private trips on evenings and weekends was perceived as a valuable benefit offered to employees. Usually, car-sharing bookings made for private purposes would be priced on a cost-recovery basis, which would be quite appealing to the occasional user. In an area such as the Paris region, with very good public transport services, some car-sharing fleet managers even thought that the corporate car-sharing scheme could be an effective substitute for a second car in households with more than one vehicle, or even for the first car in households with only an occasional need for a car. In addition, they thought that the use of corporate car-sharing vehicles for private purposes could, in turn, help build user confidence, thereby attracting and retaining new users who would use the service for work-related purposes during the working week.

**Main barriers to the uptake of car-sharing by corporate car fleets**

Based on the interviews of organisations having only embryonic experience, if any at all, of in-house car-sharing, we were able to identify several significant barriers to the uptake of car-sharing by corporate car fleets.

First, it appeared that many interviewees had only partial, and sometimes very limited, knowledge of car-sharing services, their operational requirements, their costs, and their potential benefits (economic, environmental or otherwise).

In addition, some interviewees who reported having undertaken preliminary investigations and/or more in-depth assessments of in-house car-sharing services reported that such services would face a twofold acceptability challenge with corporate stakeholders. On the one hand, it would sometimes be difficult to gain support for car-sharing services amongst middle-level managers whose jobs could be threatened by the downsizing of the traditional service vehicle fleet and/or by the modernisation of fleet management processes rendered possible by the innovative technological and software solutions associated with car-sharing (e.g. systematic geolocation, real-time dashboards). On the other hand, it might also be very difficult to convince top-level management of the scale of savings attainable with such innovative services (e.g. on taxi, short-term rental or personal car expense claims, or on the total costs of the service vehicle fleet). The high costs of externally-provided car-sharing services (between 90 EUR and 180 EUR per vehicle per month on top of the vehicle lease, according to a benchmark established by one of the interviewees), and the heavy burden placed on human resources by the deployment of internally-managed car-sharing services, could constitute a major disincentive in the preliminary stages of the costs-benefits trade-offs. Some 'success stories' were deemed necessary to gain support from top-level management.

Finally, as with vehicle monitoring and tracking technologies (see subsection 6.3.3), some interviewees were anxious that the hardware (e.g. keyless access technologies) and software (e.g. telematics applications, fleet management software) used by car-sharing solutions lacked maturity. Therefore, they feared that early adoption of in-house car-sharing would expose them to the risk of obsolescence and/or the possible lack of interoperability with systems subsequently brought to the market by manufacturers, long-term rental companies and independent suppliers.

# 6.5 Conclusion

Building on the information collected through 44 interviews with decision-makers from 22 large organisations in the Paris region, we reached a much deeper understanding of the mobility and fleet management processes of large organisations. First, we were able to describe how mobility management got to become a multi-dimensional process addressing an increasing range of needs, concerns and challenges in the organisation. Starting with core concerns about the actual physical ability to move people and goods (which we labelled the 'accessibility' output), mobility management processes have increasingly addressed a growing number of concerns regarding: *i)* the ability to attract and retain quality employees (the 'attractiveness' output); *ii)* the safety (and, to a lesser degree, the comfort) of employees on the roads or while travelling; *iii)* the environmental impacts of mobility; and, more vividly since the 2008 financial crisis, *iv)* the costs of mobility.

On this last point, however, our survey showed that mobility costs were still poorly managed in large organisations. In particular, organisations failed to report and monitor the various costs relating to mobility (e.g. from long-distance travel and local mobility) in a homogeneous manner. Very few organisations had aggregated into a discernible cost category the various expenses relating to their corporate car fleet (vehicle acquisition, maintenance, fuel, insurance, etc.), let alone consolidated them at corporate level. When the outcome of the consolidation was known, fleet costs ranked just behind wages and real estate, neck-and-neck with 'travel' expenses. A stumbling block to the dissemination of TCO approaches in corporate car fleets was the lack of any homogeneous definition of fleet costs and the inadequacy of data reporting tools and procedures.

Altogether, it appeared from our investigation that four categories of underlying strategic interests were likely to drive the mobility management processes of organisations, namely: operational efficiency, economic efficiency, brand image with customers and brand image with employees. Judging the relative *maturity* of corporate mobility management processes by the ability of the organisations to make mobility-related decisions that would integrate and weigh its various strategic interests, we observed great disparities of maturity among the large organisations we surveyed.

By a closer analysis of the decision-making processes for car fleet *acquisition*, our survey shed new light on their high degree of complexity. Indeed, the decision-makers participating in these processes had very diverse backgrounds/functions (including purchasing/procurement, fleet management, human resources, finance, facilities management, mobility management, logistics, sustainable development, strategy, etc.), they handled their respective duties at different geographical levels (local, national or international), and they came from all hierarchical ranks in the organisation, from top-level management to field staff. Interestingly, the interviews revealed that the initiative for adopting new products and services, or for implementing new fleet acquisition procedures, could come from *any level of management*, although maximum leverage and effectiveness would tend to lie in the hands of higher levels.

Our survey further revealed that some of the key functions involved in the decision-making process for fleet acquisition (e.g. purchasing/procurement, fleet management, human resources, finance) would usually have developed a tool or toolkit to handle the complexity of their interactions with the other stakeholders in the process. For instance, purchasing departments in large organisations (especially those with highly formalised and centralised decision-making structures) seemed to have extended the practice of *calls for tenders* to their fleet acquisition processes. This would offer better guarantees regarding the quality and price competitiveness of the products and services purchased, sometimes at the expense of flexibility (e.g. for introducing tailor-made TCO criteria into the procurement procedure). Human resources departments, on the other hand (especially in formalised, centralised decision-making structures), had developed *corporate car policies* as a management tool designed to formalise the rules and conditions for allocating car benefits to employees. As a testament to the impact of car policies on the relative 'democratisation' of official cars, we could establish a clear-cut link between the penetration rate of official cars in organisations and the degree of vertical differentiation in their car policies.

Looking now at the decision-making processes for corporate fleet *operations*, our first important finding was that the principles behind fleet use patterns, and the information required to optimise these patterns, were very different depending whether we considered service vehicles (i.e. vehicles that can only be used for professional purposes, 4 out of 5 vehicles in our sample), or official cars (i.e. vehicles that can be used for personal as well as professional purposes, 1 out of 5 vehicles in our sample). On the basis of this initial distinction, we built a raw typology of vehicle use patterns. We identified significant discrepancies in the intensity of use of the service vehicles (from 2,500 km per year for vehicles used as shuttles on closed sites, to 12,500 km per year on average for vehicles used for local in-house logistics and courier services, 16,000 km per year on average for vehicles used in pools or corporate car-sharing fleets, and 30,000 km on average for vehicles used for technical assistance and other on-site interventions), which could also be quite sensitive to the geographical scope of fleet operations. As far as official cars were concerned, we observed that the use of the vehicles was fairly intensive (between 14,000 km and 40,000 km per year, 24,500 km on average in our sample), and appeared most intensive when the organisations would cover the fuel expenses incurred by employees for private journeys.

Our second significant finding with regard to fleet operations was that the quality of information available to decision-makers was generally deemed unsatisfactory. Corporations would usually cope with the lack of information through using rough, aggregated indicators on fleet use and fleet costs for year-on-year comparisons and/or trial-and-error approaches (e.g. for short-term adjustments in vehicle dispatching). In addition to such coping strategies, most organisations had gradually developed a more robust approach to fleet operations management, based on report and monitoring processes on fleet operations and costs and fleet management software. Several organisations in our sample had launched pilot or large-scale programmes to deploy *monitoring and/or tracking technologies* for purposes of technical reporting (for advance planning of vehicle maintenance and limiting vehicle downtime), operational reporting (for advance planning of vehicle routing and dispatch), real-time feedback to drivers on fuel use and accelerometry data (to foster individual eco-driving practices and lessen fuel expenses), individual geolocation (to optimise individual trips or complex missions), or real-time vehicle geolocation (to achieve dynamic, real-time optimisation of routing and dispatch). On top of reductions in operating costs, further benefits were expected from monitoring and tracking technologies in terms of safety (avoiding breakdowns, locating vehicles in trouble), capital costs (downsizing the operating fleet, reducing the need for replacement vehicles), emission reduction, etc. The main obstacles to the introduction of monitoring and tracking technologies in fleet management processes appeared to be: *i)* the reluctance of trade unions (because of new threats to employee privacy), *ii)* the cumbersome process of declarations to the CNIL (French data protection authority), *iii)* the cost of the technologies, and *iv)* the risk of early obsolescence due to the current immaturity of the technologies. While the development of fleet operation management expertise seemed key to the optimisation of fleet operations over the short- to medium-term, it also appeared to us that it would be instrumental, over the longer term, in enhancing the overall efficiency of the decision-making processes for fleet *purchasing* (by creating a systematic feedback loop on the operational needs of fleet users, thereby facilitating more accurate prior assessment of the overall costs of vehicle ownership).

Thus, it appears overall that the prospects for global optimisation of the corporate car fleet – from the perspectives of both purchase behaviours and daily operations – would very much depend on the solutions that corporations could find to tackle, on the one hand, the complexity of the decision-making processes for car fleet acquisition and, on the other hand, the shortcomings of information on fleet use and fleet costs.

When discussing the prospects for EV adoption by corporate car fleets, the interviews revealed that several challenges remained, both internally (due to lack of experience of EVs and incomplete expertise in fleet optimisation) and externally (due to barriers on the regulatory side and on the supply side). Among the external challenges, lack of clarity in the legal framework (on safety, taxation, etc.) and lack of maturity in the electro-mobility system (including battery technology, vehicle resale value, public charging infrastructure) seemed to have the most unsettling effects on the organisations.

Yet EVs were acknowledged to bring added value to the organisations by serving some of their most strategic interests, namely: their brand image with customers (in terms of environmental performance and innovation), their economic efficiency (through TCO gains in some contexts, and reduced exposure to fuel price volatility), their operational efficiency (through strong drivetrain reliability and braking performance), and their brand image with employees (through embedding sustainability and/or innovation in the organisational culture). However, through the analysis of some of the 'best practices' of corporate car fleets with regard to EV adoption, we uncovered very few experimental schemes that had been designed on a relevant scale and with appropriate feedback programmes on operating experience, which significantly imperilled their chances of success and ulterior duplication.

Now looking at the prospects for the adoption of car-sharing by corporate car fleets, we learned from our survey that the main drivers for developing in-house car-sharing schemes were considerations of economic efficiency. Corporations expected to cut back on their expenses for taxis, short-term rental and employee car use, or even to downsize their service vehicle fleet. Yet several organisations also couched the deployment of their respective car-sharing schemes as an opportunity to offer their employees an additional mobility solution that would be efficient, innovative and environment-friendly.

As with EVs, the issue of the relevant scale of experimentation was reported to be crucial for in-house car-sharing schemes. The lack of visibility and poor service level of experimental car-sharing schemes that failed to achieve *critical size* at launch, would usually jeopardise the experiment and prevent any subsequent development into a full-scale corporate car-sharing scheme. Other factors seemed to bear some influence on the effective adoption of car-sharing by its target users, including: policies that prioritise the car-sharing solution over alternative solutions (e.g. taxi, short-term rental), rules regarding access to the car-sharing scheme (whether inclusive or exclusive) and experiment design (including or not a phasing-in period and an evaluation programme).

Our survey revealed two interesting developments in corporate car-sharing schemes. First, corporate car-sharing fleets seemed to include an increasing proportion of EVs. This generated interesting synergies between the two innovations, in terms of economic efficiency (associated with the high upfront costs and low running costs of EVs) and brand image with customers (associated with the increased visibility of EVs in car-sharing schemes). However, EVs were deemed to add complexity to the operational management of car-sharing fleets (to find the best combination of battery charging requirements and vehicle use patterns). Second, we noted a trend towards corporate car-sharing services being extended to include private trips by employees on evenings and weekends, giving rise to new gains in terms of both economic efficiency (employees would contribute to the costs of the service) and brand image with employees (the service would provide an appealing mobility solution for employees with occasional need of a car).

The main internal barriers to the adoption of car-sharing by corporations seemed to be the limited awareness among decision-makers at all levels of these services and their potential benefits, possible resistance from middle-level managers to fleet downsizing and modernisation, and lack of support from top-level management because of the uncertainty of cost savings. The main external barriers stemmed from the high costs of externally provided car-sharing services and the immaturity of the technologies (risk of obsolescence).

All in all, our survey showed that the road to large-scale adoption of EVs and car-sharing by corporate car fleets in large organisations was still filled with many pitfalls, most of them internal challenges stemming from shortcomings in the fleet management process. For corporate car fleet decision-makers, gaining a deeper insight into fleet operations and developing adequate decision-support tools are essential to overall fleet management performance, from acquisition to day-to-day use. In fact, it appeared that one of the greatest common challenges to all the stakeholders in this adventure, including public policy-makers and product and service providers, lay in *information*, its production, reporting and use, as well as its availability and reliability.

We will not reiterate here the biases introduced into our survey by the set of criteria used in selecting the organisations (see subsection 6.2.2 for that discussion). We believe that our discussion of the opportunities and challenges of innovations might have been very different for organisations with less formalised and/or less centralised decision-making processes for fleet management, and especially for smaller organisations. Most importantly, however, we consider that fleet management processes in organisations of all kinds have recently entered a phase of *rapid change* under the combined influence of growing economic pressure and the increasing introduction of digital technologies into their operations. Such strong underlying trends could profoundly change the prospects for innovations in corporate car fleets in the near future.

# Chapter 7
# The role of taxes in triggering change in corporate car fleets: Some lessons from history

## 7.1 Introduction

### 7.1.1 Background

Our progress in the understanding of corporate car fleets so far has shown that there are many channels through which public policy-makers can influence the decisions of corporations with regard to vehicle purchase or use. In particular, it was highlighted in Chapters 4, 5 and 6 that *tax policy* is one of these channels, and a potentially powerful one as well.

We have shown through our qualitative survey of fleet management processes that tax policy plays a significant role in the decision-making processes related to the management of corporate car fleets (see Chapter 6 for detailed information). In addition, we have brought to light, using existing databases based on large quantitative surveys, the influence of tax policy on the choices of corporate car fleets with regard to vehicle *energy* types (cf. the 90% share of diesel vehicles among the corporate vehicles in private household fleets in the

Paris region in 2010,[1] or the 94% share of diesel vehicles in the professional LCV fleet in France in 2010[2]) or vehicle *body* types (cf. the 23% share of passenger-car derivatives in the professional LCV fleet in France in 2010[3]).

However, tax policy as applied to corporate car fleets in France as of today is complex. It is, indeed, the product of decades of tax innovation in many areas of the French economy and society (on income and wages, social security, general consumption, energy consumption, etc.). Hence, it consists of *many layers* of taxes that differ from one another in their intended purposes (if any besides tax revenue generation), in their terms and conditions (i.e. in their scope, exclusions, tax base, etc.), as well as in their observable effects.

We already discussed in Chapter 3 the taxation of company car benefits. We highlighted that the use of corporate cars for personal purposes is considered, at least under French law, as a benefit in kind (i.e. a non-wage benefit provided in addition to the employee's normal wage) and is therefore subject to personal income tax and to employer social contribution.[4] We also pointed out that there is a large literature discussing the influence of benefit-in-kind taxation on the willingness of corporations to provide 'official vehicles' to their employees, and thereby on the relative *size* of the corporate car fleet market in a particular country. We further argued in Chapter 5 that national accounting rules applicable to vehicle depreciation might be partly responsible for the high *turnover rate* of light-duty vehicles in corporate car fleets. Therefore, it would appear that, together, national tax policy on corporate car benefits and national accounting rules applicable to corporate vehicle depreciation could play a significant part in the *large market share* (40%) of corporate car fleets in new light-duty vehicle sales in France.[5]

When considering the opportunity for leveraging the large size and high turnover rate of the corporate car fleet market segment in France to foster the

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[1] Source: 2010 EGT survey; for detailed information see Chapter 4.

[2] Source: 2010 LCV survey; for detailed information see Chapter 5.

[3] *Ibid.*

[4] Chapter 3 provides further detail on taxes applicable to company car benefits.

[5] For the record, this 40% market share of corporate car fleets in new light-duty vehicle sales in France compares with a 60% market share in Germany and Sweden, a 58% market share in the UK, and a 54% market share in the Netherlands (in these countries, taxation policy is more favourable to corporate car fringe benefits than it is in France) (Naess-Schmidt and Winiarczyk, 2010).

uptake of *innovations*, e.g. alternative-fuel vehicles, it would seem relevant to focus the discussion on tax policies likely to have an influence on the choices of corporations with regard to some *key features* of the vehicles they purchase and use, such as: the body type, the energy type, or the environmental performance.

We have no reason to think that *either* the taxation of company-car fringe benefit *or* the accounting rules applicable to corporate vehicle depreciation could have had any direct influence on the features of vehicles in corporate car fleets in France to this day. Several other tax schemes, on the other hand, are likely to have a direct influence on the choices of corporations with regard to the main features of their corporate vehicles. The differentiated excise taxes on diesel and petrol, or the environmental penalty on the registration of new passenger cars with high $CO_2$ emission levels (also known as '*malus*'), are just two of the most obvious examples of such tax schemes.

### 7.1.2 Statement of the problem

The tax policy framework that is likely to influence the choices of corporations with regard to some of the key features (e.g. body type, energy type, $CO_2$ emissions) of the vehicles they purchase and use, is rather complex. Indeed, it consists of many layers of taxes, each of them proceeding from a specific historical context (and/or a specific economic rationale), and therefore presenting specific *terms and conditions*, whether we consider their scope, their tax base, or yet their incentivisation – explicit or implicit – of alternative-fuel vehicles.

Unravelling the complexity of this tax policy framework is a prerequisite for assessing its influence on corporations with regard to the features of the vehicles they purchase and use. Hence, it is also a prerequisite for analysing the influence of tax policy on the uptake of *innovations*, such as alternative-fuel vehicles, by corporate car fleets.

### 7.1.3 Purpose of the chapter

The objective of the analysis developed in this chapter is twofold. First, it is intended to identify the main tax schemes that have a probable influence on the choices of corporations with regard to some *key features* of the vehicles they purchase and use, trace back their history, and present their current terms and conditions. In particular, when considering their scope, the analysis will focus on whether these tax schemes apply to all vehicle owners (or users) or to corporations only, whether they cover all vehicle body types or passenger cars (or light commercial vehicles) only, and finally whether or not they discriminate among fuel types. The analysis will also consider the tax base, the particular stage of the vehicle life at which the tax is payable (i.e. at the purchase/registration of a new vehicle, at the purchase/registration of a used vehicle, or in the course of ownership or use of a vehicle), and the explicit or implicit incentivisation of alternative-fuel vehicles.

This analysis ultimately aims to provide the necessary background information against which we could assess the impacts of tax policies on the features of corporate vehicles in France over recent decades. In the absence of historical data sets on the mix of the corporate vehicle stock in terms of body type, energy type, etc.,[6] this chapter will provide a preliminary assessment of the relative effectiveness of the various tax schemes listed, based on the magnitude of the costs (or benefits) they impose on corporations.

### 7.1.4 Method

Building upon the professional literature (in particular: OVE, 2014c and 2014d), we identified five main tax schemes with a probable influence on the choices of corporations with regard to some key features of the vehicles they purchase and use. Considering our interest in the outlook for *innovations* in general, and *alternative-fuel vehicles* in particular, in corporate car fleets, our main focus was on the following (interrelated) vehicle features: *i)* body type, *ii)* energy type, and *iii)* environmental performance (as measured by fuel consumption, $CO_2$ emissions, and/or emissions of local pollutants). The five tax schemes which we acknowledged may have had an impact, over time, on the abovementioned features of corporate vehicles, are the following: *i)* the fuel excise tax scheme; *ii)* the VAT (Value-Added Tax) scheme on vehicles, fuels, and parts and maintenance; *iii)* the TVS (*Taxes sur les Véhicules de tourisme de Société*) scheme on corporate passenger cars; *iv)* the vehicle registration tax scheme; and, more recently, *v)* the bonus/malus scheme. As already mentioned in the background section, neither the taxation of corporate car fringe benefits, nor the accounting rules on vehicle depreciation, should have a significant influence on the abovementioned features of corporate vehicles.[7]

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[6] An advanced statistical register of road motor vehicles (RSVERO) was developed in 2009 through the joint effort of the French Interior Ministry and the Ministry for Sustainable Development. At the time of writing, the register was, however, still in the testing phase. Until this advanced register is fully operational, only partial and fragmented information is available on the current and past states of the motor vehicle fleet, and in particular on its corporate component (see Chapter 3 for further information) (Friez and Dervieux, 2013).

[7] We acknowledge that the existence of a specific ceiling on the amount of tax-deductible depreciation for corporate *passenger cars* might introduce an additional, indirect distortion between passenger cars and light commercial vehicles, but this ceiling would most affect vehicle market segments where passenger cars are not in direct

For each of the five tax schemes listed above, we endeavoured to trace their history back to their initial implementation through a review of past laws and regulations, using the online legal archives of Legifrance[8] (for legal documents published in the *Journal Officiel* of the French Republic after 1947) and Gallica[9] (for earlier issues of the *Journal Officiel*). To help build the historical perspective, this chapter successively reviews the five tax schemes in chronological order of their introduction. Whenever relevant to our analysis, we provide contextual information on the initial implementation and/or subsequent developments in the tax schemes reviewed (e.g. changes in scope or in tax base), using ministerial documents and other, academic or professional, sources. For each tax scheme, we also present their current terms and conditions, in particular their scope, tax base, and specific provisions for incentivising alternative-fuel vehicles.

In order to improve our understanding of how such diverse tax schemes *combine* to influence corporate car fleets in their choices with regard to vehicle features, we first present an analytical framework to discuss the similarities and differences in their terms and conditions, then we endeavour to provide a preliminary assessment of their relative effectiveness, based on the magnitude of the costs (or benefits) each of them imposes on corporations. To estimate the cost (or benefit) impacts, we use a TCO (*Total Costs of Ownership*) approach, building on the methodology developed by OVE (2014d).[10] In particular, we consider that the vehicles purchased (or leased) by corporations are held by them for 4 years, and travel 100,000 km during that period of time. For each vehicle body type market segment (i.e. passenger cars vs. light commercial vehicles), we take as our reference vehicle features the 'average' features of corporate vehicles registered in this market segment, as described by OVE (2014d): the 'average' corporate vehicle in the *passenger car* market segment in

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competition with light commercial vehicles (i.e. vehicles with a purchase price in excess of 18,300 EUR).

[8] Source: http://www.legifrance.gouv.fr.

[9] Source: http://gallica.bnf.fr. Gallica is the online website of the French National Library (*Bibliothèque Nationale de France*, or BNF).

[10] See Chapter 3 for further information. For the record, based on the methodology developed by OVE, the average TCO in the corporate passenger car market segment in France in 2013 was 35,345 EUR over 4 years (for 100,000 km), whereas the average TCO in the corporate LCV market segment was 26,563 EUR over 4 years (for 100,000 km) (OVE, 2014d).

2013 was powered by diesel, consumed 4,2L/100 km, and emitted 109 $gCO_2$/km; the 'average' corporate vehicle in the *light commercial vehicle* market segment in 2013 was also powered by diesel, but it consumed 5.7L/100 km, and emitted 145 $gCO_2$/km[11]. In addition, we take as our reference fuel prices the average fuel prices in France in 2014, as computed by the French Ministry for Sustainable Development: 1.29 EUR/litre for diesel and 1.49 EUR/litre for petrol.[12] These assumptions will enable us to compute, for each tax scheme, the TCO differential they generate between two vehicles with different body types, and/or different energy types, and/or different environmental performances (as measured by $CO_2$ emissions, for instance).

### 7.1.5 Outline of the chapter

The chapter is structured into five main parts and a conclusion. First, we show how the excise taxation on fuels and the VAT scheme on corporate vehicles initiated the long-lasting preferential tax treatment of diesel over petrol for corporate car fleets in France (Section 7.2). Then, we present the vehicle registration tax scheme and highlight its increasing focus on environmental concerns (Section 7.3). Later, we review the TVS scheme and show how it has been reshaped over time to account for the local and global impacts of corporate car fleets on the environment (Section 7.4). Next, we present the bonus/malus scheme, whose four components are all focused on $CO_2$ emissions (Section 7.5). Section 7.6 discusses the similarities and differences in the terms and conditions of the schemes reviewed, and the relative strength of their incentive effects on corporate car fleets.

## 7.2 Have corporate car fleets always preferred diesel over petrol?

### 7.2.1 Excise taxes on fuel and the original competitive advantage of diesel

[11] According to OVE, the average $CO_2$ emissions of light commercial vehicles in long-term rental were at 149 $gCO_2$ in 2012 (OVE, 2013b: p.31), and had fallen '*below the 147 gCO₂ threshold*' in 2013 (OVE, 2014d: p.40).

[12] These are annual average retail prices at the pump, inclusive of tax. Source: http://www.developpement-durable.gouv.fr/Prix-de-vente-moyens-des,10724.html [Accessed: 19th February 2015].

Excise taxation[13] on energy products in France is known as the 'domestic consumption tax on energy products', or TICPE (*Taxe Intérieure de Consommation sur les Produits Energétiques*), also known as TIPP up until 2011 (*Taxe Intérieure de consommation sur les Produits Pétroliers*), and originally created as TIP (*Taxe Intérieure Pétrolière*) (SOeS, 2012c). TIP dated back to 1920.[14] Excise taxation on fuels in France applies equally to all light-duty vehicle users, be they private households or corporations.[15] It is included in the fuel prices paid by consumers 'at the pump'.

Back in the 1950s and 1960s, most *diesel* vehicles in France were commercial vehicles used by corporate car fleets for professional purposes (ACA, 2013: p.17; OVE, 2014a: p.15; *Les Echos*, 2014). Conversely, most passenger cars used by French private households in those days were petrol vehicles. Although they have lost some of their currency over the past fifty years, the implicit associations between corporate vehicles and diesel fuel on the one hand, and between private vehicles and petrol fuel on the other hand, have had an influence on fuel tax policies to this day.

Indeed, the clear-cut distinction one could make, back in the 1960s, between *diesel*-powered *corporate* vehicles on the one hand, and *petrol*-powered *private* vehicles on the other hand, resulted in a two-tier policy with regard to excise taxes on fuels, whereby it was admitted that diesel was entitled to a lighter tax burden than petrol. Over the years, French authorities have successively used different kinds of public-policy rationales to justify the gap in excise taxes between diesel and petrol (Loubet, 1996; INSEE, 2009; *Les Echos*, 2014). Originally, the rationale for such a gap in excise taxes between diesel and petrol focused on the need to support the economic development of companies during the thirty years of post-war reconstruction (also known in French as '*Les Trente Glorieuses*', running from 1945 to 1973), because back then companies relied mainly on diesel fuel for their transport needs. Later on, the rationale shifted to the need to support the national refining industry in managing the

[13] An excise tax (or excise duty) is a tax levied on particular goods (e.g. spirits, tobacco, energy products); it is usually a per unit tax in that it is calculated in proportion to the volume or number of units of the goods taxed.

[14] *Loi du 25 juin 1920 portant création de nouvelles ressources fiscales*, Art.104. Available from: http://gallica.bnf.fr/ark:/12148/bpt6k63678312/f15.image.

[15] Since 1999, corporations have been granted a partial refund on the excise taxation paid on diesel used by heavy-duty vehicles. Source: *Loi n°98-1266 de finances pour 1999*, Art.26. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT 000000209044.

diesel surplus that resulted from the implementation of the French nuclear programme for electricity generation in the 1970s and 1980s (the growing share of nuclear power in electricity generation in France progressively undercut demand for diesel fuel in thermal power stations). In the 1980s, the rationale for a gap in excise taxes between diesel and petrol included the need to support the competitiveness of French car manufacturers, by leveraging their early mastery of the diesel engine technology, in the face of an increasingly fierce competition from Japanese and German manufacturers on the global market.

Figure 7.1 illustrates the development in excise taxes on diesel and petrol in France from 1961 to this day. In 1961, the excise tax on diesel was 44% lower than the excise tax on petrol (38.94 FRF per diesel hectolitre, as compared with 69.04 FRF per petrol hectolitre). This tax differential fluctuated between 42% and 54% in the period 1961-1985. It reached a first peak at 54% (45.41 FRF per diesel hectolitre, as compared with 97.95 FRF per petrol hectolitre) in 1976, when the French government implemented an austerity plan following the 1973 oil shock. After nearly ten years on a downward trend, it reached a second peak at 51% (113.73 FRF per diesel hectolitre, as compared with 229.89 FRF per petrol hectolitre) in 1985, following two years of another austerity plan (1982-1984) implemented by the French government in the aftermath of the second oil shock (1979).

Since the last peak at 40% (213.79 FRF per diesel hectolitre, as compared with 357.23 FRF per petrol hectolitre) in 1995, the gap in excise taxes between petrol and diesel has progressively narrowed. Indeed, after three years of symmetrical excise tax rises for diesel and petrol in 1996, 1997 and 1998 (successively +13 FRF per hectolitre, +6 FRF per hectolitre and +8 FRF per hectolitre for both diesel and petrol), the French Finance Act for 2009 officially initiated a long-term policy aiming to reduce the excise tax differential between diesel and petrol and bring it closer to the European average. As of 2014, taxation on energy products and electricity in the European Union was regulated by Directive 2003/96/EC (EC, 2003). This Directive sets the following minimum levels of excise taxation in the EU Member States: 33.0 EUR per hectolitre for diesel, and 35.9 EUR per hectolitre for unleaded petrol (the gap between the minimum excise taxes on petrol and on diesel is therefore 8%).[16]

In 2014, the excise tax differential between petrol and diesel in France remained as high as 29% (or a 17.85 EUR gap between 42.84 EUR per hectolitre

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[16] Prior to Directive 2003/96/EC, Directive 92/82/EEC (EEC, 1992g) set the following minimum levels of excise taxation in the EU Member States: 24.5 ECU per hectolitre for diesel, and 28.7 ECU per hectolitre for unleaded petrol (the gap between the minimum excise taxes on petrol and on diesel was then 15%).

for diesel and 60.69 EUR per hectolitre for petrol), as compared to an EU-28 average of 21% (or an 11.6 EUR gap between 42.4 EUR per hectolitre for diesel and 54.0 EUR per hectolitre for petrol) as at 1 July 2014 (EC, 2014b). Interestingly, the French excise tax on diesel in 2014 was very close to the EU-28 average (only 1% higher); on the other hand, the French excise tax on petrol was 12% higher than the EU-28 average. However, most States from Western Europe had yet higher excise taxes on petrol than France: the Netherlands (75.92 EUR per hectolitre), Italy (73.08 EUR), the UK (67.42 EUR), Finland (67.29 EUR), Greece (67.00 EUR), Germany (66.98 EUR), Sweden (65.56 EUR), and Belgium (61.36 EUR). On the other hand, four Member States –namely: Greece, Portugal, Denmark and Slovakia– displayed excise tax differentials between diesel and petrol in excess of the French tax differential.

As a result of 50 years of a preferential excise tax treatment of diesel over petrol through excise taxation, diesel drivetrains have progressively retained an increasing share in new vehicle sales in France. The share of diesel vehicles in the total *commercial* vehicle fleet (including light commercial vehicles and large goods vehicles) rose from 39% in 1980 to 94% in 2013 (CCFA, 2014). In addition, the share of diesel vehicles in the total *passenger car* fleet in France also increased, from 4% in 1980 to 61% in 2013 (CCFA, 2014), which is well beyond the share of corporate car fleets in the total car fleet. Thus, the preferential excise tax treatment of diesel appears to have had a growing influence on private households, as well as corporations, in their vehicle choices. Though corporate car fleets have remained loyal to diesel ever since the 1960s, the reduced excise tax rate applicable to this fuel is no longer their exclusive privilege.

In order to provide a preliminary assessment of the impact on corporate car fleets of the preferential excise tax treatment of diesel over petrol, we make the following assumptions, which we draw from the methodology of OVE (2014d) for TCO computation and from our own investigation: *i)* a corporation is faced with a choice between a diesel passenger car and a petrol passenger car; *ii)* the corporation plans to use the passenger car for 100,000 km over 4 years; *iii)* both passenger cars have a fuel consumption of 4.2 litres per 100 km;[17] and *iv)* the excise tax on diesel is lower, by 17.85 EUR per hectolitre,[18] than the excise tax on petrol. Based on these assumptions, the corporation would face an additional

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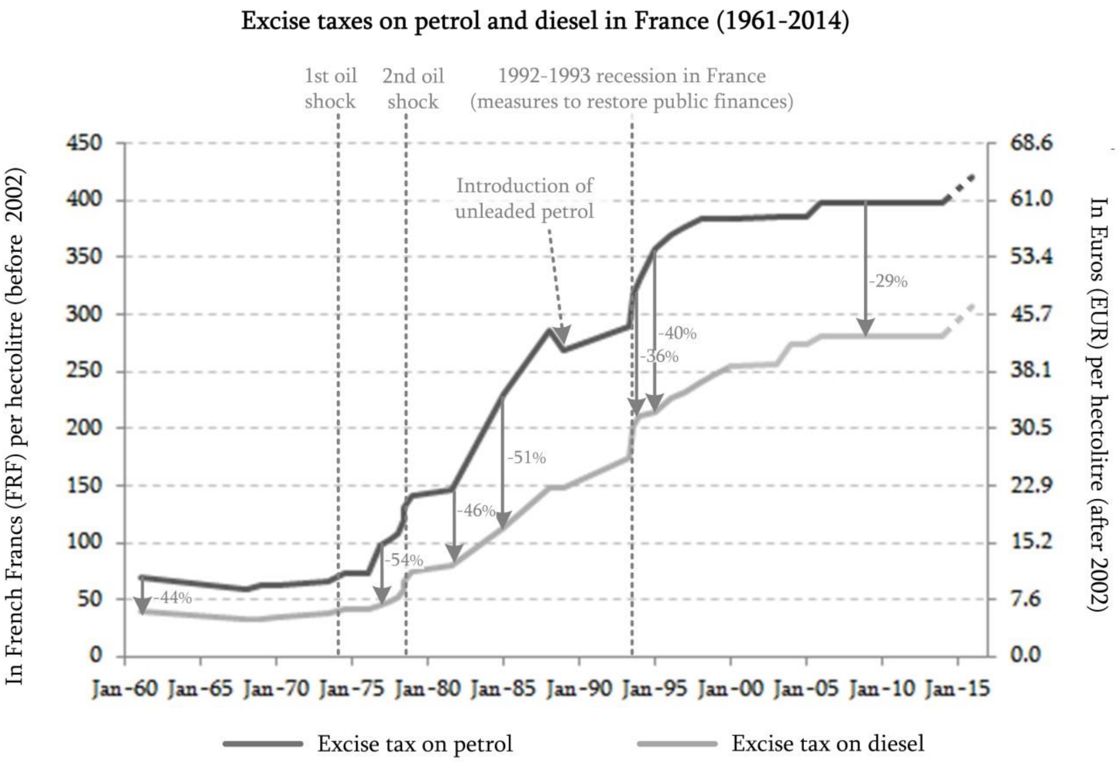
[17] We acknowledge that diesel-powered vehicles are generally considered to have higher fuel efficiency than petrol-powered vehicles, but we choose to ignore this effect in our analysis.

[18] For the record, this was the excise tax differential between diesel and petrol in France as of 2014.

cost of 750 EUR (over 4 years) if it chose the petrol vehicle over the diesel vehicle, due only to the difference in excise taxes.




*Sources: Loi n°60-1384 du 23 décembre 1960 de finances pour 1961; Loi n°67-1114 du 21 décembre 1967 de finances pour 1968; Loi n°68-1172 du 27 décembre 1968 de finances pour 1969; Loi n°69-1161 du 24 décembre 1969 de finances pour 1970; Loi n°72-1121 du 20 décembre 1972 de finances pour 1973; Loi n°74-644 du 16 juillet 1974 de finances rectificative pour 1974; Loi n°75-1278 du 30 décembre 1975 de finances pour 1976; Loi n°76-978 du 29 octobre 1978 de finances rectificative pour 1978; Loi n°77-608 du 14 juin 1977 de finances rectificative pour 1977; Loi n°77-1467 du 30 décembre 1977 de finances pour 1978; Loi n°78-653 du 22 juin 1978 de finances rectificative pour 1978; Loi n°78-1239 du 29 décembre 1978 de finances pour 1979; Loi n°81-734 du 3 août 1981 de finances rectificative pour 1981; Loi n°84-1208 du 29 décembre 1984 de finances pour 1985; Loi n°87-1060 du 30 décembre 1987 de finances pour 1988; Loi n°88-1149 du 23 décembre 1988 de finances pour 1989; Loi n°92-1376 du 30 décembre 1992 de finances pour 1993; Loi n°93-859 du 22 juin 1993 de finances rectificative pour 1993; Loi n°93-1352 du 30 décembre 1993 de finances pour 1994; Loi n°94-1162 du 29 décembre 1994 de finances pour 1995; Loi n°95-1346 du 30 décembre 1995 de finances pour 1996; Loi n°96-1181 du 30 décembre 1996 de finances pour 1997; Loi n°97-1269 du 30 décembre 1997 de finances pour 1998; Loi n°98-1266 du 30 décembre 1998 de finances pour 1999; Loi n°99-1172 du 30 décembre 1999 de finances pour 2000; Loi n°2002-1575 du 30 décembre 2002 de finances pour 2003; Loi n°2003-1311 du 30 décembre 2003 de finances pour 2004; Loi n° 2005-1720 du 30 décembre 2005 de finances rectificative pour 2005; Loi n° 2013-1278 du 29 décembre 2013 de finances pour 2014.*

Figure 7.1: A historical perspective on petrol and diesel excise taxes in France

### 7.2.2 An institutionalised discrimination *against* passenger cars and petrol fuel in corporate car fleets through VAT

A Value-Added Tax (VAT) is a consumption tax on goods and services.[19] The French VAT scheme was first introduced in 1954,[20] but many of the principles that still govern the scheme nowadays (as regards the tax base, the exemptions, etc.) were taken pursuant to a 1966 law which generalised VAT to all industrial and commercial operations, in the place of a number of former taxes (e.g. old taxes on wines, wheat milling).[21] The standard VAT rate, which applies to automotive products and fuels, was 20% in France in 2014.[22] As far as automotive fuels are concerned, it is worth noting that VAT is calculated on the basis of the selling prices inclusive of excise duty.

VAT applies to all consumers, be they private households or corporations. However, unlike private households, most companies are entitled to deduct the VAT they pay on their purchases (i.e. their input tax)[23] insofar as the purchased goods or services are *i)* necessary to their operations and *ii)* exclusively used for the purpose of operations. As far as corporate vehicles are concerned, however, the VAT deduction rules discriminate between passenger cars and light commercial vehicles, as well as between diesel and petrol fuels.

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[19] A Value-Added Tax is an indirect tax in that it is not levied on individuals or companies and collected directly by the government, but rather levied on goods and services and collected by intermediaries (e.g. companies). It is an *ad valorem* tax in that it is calculated in proportion to the estimated value of the goods or services taxed. See: *Collins English Dictionary*: http://www.collinsdictionary.com/dictionary/english. [Accessed: 25th August 2014]

[20] *Loi n°54-404 du 10 avril 1954 portant réforme fiscale*, Art.1. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000000864818.

[21] *Loi n°66-10 du 6 janvier 1966 portant réforme des taxes sur le chiffre d'affaires et diverses dispositions d'ordre financier*. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000000320413.

[22] *Loi n°2012-1510 du 29 décembre 2012 de finances rectificative pour 2012*ï¸Art.68. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000026857857.

[23] Companies that are not obliged to charge VAT on their outputs (e.g. schools, banks, insurance companies, medical and paramedical activities, small businesses under the threshold) cannot deduct input VAT.

### How VAT deduction rules started to discriminate against passenger cars

LCVs in corporate car fleets have long been recognised by policy-makers as operational working tools. That is why, as regards VAT deduction, they have been conferred a status of tangible fixed assets[24] used for the purpose of operations. This particular status of LCVs has made it possible for companies to deduct the VAT on these vehicles – whether purchased or leased – and their associated parts and maintenance expenses.

Passenger cars in corporate car fleets, on the other hand, have been equated to 'luxury goods' (OVE, 2014b) rather than operational tools. Therefore, pursuant to a 1967 decree,[25] passenger cars – whether purchased or leased – and their associated parts and maintenance expenses, have been excluded from the deduction of VAT. Driving schools,[26] taxis, ambulances, short-term leasing companies and funeral directors are some rare exceptions to this rule, which is justified by the fact that the corresponding companies indeed use passenger cars for the purposes of their core transport activities. Automotive dealers can also deduct the VAT on their passenger car acquisitions insofar as the vehicles are purchased for later retail sale.

### How VAT deduction rules started to discriminate against petrol fuel

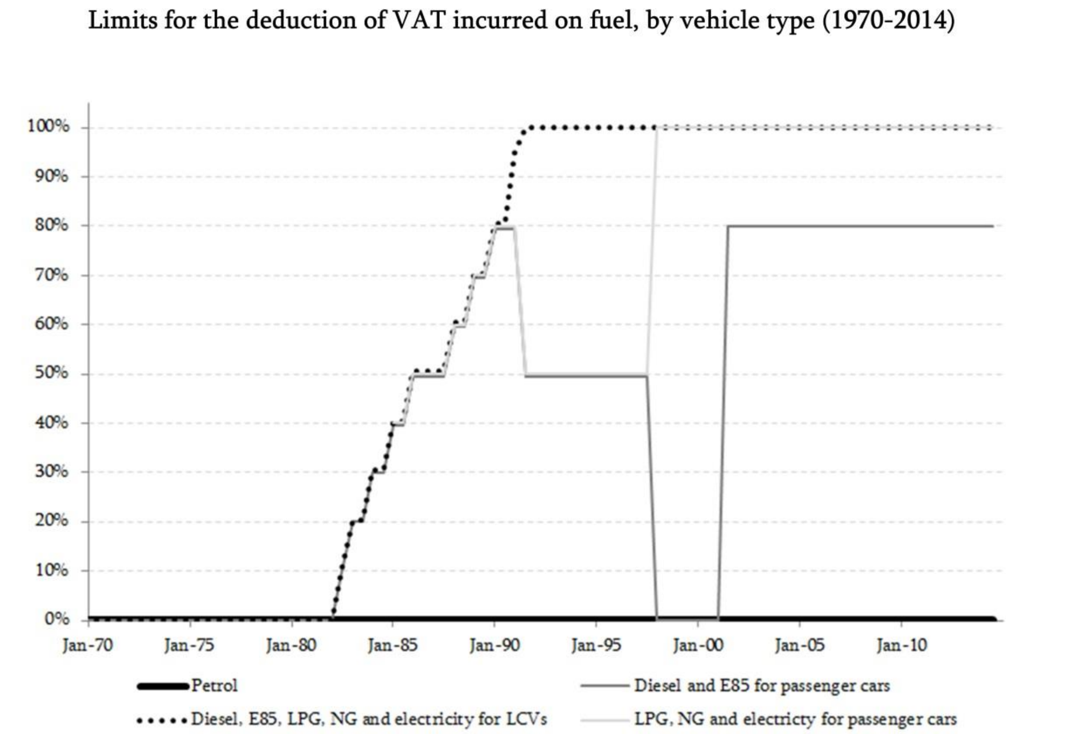
Besides discriminating between vehicle types, VAT deduction rules further discriminate between fuel types. The right to deduct the VAT incurred on diesel used as a propellant in corporate vehicles was introduced in 1982, at first

[24] Tangible assets are financial assets with a physical substance (e.g. property, vehicles, equipment), as opposed to intangible assets that are saleable though lacking physical substance as well as an intrinsic productive value. Fixed assets are non-trading business assets of a relatively permanent nature, (e.g. plant, fixtures or goodwill), as opposed to current assets, which are cash and operating assets that are convertible into cash within a year. See *Collins English Dictionary*: http://www.collinsdictionary.com/dictionary/english. [Accessed: 25th August 2014]

[25] *Décret n°67-604 du 27 juillet 1967 fixant des exclusions et restrictions en matière de droit à déduction pris en application des dispositions de l'article 18-2 de la loi n°66-10 du 6 janvier 1966 portant réforme des taxes sur le chiffre d'affaires et diverses dispositions d'ordre financier*. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000000876311.

[26] *Loi n°91-716 du 26 juillet 1991 portant diverses dispositions d'ordre économique et financier*, Art.13. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000000355163.

partially (10% of the VAT could be deducted in the second semester of 1982, 20% in 1983, 30% in 1984, 40% in 1985, 50% in 1986, then 60% in 1988, 70% in 1989, 80% in 1990, 95% in the first semester of 1991), then totally from mid-1991 onwards.[27]




*Notes: LPG was explicitly covered from 1 January 1985 onwards, natural gas from 1 January 1993 onwards, electricity from 1 January 1998 onwards, and E85 from 1 January 2007 onwards.*

*Sources: Loi n°82-540 du 28 juin 1982 de finances rectificative pour 1982, Art. 3; Loi n°84-1208 du 29 décembre 1984 de finances pour 1985, Art.7; Loi n°97-1060 du 30 décembre 1987 de finances pour 1988, Art.27; Loi n°90-1168 du 29 décembre 1990 de finances pour 1991, Art.7; Loi n°91-716 du 26 juillet 1991 portant diverses dispositions d'ordre économique et financier, Art.12; Loi n°92-1376 du 30 décembre 1992 de finances pour 1993, Art.25; Loi n°97-1269 du 30 décembre 1997 de finances pour 1998, Art.15; Loi n°2001-1275 du 28 décembre 2001 de finances pour 2002, Art.18; Loi n°2006-1771 du 30 décembre 2006 de finances rectificative pour 2006, Art.27.*

**Figure 7.2: A historical perspective on VAT deduction rules for fuels**

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[27] *Loi n°82-540 du 28 juin 1982 de finances rectificative pour 1982*, Art. 3. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000000691740;
*Loi n°87-1060 du 30 décembre 1987 de finances pour 1988*, Art.27. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000000317543;
*Loi n°90-1168 du 29 décembre 1990 de finances pour 1991*, Art.7. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000000717191.

By the end of 1990, as VAT deduction on *diesel* had been progressively introduced and had reached 80%, it was decided to set an 80% limit to the VAT deduction incurred on diesel *for passenger cars*, whereas commercial vehicles would soon be entitled full deduction.[28] As early as 29 July 1991, the limit for VAT deduction on diesel used to propel passenger cars was lowered from 80% to 50%.[29] It was even further reduced to 0% in 1998,[30] before being set back at 80% from 1 June 2001 onwards.[31] Meanwhile, full deduction has been maintained for the VAT incurred on diesel used to propel commercial vehicles ever since mid-1991. Petrol, on the other hand, has remained *totally excluded* from the deduction of VAT so far, be it used to propel commercial vehicles or passenger cars.

As far as alternative fuels are concerned, first LPG, as of 1985,[32] then compressed natural gas (CNG), as of 1993,[33] electricity, as of 1998,[34] and finally E85,[35] as of 2007,[36] were granted the same conditions as diesel for VAT

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28 *Loi n°90-1168 du 29 décembre 1990 de finances pour 1991*, Art.7. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000000717191.

29 *Loi n°91-716 du 26 juillet 1991 portant diverses dispositions d'ordre économique et financier*, Art.12. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000000355163.

30 *Loi n°97-1269 du 30 décembre 1997 de finances pour 1998*, Art.15. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000000569621.

31 *Loi n°2001-1275 du 28 décembre 2001 de finances pour 2002*, Art.18. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000000592233.

32 *Loi n°84-1208 du 29 décembre 1984 de finances pour 1985*, Art.7. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000000880778.

33 *Loi n°92-1376 du 30 décembre 1992 de finances pour 1993*, Art.25. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000000178406.

34 *Loi n°97-1269 du 30 décembre 1997 de finances pour 1998*, Art.15. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000000569621.

35 For the record, E85 (in French: '*Superéthanol E85*') is an abbreviation for an ethanol fuel blend of 85% denatured ethanol fuel and 15% petrol by volume. See Chapter 8 for further information.

deduction. Unlike diesel, however, LPG, CNG and electricity have been entitled to *full* VAT deduction for *both* light commercial vehicles and passenger cars since 1998,[37] as a measure to further promote the acquisition of these alternative fuel vehicles by corporate car fleets. E85 on the other hand, has the same 80% limit on VAT deduction as diesel when used to propel passenger cars in corporate car fleets.

Table 7.1 synthesises the rules for VAT deduction on corporate vehicles and their related expenses (parts and maintenance on the one hand, fuels on the other hand) as of July 2014 in France.

| Category of expense | Limits for VAT deduction by vehicle type and by category of expense, as of July 2014 | |
|---|---|---|
| | LCVs | Passenger cars |
| **Vehicle (purchase or lease)** | 100% | 0% |
| **Parts and maintenance** | 100% | 0% |
| **Fuel** | | |
| Petrol | 0% | 0% |
| Diesel | 100% | 80% |
| E85 | 100% | 80% |
| LPG | 100% | 100% |
| Natural gas | 100% | 100% |
| Electricity | 100% | 100% |

*LCV: Light commercial vehicle*

**Table 7.1: VAT deduction rules for corporate vehicles and their related expenses**

In order to provide a preliminary assessment of the impact on corporate car fleets of the differences in the VAT deduction rules between passenger cars and light commercial vehicles on the one hand, and between petrol-powered vehicles and diesel-powered vehicles, on the other hand, we take the following assumptions, which we draw from the methodology of OVE (2014d) for TCO computation and from our own investigation: *i)* a corporation is faced with a

[36] *Loi n°2006-1771 du 30 décembre 2006 de finances rectificative pour 2006*, Art.27. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT 000000273196.

[37] *Loi n°97-1269 du 30 décembre 1997 de finances pour 1998*, Art.15. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000000569621.

choice between a passenger car in the compact-car segment (e.g. Renault Clio) and a passenger-car derivative (registered as a light commercial vehicle) from the same segment;[38] *ii)* the corporation plans to use the vehicle for 100,000 km over 4 years; *iii)* all vehicles have a fuel consumption of 4.2 litres per 100 km (be they diesel or petrol,[39] passenger cars or passenger-car derivatives); *iv)* the costs of depreciation and parts and maintenance are approximated at 16,000 EUR over 4 years for all vehicles, exclusive of VAT;[40] *v)* the pump price of diesel (inclusive of tax) is 1.29 EUR/litre and the pump price of petrol (inclusive of tax) is 1.49 EUR/litre; *vi)* the VAT rate is 20%. Based on these assumptions, the corporation would face an additional cost of 3,200 EUR (20% of 16,000 EUR) over 4 years if it chose the passenger car over the light commercial vehicle, due to the non-deductibility rule for the VAT incurred on passenger cars (vehicle depreciation) and their related expenses (parts and maintenance). On top of that, the corporation would bear another additional cost of 862 EUR over 4 years if it chose a *petrol* passenger car over a *diesel* passenger car. For the sake of clarity, it should be noted that 140 of these 862 EUR (16%) stem from the gap in fuel prices between petrol and diesel, while the remaining 722 EUR (84%) stem from the non-deductibility rule for the VAT incurred on petrol expenses.

## 7.3 The early incentives for clean vehicles in vehicle registration taxes

In France, any person, natural or juridical, upon registering a new or second-hand light-duty vehicle, must pay a compound registration tax which consists

[38] This assumption allows us to neutralise the effect of the higher average fuel efficiency of passenger cars compared to light commercial vehicles.

[39] We acknowledge that diesel-powered vehicles are generally considered to have higher fuel efficiency than petrol-powered vehicles, but we choose to ignore this effect in our analysis.

[40] According to OVE (2014d), the aggregated costs of depreciation and parts and maintenance make up 63% of the TCO of passenger cars in the compact-car segment (or 16,236 out of 25,772 EUR over 4 years) and 74% of the TCO of LCVs in the passenger-car derivative segment (or 15,327 out of 20,712 EUR over 4 years). The cost gap of 909 EUR between the two vehicle types stems from both, a difference in the costs of parts and maintenance (for 70%), and a difference in the depreciation costs (for the remaining 30%). However, for the sake of simplicity, we choose to ignore this gap in our analysis.

of: *i)* a regional registration tax based on engine horsepower; *ii)* a parafiscal registration charge on commercial vehicles for funding professional training in road transport; and *iii)* additional registration taxes on passenger cars based on $CO_2$ emissions (also known as '*malus*' as far as *new* passenger cars are concerned, and '$CO_2$ surtax' as far as *used* passenger cars are concerned). Corporate vehicles are not treated differently from private vehicles as far as registration taxes are concerned. Yet, as will be described thereafter, registration taxes have pioneered the introduction of explicit tax incentives for alternative-fuel vehicles.

### 7.3.1 The regional registration tax

The regional registration tax was introduced in 1983[41] in place of the prior national registration tax for motor vehicles, which had been introduced in 1920[42] and later codified in the General Tax Code upon its publication in 1950.[43] The regional registration tax is based on the vehicle's taxable horsepower (rated in HP, or CV in French: '*Cheval Vapeur*').[44] The regional registration tax rates are voted by Regional Councils and the proceeds of the tax go to the budget of the region where the owner has his/her usual residence – if the owner is a natural person – or to the budget of the region where the vehicle has its main operating base – if the owner is a juridical person. Vehicles owned by leasing

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[41] *Loi n°82-1126 du 29 décembre 1982 de finances pour 1983*, Art.20. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000000503959.
Later modified by : *Décret n°88-1001 du 20 octobre 1988 portant incorporation au Code Général des Impôts de divers textes modifiant et complétant certaines dispositions de ce code*, Art.1. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte= JORFTEXT000000509838.
Later modified by: *Loi n°2008-1443 du 30 décembre 2008 de finances rectificative pour 2008*, Art.72. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte= JORFTEXT000020014790.

[42] *Loi n°25 juin 1920 portant création de nouvelles ressources fiscales*, Art.99-102. Available from: http://gallica.bnf.fr/ark:/12148/bpt6k61509851/f28.image.

[43] *Décret n°50-478 du 6 avril 1950 portant règlement d'administration publique pour la refonte des codes fiscaux et la mise en harmonie de leurs dispositions avec celles du décret du 9 décembre 1948 et des lois subséquentes*, Art. 972 of the Annex. Available from: http://www.legifrance.gouv.fr/jopdf/common/jo_pdf.jsp?numJO=0&dateJO= 19500430&pageDebut=04469&pageCourante=04551.

[44] See Annex E for further information on the French legal framework for calculating the taxable horsepower of vehicles.

companies are registered in the region where the first leasing contract takes place. For long-term rental contracts (i.e. 2 years or more), the vehicles are registered in the region where the holder has his/her usual residence – if the holder is a natural person – or in the region where the vehicle has its main operating base – if the holder is a juridical person. Vehicles registered by the distribution networks of car manufacturers (car dealerships, etc.) are not subject to the regional registration tax. Light-duty vehicles older than 10 years upon registration are taxable at a reduced rate of half the tax rate for new and recent light-duty vehicles.

As of 2014, regional tax rates ranged from 27.00 EUR per HP (in Corsica) to 51.20 EUR per HP (in *Provence-Alpes-Côte d'Azur*). For illustrative purposes, we present here the range of registration taxes paid for various vehicle models: *i)* for a Peugeot 2008 HDi or a Volkswagen Polo TDI (diesel-powered compact cars rated 4 HP), the regional registration tax would range from 108 EUR to 204.8 EUR depending on the region of registration; *ii)* for a Peugeot 3008 HDi (diesel-powered saloon rated 6 HP) or a Mercedes-Benz A-Class (petrol-powered compact car rated 6 HP), the regional registration tax would range from 162 EUR to 307.20 EUR depending on the region of registration; *iii)* for a Peugeot 807 HDi (diesel-powered minivan rated 8 HP) or a Mercedes-Benz C-Class (petrol-powered saloon rated 8 HP), the regional registration tax would range from 216 EUR to 409.6 EUR depending on the region of registration.

#### Introducing tax rebates for AFVs

Since 1999,[45] Regional Councils have been allowed to offer rebates (either 50% or 100%) on their respective regional registration tax rates with a view to incentivising the uptake of alternative-fuel vehicles. From 1999 to 2007, alternative-fuel vehicles eligible to such rebates would include vehicles *fully or partially* propelled by the following energy types: electricity, natural gas or liquefied petroleum gas. Furthermore, E85 has been eligible since 2007.[46] In more practical terms, the following alternative-fuel vehicles are eligible to rebates on regional registration tax rates: battery-electric vehicles, natural gas vehicles (mono-fuel or bi-fuel with petrol), liquefied petroleum gas vehicles (mono-fuel or bi-fuel with petrol), diesel- and petrol-hybrid electric vehicles, and flexible-fuel vehicles (which can run on any blend ratio from 0 to 85% ethanol E85 in petrol) DGFIP (2012).

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[45] *Loi n°98-1266 du 30 décembre 1998 de finances pour 1999*, Art.98. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000000209044.

[46] *Loi n°2006-1771 du 30 décembre 2006*, Art.27. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000000273196.

As illustrated in Table 7.2, as at 2014, 13 of the 27 regions in France offered a 100% rebate on regional registration tax rates for alternative-fuel vehicles; 7 additional regions offered a 50% rebate.

These rebates can translate into significant savings on registration costs for such alternative-fuel vehicles as LPG, natural gas, E85 or hybrid-electric vehicles. Indeed, most such vehicles currently on the market have a taxable horsepower rating between 3 HP (e.g. for a Toyota Yaris HSD), and 18 HP (e.g. for a Lexus GS 450H). However, because of a specific calculation formula, most electric cars, such as the Renault Zoé or Tesla Model S, are rated 1 HP only.[47] Consequently, the regional registration tax rebates for alternative-fuel vehicles result in rather insignificant savings as far as electric cars are concerned.

In order to provide a preliminary assessment of the impact on corporate car fleets of the rebates on regional registration taxes for alternative-fuel vehicles, we take the following assumptions: *i)* a corporation is faced with a choice between a conventional passenger car in the mid-luxury segment (e.g. Peugeot 607) and a hybrid-electric vehicle from the same segment (e.g. Lexus GS 450H); *ii)* the conventional passenger car has a taxable horsepower of 13 HP, whereas the hybrid-electric vehicle has a taxable horsepower of 18 HP; *iii)* the chosen vehicle is to be registered in the Paris region (where the regional registration tax rate is 46.15 EUR per HP and where clean vehicles get a full discount on this rate). Based on these assumptions, the corporation could save 600 EUR if it chose the hybrid-electric vehicle over the conventional passenger car.[48]

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[47] See Annex E for further information on the French legal framework for calculating the taxable horsepower of vehicles.

[48] In the Alsace region, where the regional registration tax rate is 36.50 EUR per CV and where clean vehicles get a half discount on this rate, the gain would be reduced to 146 EUR.

| Region in France | Regional registration tax on new and second-hand light-duty vehicles as at June 2014 | |
|---|---|---|
| | Tax rate (EUR/HP) (1) | Discount for "clean vehicles" (2) |
| Alsace | 36.50 | 50% |
| Aquitaine | 36.00 | 100% |
| Auvergne | 45.00 | 100% |
| Basse-Normandie (3) | 35.00 | 100% |
| Bourgogne | 51.00 | 100% |
| Bretagne (3) | 46.00 | 50% |
| Centre | 42.45 | 100% |
| Champagne-Ardenne (3) | 35.00 | 100% |
| Corse | 27.00 | 100% |
| Franche-Comté | 36.00 | 100% |
| Haute-Normandie | 35.00 | 50% |
| Ile-de-France | 46.15 | 100% |
| Languedoc-Roussillon (3) | 44.00 | 0% |
| Limousin | 42.00 | 100% |
| Lorraine | 45.00 | 50% |
| Midi-Pyrénées | 34.00 | 100% |
| Nord-Pas-de-Calais | 45.00 | 100% |
| Pays de Loire | 48.00 | 100% |
| Picardie | 33.00 | 50% |
| Poitou-Charentes | 41.80 | 50% |
| Provence-Alpes-Côte d'Azur (3) | 51.20 | 0% |
| Rhône-Alpes | 43.00 | 50% |
| Guadeloupe | 41.00 | 0% |
| Guyane (3) | 42.50 | 0% |
| La Réunion (3) | 39.00 | 0% |
| Martinique (3) | 30.00 | 0% |
| Mayotte (3) | - | 0% |

*HP: rated horsepower unit (in French: CV, for '*Cheval Vapeur*')*
*Notes: 1. Registration tax rates are voted by Regional Councils. They apply to rated horsepower. Rated horsepower classes are established for tax purposes only. They are country-specific. In France, they result from complex calculations and are only remotely related to actual engine horsepower. Rated horsepower appears on the vehicle registration certificate. 2. "Clean vehicles" include vehicles running on such alternative fuels as: electricity, E85, liquefied petroleum gas or natural gas. 3. Regional registration tax rate as of 2013.*
*Sources: http://vosdroits.service-public.fr/particuliers/F19211.xhtml#N100C4 [Accessed: 31st August 2014]; https://immatriculation.ants.gouv.fr/Vos-demarches/Cout-et-taxes-additionnelles [Accessed: 31st Aug. 2014].*

**Table 7.2: Regional registration taxes on light-duty vehicles and rebates for AFVs**

### 7.3.2 The parafiscal registration charge on commercial vehicles

In addition to the regional registration tax, a national parafiscal charge on the registration certificates of commercial vehicles was introduced in January 2004[49] to fund the implementation of professional training actions in the road transport sector (i.e. state-recognised diplomas on the one hand, mandatory professional training on the other hand). Passenger cars do not fall within the scope of this charge. However, because of the small amounts involved, it can be assumed that the parafiscal registration charge on commercial vehicles does not put light commercial vehicles at a significant disadvantage compared to passenger cars.

Indeed, for light commercial vehicles (i.e. commercial vehicles with a vehicle gross weight not exceeding 3.5 tonnes), the upper limit set for the charge was 30 EUR for the period 2004-2006; it was then increased to 38 EUR for the period 2007-2011[50], further extended to 2016.[51] For information, the upper limit for the parafiscal charge on the registration certificates of commercial vehicles with a vehicle gross weight exceeding 11 tonnes (and public transit vehicles as well) was set at 270 EUR for the period 2004-2006; it was then increased to 305 EUR for the period 2007-2011, further extended to 2016.

Considering the small amounts involved, we can reasonably assume that the parafiscal registration charge on commercial vehicles, although it discriminates between vehicle body types, should have virtually no impact on the choices of corporations as far as *light-duty* vehicles are concerned (i.e. when weighing the options between passenger cars on the one hand, and light commercial vehicles on the other hand).

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[49] *Loi n°2002-1576 du 30 décembre 2002 de finances rectificative pour 2002*, Art.53. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT 000000781906.

[50] *Loi n°2006-1771 du 30 décembre 2006 de finances rectificative pour 2006*, Art.110. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT 000000273196.

[51] *Loi n°2011-1978 du 28 décembre 2011 de finances rectificative pour 2011*, Art.87. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT 000025045613.

### 7.3.3 The '$CO_2$ surtax' on *used* passenger cars with high emission levels

As of 1 July 2006[52] an additional registration tax was introduced to discourage the purchase of *used* passenger cars emitting high levels of $CO_2$. Light commercial vehicles do not fall within the scope of this additional registration tax, which is otherwise collected according to the same rules applicable to the regional registration tax.

Under this $CO_2$ surtax scheme, higher polluting used passenger cars have been taxed for their emissions in excess of the threshold of 200 $gCO_2$/km. For each gram of $CO_2$ per kilometre between 200 $gCO_2$/km and 250 $gCO_2$/km, the additional registration tax rate is 2 EUR/$gCO_2$. For each gram of $CO_2$ per kilometre above the 250 $gCO_2$/km threshold, the additional registration tax rate is 4 EUR/$gCO_2$. Thus, a person or a corporation which would register a used passenger car emitting 280 $gCO_2$/km would pay an additional registration tax of 220 EUR: (250 $gCO_2$ - 200 $gCO_2$) × 2 EUR/$gCO_2$ + (280 $gCO_2$ - 250 $gCO_2$) × 4 EUR/$gCO_2$) = 220 EUR.

A 50% rebate on the additional registration tax rate was introduced in 2007[53] for used passenger cars propelled by E85. In 2014[54], this rebate was reduced to 40%, and passenger cars emitting 250 $gCO_2$/km or more were excluded from the rebate.

### 7.3.4 The environmental penalty, or '*malus*', on *new* passenger cars with high emission levels

A final registration tax was added to the list in January 2008.[55] This additional registration tax, also known as '*malus*', was one of the outputs of the 'Grenelle

[52] *Loi n°2005-1719 du 30 décembre 2005 de finances pour 2006*, Art.18. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000000634802.

[53] *Loi n°2006-1771 du 30 décembre 2006 de finances rectificative pour 2006*, Art.27. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT 000000273196.

[54] *Loi n°2013-1278 du 29 décembre 2013 de finances pour 2014*, Art.31. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000028399511.

[55] *Loi n°2007-1824 du 25 décembre 2007 de finances rectificative pour 2007*, Art.63. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT 000017839505.

Environment Round Tables' held in October 2007. It was meant as an environmental penalty aiming to discourage the purchase of *new* passenger cars emitting high levels of $CO_2$. As with the $CO_2$ surtax, light commercial vehicles do not fall within the scope of this additional registration tax, which is otherwise collected according to the same rules applicable to the regional registration tax.

The proceeds from this additional tax have been allocated to a dedicated fund aimed to subsidise the purchase of clean vehicles under the '*bonus*' programme. Because of the intricate links between these two policy instruments, we will further present the main features of the '*malus*' programme in Section 7.5, which deals with the bonus/malus scheme in its entirety.

# 7.4 The key role of TVS in driving down $CO_2$ emissions

## 7.4.1 The last-standing vehicle circulation tax in France

The 1956 law establishing the National Solidarity Fund intended for the benefit of the elderly (in French: '*Fonds National de Solidarité*'),[56] created three vehicle circulation taxes – also known as road taxes – with a view to contributing to that fund: *i)* an annual differential tax on motor vehicles ('*Taxe différentielle sur les véhicules à moteur*');[57] *ii)* an annual tax on passenger cars with high taxable horsepower;[58] and *iii)* an annual tax on passenger cars registered by corporations

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[56] *Loi n°56-639 du 30 juin 1956 portant institution d'un Fonds National de Solidarité*, Art.1. Available from: http://legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT 000000692223.

[57] *Décret n°56-875 du 3 septembre 1956 pris en application de l'article 1er de la loi n°56-639 du 30 juin 1956 et relatif à l'institution d'une taxe différentielle sur les véhicules à moteur*. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT 000000328357.

[58] *Décret n°56-876 du 3 septembre 1956 pris en application de l'article 1er de la loi n°56-639 du 30 juin 1956 et relatif à l'institution d'une taxe sur les voitures de tourisme d'une puissance supérieure à 16 CV*. Available from: http://www.legifrance.gouv.fr/ jo_pdf.do?cidTexte=JORFTEXT000000328357.

('*Taxe sur les Véhicules de tourisme de Société*', more commonly known as TVS).[59]

The 'vehicle tax sticker' (in French: '*vignette automobile*') was created in 1956[60] to serve as a fiscal certificate attesting the payment of the first two taxes, both of which were based on the vehicle's age and taxable horsepower.[61] The revenues from these two taxes were transferred to the district level (in French: '*département*') in 1983.[62] In 1985, the tax on passenger cars with high taxable horsepower was merged into the differential tax on motor vehicles.[63] As of 2001, private households, non-profit associations and trade unions, were excluded from this tax scheme (except for their light commercial vehicles with an Authorised Gross Weight in excess of 2 tonnes),[64] before it was fully repealed with effect from 1 December 2006.[65]

Since that date, therefore, TVS has remained as the last vehicle circulation tax still in effect in France. It is only applicable to corporations, not private

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[59] *Décret n°56-877 du 3 septembre 1956 pris en application de l'article 1er de la loi n°56-639 du 30 juin 1956 et relatif à l'institution d'une taxe annuelle sur les véhicules de tourisme des sociétés*. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000000328357.

[60] *Arrêté du 19 octobre 1956 Conditions d'application des décrets 56-875 et 56-876 du 3 septembre 1956 relatifs à l'institution d'une taxe différentielle sur les véhicules à moteur et d'une taxe sur les voitures e tourisme d'une puissance fiscale supérieure à 16 CV*. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000000838543.

[61] See Annex E for further information on the French legal framework for calculating the taxable horsepower of vehicles.

[62] *Loi n°83-8 du 7 janvier 1983 relative à la répartition de compétences entre les communes, les départements, les régions et l'Etat*, Art.99. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000000320197.

[63] *Loi n°85-695 du 11 juillet 1985 portant diverses dispositions d'ordre économique et financier*, Art.17-18. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000000693456.

[64] *Loi n°2000-1352 de finances pour 2001*, Art.6. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000000220595.

[65] *Loi n°2005-1719 du 30 décembre 2005 de finances pour 2006*, Art.14. Available from: http://legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000000634802.

households, and light commercial vehicles are exempted.[66] With close to 1 billion EUR in tax revenues in 2012, it contributed 2.1% of the total tax revenues allocated to the compulsory social security pension scheme in France (Sécurité Sociale, 2013).

### 7.4.2 The shift in the tax base of TVS from engine horsepower to $CO_2$ emissions

TVS is an annual tax, levied on corporations only, for the use of passenger cars (registered in the M1 category under EC Directive 2007/46/CE) and, since October 2010,[67] of those of the motor vehicles registered in the N1 category (i.e. light commercial vehicles) which are nonetheless designed to transport passengers and their luggage (e.g. some Sport Utility Vehicles, some Multi-Purpose Vehicles). It should be noted that vehicles exclusively used to perform a commercial transport service (e.g. taxis) are exempt from TVS liability, and so are short-term rental cars and dealership vehicles meant for retail sale.

In 1979,[68] the tax structure of TVS was changed from a single fee level to 2 fee levels, based on the taxable horsepower of the vehicle (with a stable threshold at 7 HP from 1979 to 2005,[69] the higher-horsepower category was taxed more than twice as much as the lower-horsepower category over the period 1983-2005). In 1996,[70] special provisions were introduced to exempt alternative-fuel vehicles from TVS, including battery- and hybrid-electric vehicles, natural gas vehicles and liquefied petroleum gas vehicles[71].

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[66] See the following subsection for two exceptions.

[67] *Loi n°2010-1657 du 29 décembre 2010 de finances pour 2011*, Art.24. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000023314376.

[68] *Loi n°80-30 du 18 janvier 1980 de finances pour 1980*, Art.3. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000000705191.

[69] See Annex E for further information on the French legal framework for calculating the taxable horsepower of vehicles.

[70] *Loi n°96-1236 du 30 décembre 1996 sur l'air et l'utilisation rationnelle de l'énergie* (also known as 'Loi LAURE'), Art.28. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000000381337.

[71] Bi-fuel vehicles running on LPG *and* petrol were only partially exempt: for 25% of the amount payable between 1996 and 2000, for 50% between 2000 and 2011.

After 50 years of existence, the TVS scheme was extensively redrafted under the French Finance Act for 2006, effective 1 October 2005.[72] First, the tax base was switched from taxable horsepower to *$CO_2$ emissions*, in order to discourage the purchase of new passenger cars emitting high levels of $CO_2$. In addition, the number of tax levels was raised from 2 to 7, with increasingly dissuasive tax rates, from 2 EUR per $gCO_2$/km for vehicles with emissions not exceeding 100 $gCO_2$/km, up to 19 EUR per $gCO_2$/km for vehicles with emissions in excess of 250 $gCO_2$/km. Finally, the new scheme clarified the status of the vehicles of employees (or business directors) with regard to TVS liability. Indeed, the French General Tax Code considers that the TVS scheme should cover all vehicles used for corporate purposes, including vehicles owned or leased by employees and business directors, and used to such purposes that they are eligible for the payment of mileage allowances by the corporation. Such 'private' vehicles should be treated as plain corporate vehicles with regard to TVS liability (i.e. the full TVS tax rate applies) if the employee received mileage allowances for the *professional* use of their car in excess of 20,000 km for the tax year concerned. A 75% tax rate applies (respectively: 50%, 25%) if the employee received mileage allowances for professional car use in the range of 15,001 km to 20,000 km (respectively: 10,001 km to 15,000 km, 5,001 km to 10,000 km) over a year. Private vehicles of employees that are used for professional purposes for no more than 5,000 km over a year are fully exempt from TVS.

In late 2006,[73] the TVS exemptions for AFVs were limited to two years,[74] and flexible-fuel vehicles were incorporated into their scope (specifically to run on any blend ratio from 0 to 85% ethanol E85 in petrol).

The TVS scheme was further modified as of 1 October 2011.[75] In order to support more effectively the development of EV and HEVs on the corporate car market and to further discourage corporations from purchasing new passenger

[72] *Loi n°2005-1719 du 30 décembre 2005 de finances pour 2006*, Art.14-16. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000000634802.

[73] *Loi n°2006-1771 du 30 décembre 2006 de finances rectificative pour 2006*, Art.27. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT 000000273196.

[74] More precisely, the law provided for a TVS exemption over 8 quarters. Indeed, although it is an annual tax, TVS is payable quarterly.

[75] *Loi n°2011-1906 du 21 décembre 2011 de financement de la sécurité sociale pour 2012*, Art.21. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte= JORFTEXT000025005833.

cars emitting high levels of $CO_2$, the following changes were made to the scheme: *i)* vehicles emitting no more than 50 $gCO_2/km$ were *de facto* exempted (the tax rate for this emission category has been set at 0 EUR per $gCO_2/km$); *ii)* the tax rates in the upper emission categories were raised sharply (by 10% for vehicles with emissions in the range of 121 to 140 $gCO_2/km$, by 15% for vehicles with emissions in the range of 141 to 160 $gCO_2/km$, by 20% for vehicles with emissions in the range of 161 to 200 $gCO_2/km$, etc.); and *iii)* the 2-year TVS exemption formerly granted to all AFVs was restricted to hybrid-electric vehicles (both diesel and petrol) with emissions not exceeding 110 $gCO_2/km$. Table 7.3 illustrates the developments in the TVS scheme from 2006 to 2014.

<table>
<tr><th rowspan="2">Vehicle emission class (in $gCO_2/km$)</th><th colspan="2">Annual TVS tax rate on corporate passenger cars, by vehicle emission class (in $EUR/gCO_2$)</th></tr>
<tr><th>From 2006 to 2011</th><th>From 2012 to 2014</th></tr>
<tr><td>0 - 10</td><td rowspan="10">2</td><td rowspan="5">0</td></tr>
<tr><td>11 - 20</td></tr>
<tr><td>21 - 30</td></tr>
<tr><td>31 - 40</td></tr>
<tr><td>41 - 50</td></tr>
<tr><td>51 - 60</td><td rowspan="5">2</td></tr>
<tr><td>61 - 70</td></tr>
<tr><td>71 - 80</td></tr>
<tr><td>81 - 90</td></tr>
<tr><td>91 - 100</td></tr>
<tr><td>101 - 110</td><td rowspan="2">4</td><td rowspan="2">4</td></tr>
<tr><td>111 - 120</td></tr>
<tr><td>121 - 130</td><td rowspan="2">5</td><td rowspan="2">5.5</td></tr>
<tr><td>131 - 140</td></tr>
<tr><td>141 - 150</td><td rowspan="2">10</td><td rowspan="2">11.5</td></tr>
<tr><td>151 - 160</td></tr>
<tr><td>161 - 170</td><td rowspan="4">15</td><td rowspan="4">18</td></tr>
<tr><td>171 - 180</td></tr>
<tr><td>181 - 190</td></tr>
<tr><td>191 - 200</td></tr>
<tr><td>201 - 210</td><td rowspan="5">17</td><td rowspan="5">21.5</td></tr>
<tr><td>211 - 220</td></tr>
<tr><td>221 - 230</td></tr>
<tr><td>231 - 240</td></tr>
<tr><td>241 - 250</td></tr>
<tr><td>251 or more</td><td>19</td><td>27</td></tr>
</table>

*Sources: Loi n°2005-1719 du 30 décembre 2005 de finances pour 2006, Art.14; Loi n°2011-1906 du 21 décembre 2011 de financement de la sécurité sociale pour 2012, Art.21; Loi n°2013-1278 du 29 décembre 2013 de finances pour 2014, Art.30*

**Table 7.3: TVS tax rates from 2006 to 2014**

In order to provide a preliminary assessment of the dissuasive effect of the gradual TVS tax rates on corporate car fleets, we take the following assumptions: *i)* a corporation is faced with a choice between two passenger cars; *ii)* the first car emits 140 $gCO_2$/km, the second car emits 141 $gCO_2$/km; and *iii)* the corporation plans to use the vehicle for 4 years. Based on these assumptions, the corporation would face an additional cost of 3,384 EUR (over 4 years) if it chose the car emitting 141 $gCO_2$/km over the car emitting 140 $gCO_2$/km. Now, if both cars emitted 110 $gCO_2$/km, but one was a hybrid-electric vehicle and the other one was a conventional vehicle, the corporation could save 880 EUR (over 4 years) if it chose the hybrid-electric vehicle over the conventional passenger car, because of the 2-year exemption.

### 7.4.3 The inclusion of local emissions in the tax base of TVS

Since 1 October 2013,[76] the TVS tax base has included a second component, besides $CO_2$ emissions, in order to account for local air pollution caused by corporate passenger cars. Table 7.4 provides the structure and levels of the TVS component based on local air pollutant emissions.

Although this additional component of the TVS scheme appears to discriminate against diesel-powered vehicles (e.g. 600 EUR per year for diesel vehicles registered in 1996 or earlier, as compared with 70 EUR for petrol vehicles the same age), this discrimination is restricted to the oldest vehicles in corporate car fleets. Indeed, the taxation gap between diesel vehicles and petrol vehicles is narrowing for more recently-registered vehicles (40 EUR per year for diesel vehicles registered in 2011 or later, as compared with 20 EUR for petrol vehicles the same age), in line with the developments in emission performance expected from the gradual tightening of the Euro emission standards.[77]

The TVS scheme acknowledges the strong performances of electric vehicles with regard to local air pollution by exempting them from the additional TVS component on local air pollutant emissions. Hybrid-electric vehicles, on the other hand, are differentiated on the basis of the fuel type they use besides electricity (diesel vs. petrol), *and* on their $CO_2$ emissions: indeed, hybrid diesel-electric vehicles with emissions not exceeding 110 $gCO_2$/km are liable to the same additional TVS on local air pollutant emissions as petrol vehicles.

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[76] *Loi n°2013-1278 du 29 décembre 2013 de finances pour 2014*, Art.30. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000028399511.

[77] See Annex A for further information on the European legislative framework for action against local air pollution caused by motor vehicles.

Considering the small amounts involved, we can reasonably assume that the additional component of TVS based on local air pollutant emissions, although it discriminates between diesel and petrol passenger cars, should have virtually no impact on the choices of corporations with regard to fuel type, as far as *recent* vehicles are concerned. On the other hand, this additional tax is likely to have an impact on the willingness of corporate car fleets to get rid of their *older* diesel cars. Indeed, a corporation could save 260 EUR per year (1,040 EUR over 4 years) if it replaced an older diesel passenger car (10 years of age) with a recent one.

Of course, because light commercial vehicles are not within the scope of TVS, the full cost of TVS can be avoided if the corporation chooses to register a vehicle in the LCV category instead of the passenger car category. When faced with a choice between two vehicles, one passenger car and one light commercial vehicle, both recent, both diesel, and both emitting 110 $gCO_2$/km, the corporation could save 480 EUR per year (440 EUR for the $CO_2$ emissions component of TVS, 40 EUR for the local air pollutant emissions component of TVS), or 1,920 EUR over 4 years if it chose the light commercial vehicle over the passenger car.

| Year of first registration | Additional TVS on corporate passenger cars' local air pollutant emissions, by fuel type and by year of first registration (in EUR) | |
|---|---|---|
| | Diesel and similar fuels (1) | Petrol and similar fuels (2) |
| Up until 1996 | 600 | 70 |
| 1997 to 2000 | 400 | |
| 2001 to 2006 | 300 | 45 |
| 2007 to 2010 | 100 | |
| From 2011 onwards | 40 | 20 |

*Source: Loi n°2013-1278 du 29 décembre 2013 de finances pour 2014, Art.30*
*Notes: 1. The "diesel and similar fuels" category includes vehicles powered by a diesel engine and hybrid diesel-electric vehicles with emissions in excess of 110 $gCO_2$/km. 2. The "petrol and similar fuels" category includes all other vehicles, but for full-electric vehicles. Electric vehicles are exonerated from the additional TVS on local air pollutant emissions.*

**Table 7.4: The TVS additional component based on local air pollutant emissions**

# 7.5 The bonus/malus scheme: A complex, but powerful, instrument

In the aftermath of the 'Grenelle Environment Round Tables' held in October 2007, a bonus/malus scheme on light-duty vehicles was set up in France in order to promote the uptake of clean and energy-efficient vehicles in the light-duty vehicle fleet. The French bonus/malus scheme is rather complex, for it consists of four distinct components (commonly known as 'bonus', 'super bonus', 'malus', and 'super malus'), which differ from one another in their nature (e.g. one-shot additional registration tax vs. annual tax, for the 'malus' and 'super malus' respectively), in the nature of their legal basis (e.g. law vs. decree for the 'malus' and 'bonus' respectively), in the pace of their updating, in the vehicle types covered (passenger cars and/or LCVs), in the treatment of alternative-fuel vehicles (HEVs in particular), etc. As of 2014, all components in this scheme were equally applicable to all vehicle owners (or users), be they private households or corporations, although corporate car fleets may have been treated differently in the past.

## 7.5.1 The environmental penalty, or 'malus', on *new* passenger cars with high emission levels

As already mentioned in a previous section, the 'malus' was introduced in January 2008[78] as an additional vehicle registration tax. It was meant as an environmental penalty designed to discourage the purchase of *new* passenger cars emitting high levels of $CO_2$, and its proceeds have been allocated to a dedicated fund aimed to subsidise the purchase of clean vehicles under the 'bonus' scheme. LCVs do not fall within the scope of this tax.

Table 7.5 provides an overview of the development of the 'malus' programme since its introduction. It highlights that the penalties increased steeply over the period 2008-2014. As an illustration, the maximum fee rose from 2,600 EUR in 2008 (for new passenger cars emitting more than 250 $gCO_2$/km) to 8,000 EUR in 2014 (for new passenger cars emitting more than 200 $gCO_2$/km). In addition, the emission level below which no penalty is payable decreased from 160 $gCO_2$/km in 2008 to 130 $gCO_2$/km in 2014. Parallel to the steep rise in penalties, the number of different tax levels was raised from 4

[78] *Loi n°2007-1824 du 25 décembre 2007 de finances rectificative pour 2007*, Art.63. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT 000017839505.

levels in 2008 to 11 in 2014, thereby smoothing out tax differentials between two subsequent vehicle emission classes and limiting potential threshold effects.

<table>
<tr><th rowspan="2">Vehicle emission class (in $gCO_2$/km)</th><th colspan="7">"Malus" or environmental penalty on newly-registered passenger cars, by vehicle emission class and by year of registration (in EUR)</th></tr>
<tr><th>2008</th><th>2009</th><th>2010</th><th>2011</th><th>2012</th><th>2013</th><th>2014</th></tr>
<tr><td>0 - 130</td><td rowspan="7">0</td><td rowspan="7">0</td><td rowspan="6">0</td><td rowspan="5">0</td><td rowspan="3">0</td><td rowspan="2">0</td><td>0</td></tr>
<tr><td>131 - 135</td><td>150</td></tr>
<tr><td>136 - 140</td><td>100</td><td>250</td></tr>
<tr><td>141 - 145</td><td rowspan="2">200</td><td>300</td><td>500</td></tr>
<tr><td>146 - 150</td><td>400</td><td>900</td></tr>
<tr><td>151 - 155</td><td>200</td><td>500</td><td>1,000</td><td>1,600</td></tr>
<tr><td>156 - 160</td><td>200</td><td rowspan="7">750</td><td rowspan="5">750</td><td rowspan="4">1,500</td><td rowspan="4">2,200</td></tr>
<tr><td>161 - 165</td><td>200</td><td>200</td><td rowspan="7">750</td></tr>
<tr><td>166 - 170</td><td rowspan="7">750</td><td rowspan="7">750</td></tr>
<tr><td>171 - 175</td></tr>
<tr><td>176 - 180</td><td>2,000</td><td>3,000</td></tr>
<tr><td>181 - 185</td><td rowspan="2">1,300</td><td>2,600</td><td>3,600</td></tr>
<tr><td>186 - 190</td><td>3,000</td><td>4,000</td></tr>
<tr><td>191 - 195</td><td rowspan="10">1,600</td><td rowspan="8">2,300</td><td rowspan="2">5,000</td><td rowspan="2">6,500</td></tr>
<tr><td>196 - 200</td><td rowspan="10">1,600</td></tr>
<tr><td>201 - 205</td><td rowspan="10">1,600</td><td rowspan="10">1,600</td><td rowspan="11">6,000</td><td rowspan="11">8,000</td></tr>
<tr><td>206 - 210</td></tr>
<tr><td>211 - 215</td></tr>
<tr><td>216 - 220</td></tr>
<tr><td>221 - 225</td></tr>
<tr><td>226 - 230</td></tr>
<tr><td>231 - 235</td><td rowspan="5">3,600</td></tr>
<tr><td>236 - 240</td></tr>
<tr><td>241 - 245</td><td rowspan="3">2,600</td></tr>
<tr><td>246 - 250</td><td rowspan="2">2,600</td></tr>
<tr><td>251 or more</td><td>2,600</td><td>2,600</td></tr>
</table>

*Sources: Loi n°2007-1824 du 25 décembre 2007 de finances rectificative pour 2007, Art.63; Loi n°2009-1673 du 30 décembre 2009 de finances pour 2010, Art.93; Loi n°2011-1977 du 28 décembre 2011 de finances pour 2012, Art.55; Loi n°2012-1509 du 29 décembre 2012 de finances pour 2013, Art.17; Loi n°2013-1278 du 29 décembre 2013 de finances pour 2014, Art.54.*

**Table 7.5: The 'malus' on higher polluting new passenger cars**

In order to provide a preliminary assessment of the dissuasive effect of the gradual *malus* penalties on corporate car fleets, we take the following assumptions: *i)* a corporation is faced with a choice between two passenger cars; *ii)* the first car emits 140 $gCO_2$/km and the second emits 141 $gCO_2$/km. Based on these assumptions, the corporation would face an additional cost of 250 EUR if it chose the car emitting 1 more gram of $CO_2$ per kilometre. Now, if the first car emitted 150 $gCO_2$/km and the second car emitted 151 $gCO_2$/km, the additional cost incurred by the corporation if it chose the car emitting 1 more gram of $CO_2$ per kilometre, would be 700 EUR.

Obviously, because light commercial vehicles are not within the scope of the *malus* programme, all penalties can be spared if the corporation chooses to register a vehicle in the LCV category instead of the passenger car category.

### 7.5.2 The 'bonus' on new light-duty vehicles with low emission levels

The same act that in 2008 introduced the environmental penalty, commonly known as 'malus', on new passenger cars emitting *high* levels of $CO_2$, also introduced an environmental incentive, commonly known as 'bonus', on the purchase of new passenger cars emitting *low* levels of $CO_2$[79]. Indeed, as already mentioned, the proceeds from the 'malus', which is collected upon registration of new passenger cars, have been allocated to a dedicated fund aimed to subsidise the purchase of clean vehicles through the 'bonus' programme.

Although the 'malus' and 'bonus' are presented as the two sides of a single scheme, many differences can be noted between these two policy instruments. Firstly, unlike the 'malus', the 'bonus' has had its scale (i.e. the number of levels and the incentive amount for each level) fixed by decree, not law, thereby allowing for greater flexibility in modifying the incentive scheme. The first implementing decree entered into force in 2008,[80] and was later modified by 9 successive decrees in a 7-year period of time (see Table 7.6 for detailed information). Secondly, the 'bonus has been extended to *light commercial vehicles* emitting less than 60 $gCO_2$/km from 20 January 2009 onwards[81] (LCVs with emissions in excess of 60 $gCO_2$/km were still excluded from the 'bonus' programme as of 2014), whereas the 'malus' has remained applicable to passenger cars only. Thirdly, the 'bonus' has explicitly sought to promote such alternative-fuel vehicles as LPG and natural gas passenger cars (up until 2010

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[79] *Loi n°2007-1824 du 25 décembre 2007 de finances rectificative pour 2007*, Art.63. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT 000017839505.

[80] *Décret n°2007-1873 du 26 décembre 2007 instituant une aide à l'acquisition de véhicules propres*. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte= JORFTEXT000017764437.

[81] *Décret n°2009-66 du 19 janvier 2009*. Available from: http://www.legifrance.gouv.fr/ jo_pdf.do?cidTexte=JORFTEXT000020124258.

only),[82] and diesel and petrol hybrid-electric passenger cars (up to this day), whereas the 'malus' has never discriminated between drivetrain technologies and/or fuels. Table 7.7 illustrates the specific bonus scales that have been designed and implemented to promote hybrid-electric passenger cars (and other AFVs before them).

As far as *corporate* vehicles are concerned, the year 2012 was something of a turning point in the rules of eligibility for the 'bonus' programme. Indeed, while corporate vehicles held by private corporations and local administrations had been eligible for the general 'bonus' programme ever since its introduction in 2008, corporate vehicles held by State administrations were not eligible for the general 'bonus' programme until 1 August 2012.[83] This was also the date when corporate vehicles in general, both private and public, became eligible for the specific 'bonus' programme for hybrid-electric passenger cars.

The maximum emission level beyond which no incentive is granted decreased from 130 $gCO_2$/km in 2008 (respectively 140 $gCO_2$/km under the specific 'bonus' programme for hybrid-electric cars) to 90 $gCO_2$/km in 2014 (respectively 110 $gCO_2$/km). Thus, in 2014, there was a 40-$gCO_2$/km gap between the last emission category eligible for the 'bonus' programme and the first emission category taxable under the 'malus' programme (respectively, 90 $gCO_2$/km and 130 $gCO_2$/km); this gap was only 30 $gCO_2$/km in 2008 (between 130 $gCO_2$/km and 160 $gCO_2$/km). Unlike for the 'malus' programme, the number of incentive levels under the 'bonus' programme varied only slightly, between 3 and 5 levels, over the period 2008-2014. Interestingly, in just 7 years, the maximum threshold for eligibility for the 'bonus' programme upon its launch in 2008 (130 $gCO_2$/km) had become the minimum threshold for taxation under the 'malus' programme by 2014.

The sharp decline initiated in January 2012[84] in the incentive amounts for new vehicles with emissions in excess of 60 $gCO_2$/km could be interpreted as the starting point of a progressive reorientation of the 'bonus' programme towards a

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[82] *Décret n°2010-1618 du 23 décembre 2010*. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000023281122.

[83] *Décret n°2012-925 du 30 juillet 2012*. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000026236984.

[84] *Décret n°2011-2055 du 29 décembre 2011 modifiant le décret n°2007-1873 du 26 décembre 2007 instituant une aide à l'acquisition des véhicules propres*. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000025059779.

near-exclusive promotion of battery-electric and plug-in hybrid vehicles.[85] Indeed, as of 2014, the incentive amount granted to the purchasers of new vehicles emitting between 61 $gCO_2/km$ and 90 $gCO_2/km$ was down to 150 EUR, which can be regarded as insignificant (about 1% or below) as compared with the purchase price of a new vehicle. The governmental support for the development of battery-electric vehicles was further underlined in mid-2012.[86] Indeed, the 2012 governmental Automotive Plan (MRP and MTEFD, 2012) provided for the upgrading of all incentive amounts under the 'bonus' programme by 100 EUR or 150 EUR, and for the upgrading of the maximum incentive from 5,000 EUR, which had been its original level since 2008, to 7,000 EUR for vehicles with emissions not exceeding 20 $gCO_2/km$.

The assessment of the incentive effect of the bonus programme on corporate car fleets with regard to HEVs is quite straightforward. As of 2014, if a corporation is faced with a choice between two passenger cars, the first a conventional car and the second a hybrid-electric car, both emitting 110 $gCO_2/km$, the corporation could save 3,300 EUR if it chose the hybrid-electric car over the conventional car, because of the special bonus on HEVs.

[85] The certified $CO_2$ emissions of most 'standard' hybrid-electric vehicles were in the range of 70 $gCO_2/km$ to 100 $gCO_2/km$, or above, as of 2014: 75 $gCO_2/km$ for a Toyota Yaris HSD, 89 $gCO_2/km$ for a Toyota Prius III, 91 $gCO_2/km$ for a Peugeot 3008 Hybrid4, 99 $gCO_2/km$ for a Citroën DS5 Hybrid4, or yet 139 $gCO_2/km$ for a BMW ActiveHybrid 3. On the other hand, the $CO_2$ emissions of plug-in hybrid vehicles were in the range of 20 $gCO_2/km$ to 50 $gCO_2/km$ as of 2014: 27 $gCO_2/km$ for an Opel Ampera or a Chevrolet Volt, 49 $gCO_2/km$ for Toyota Prius Plug-in Hybrid (PHV) or for a Volvo V60 Plug-in Hybrid. Source: http://www.avem.fr/voiture-hybride.html.

[86] *Décret n°2012-925 du 30 juillet 2012 modifiant le décret n°2007-1873 du 26 décembre 2007 instituant une aide à l'acquisition des véhicules propres*. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000026236984.

<table>
<tr><th rowspan="2">Vehicle emission class (in $gCO_2$/km)</th><th colspan="7">"Bonus" on the purchase of new light-duty vehicles (1) (2), by vehicle emission class and by year of registration (in EUR)</th></tr>
<tr><th>2008</th><th>2009</th><th>2010</th><th>2011</th><th>Jan.-Jul. 2012</th><th>Aug.2012- Oct.2013</th><th>Nov.2013- 2014</th></tr>
<tr><td>Eligibility status of corporate fleets (3)</td><td colspan="7">Eligible</td></tr>
<tr><td>Eligibility status of State fleets</td><td colspan="5">Not eligible</td><td colspan="2">Eligible</td></tr>
<tr><td>0 - 5</td><td rowspan="12">5,000 Max. 20% of total price (4)</td><td rowspan="12">5,000 Max. 20%</td><td rowspan="12">5,000 Max. 20%</td><td rowspan="12">5,000 Max. 20%</td><td rowspan="10">5,000 Max. 20%</td><td rowspan="4">7,000 Max. 30%</td><td rowspan="4">6,300 Max. 27%</td></tr>
<tr><td>6 - 10</td></tr>
<tr><td>11 - 15</td></tr>
<tr><td>16 - 20</td></tr>
<tr><td>21 - 25</td><td rowspan="6">5,000 Max. 20%</td><td rowspan="8">4,000 Max. 20%</td></tr>
<tr><td>26 - 30</td></tr>
<tr><td>31 - 35</td></tr>
<tr><td>36 - 40</td></tr>
<tr><td>41 - 45</td></tr>
<tr><td>46 - 50</td></tr>
<tr><td>51 - 55</td><td rowspan="2">3,500</td><td rowspan="2">4,500</td></tr>
<tr><td>56 - 60</td></tr>
<tr><td>61 - 65</td><td rowspan="8">1,000</td><td rowspan="8">1,000</td><td rowspan="7">1,000</td><td rowspan="6">800</td><td rowspan="6">400</td><td rowspan="6">550</td><td rowspan="6">150</td></tr>
<tr><td>66 - 70</td></tr>
<tr><td>71 - 75</td></tr>
<tr><td>76 - 80</td></tr>
<tr><td>81 - 85</td></tr>
<tr><td>86 - 90</td></tr>
<tr><td>91 - 95</td><td rowspan="3">400</td><td rowspan="2">100</td><td rowspan="2">200</td><td rowspan="9">0</td></tr>
<tr><td>96 - 100</td><td rowspan="4">500</td></tr>
<tr><td>101 - 105</td><td rowspan="4">700</td><td rowspan="4">700</td><td rowspan="7">0</td><td rowspan="7">0</td></tr>
<tr><td>106 - 110</td><td rowspan="6">0</td></tr>
<tr><td>111 - 115</td></tr>
<tr><td>116 - 120</td><td rowspan="2">100</td></tr>
<tr><td>121 - 125</td><td rowspan="2">200</td><td rowspan="2">200</td></tr>
<tr><td>126 - 130</td><td rowspan="2">0</td></tr>
<tr><td>131 or more</td><td>0</td><td>0</td></tr>
</table>

*Notes: 1. Light commercial vehicles emitting less than 60 $gCO_2$/km have been eligible to the same levels of bonus as passenger cars since 20 January 2009. 2. Hybrid-electric passenger cars are eligible to different levels of bonus from those presented here (see next Table). However, the following three categories of hybrid-electric passenger cars are eligible to the same levels of bonus as those presented here: those newly registered between 2008 and 2011 and emitting less than 60 $gCO_2$/km, those newly registered between January 2012 and October 2013 and emitting less than 50 $gCO_2$/km, and those newly registered from November 2013 onwards and emitting less than 60 $gCO_2$/km. 3. Excluding State fleets. 4. The bonus in the lowest emission class cannot exceed 20% of the total price of the vehicle (for electric vehicles, this total price would also include the price of battery if it were leased), inclusive of taxes.*
*Sources: Décret n°2007-1873 du 26 décembre 2007 instituant une aide à l'acquisition des véhicules propres; Décret n°2009-66 du 19 janvier 2009; Décret n°2009-1581 du 18 décembre 2009; Décret n°2010-447 du 3 mai 2010; Décret n°2010-1618 du 23 décembre 2010; Décret n°2011-310 du 22 mars 2011; Décret n°2011-2055 du 29 décembre 2011; Décret n°2012-925 du 30 juillet 2012; Décret n°2012-1545 du 28 décembre 2012; Décret n°2013-971 du 30 octobre 2013.*

**Table 7.6: The 'bonus' on new light-duty vehicles (other than hybrid-electric passenger cars)**

| Vehicle emission class (in $gCO_2$/km) | "Bonus" on the purchase of new hybrid-electric passenger cars [1] [2], by vehicle emission class and by year of registration (in EUR) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 2008 | 2009 | 2010 | 2011 | Jan.-Jul. 2012 | Aug.2012-Oct.2013 | Nov.2013-2014 |
| Eligibility status of corporate fleets | Not eligible | | | | | Eligible | |
| Eligibility status of State fleets | Not eligible | | | | | Eligible | |
| 0 - 5 | | | | | | | |
| 6 - 10 | | | | | | 7,000<br>Max. 10%<br>Min. 2,000 | 6,300<br>Max. 8.25%<br>Min. 1,650 |
| 11 - 15 | | | | | | | |
| 16 - 20 | | | | | | | |
| 21 - 25 | | | | | 5,000<br>Max. 20% | | |
| 26 - 30 | 5,000<br>Max. 20%<br>[3] [4] | 5,000<br>Max. 20% | 5,000<br>Max. 20% | 5,000<br>Max. 20% | | | |
| 31 - 35 | | | | | | 5,000<br>Max. 10%<br>Min 2,000 | |
| 36 - 40 | | | | | | | 4,000<br>Max. 8.25%<br>Min. 1,650 |
| 41 - 45 | | | | | | | |
| 46 - 50 | | | | | | | |
| 51 - 55 | | | | | | | |
| 56 - 60 | | | | | | | |
| 61 - 65 | | | | | | | |
| 66 - 70 | | | | | | | |
| 71 - 75 | | | | | | | |
| 76 - 80 | | | | | 2,000 | 4,000<br>Max. 10%<br>Min 2,000 | |
| 81 - 85 | | | | 2,000 | | | 3,300<br>Max. 8.25%<br>Min. 1,650 |
| 86 - 90 | | | | | | | |
| 91 - 95 | | | | | | | |
| 96 - 100 | 2,000 | 2,000 | 2,000 | | | | |
| 101 - 105 | | | | | | | |
| 106 - 110 | | | | | | | |
| 111 - 115 | | | | | | | |
| 116 - 120 | | | | | | | |
| 121 - 125 | | | | | | | |
| 126 - 130 | | | | 0 | 0 | 0 | 0 |
| 131 - 135 | | | | | | | |
| 136 - 140 | | | 0 | | | | |
| 141 or more | 0 | 0 | | | | | |

*Notes: 1. Including petrol and diesel hybrid-electric passenger cars 2. Alternative-fuel passenger cars powered by liquefied petroleum gas or natural gas were eligible to the same levels of bonus as those for hybrid-electric passenger cars in 2008, 2009 and 2010. They have been excluded from the bonus scheme since 2011. 3. The following hybrid-electric passenger cars are eligible to the same levels of bonus as those valid for the general case: those newly registered between 2008 and 2011 and emitting less than 60 $gCO_2$/km, those newly registered between January 2012 and October 2013 and emitting less than 50 $gCO_2$/km, and those newly registered from November 2013 onwards and emitting less than 60 $gCO_2$/km. 4. The bonus in the lowest emission class cannot exceed 20% of the total price of the vehicle (this total price would also include the price of battery if it were leased), inclusive of taxes.*
*Sources: Décret n°2007-1873 du 26 décembre 2007 instituant une aide à l'acquisition des véhicules propres; Décret n°2009-66 du 19 janvier 2009; Décret n°2010-1618 du 23 décembre 2010; Décret n°2011-310 du 22 mars 2011; Décret n°2012-925 du 30 juillet 2012; Décret n°2012-1545 du 28 décembre 2012; Décret n°2013-971 du 30 octobre 2013.*

**Table 7.7: The 'bonus' on new hybrid-electric passenger cars**

### 7.5.3 The scrappage incentive or 'super-bonus'

Since 2008,[87] an additional incentive, known as 'super-bonus' (or scrappage incentive, or indeed scrappage premium), has been granted to beneficiaries of the 'bonus' programme in exchange for their scrapping of an old vehicle (on condition that the old vehicle is in operating condition, and duly insured, to the date of its release to an accredited scrapping site). The 'super-bonus' has inherited some of its restrictions in scope from the 'bonus' programme, upon which it is based. In particular, corporate vehicles held by state administrations and corporate hybrid-electric cars have only been eligible for the 'super-bonus' programme since 1 August 2012. Like the 'bonus', the 'super-bonus' has its terms and conditions fixed by decree, not law, thereby allowing for greater flexibility in modifying the incentive scheme. Table 7.8 illustrates the development in the terms and conditions of the 'super-bonus' from 2008 to 2014.

Upon its introduction in 2008, the scrappage incentive represented between 6% and 150% of the 'bonus' granted to purchasers of low-emitting vehicles (300 EUR compared to 200 to 5,000 EUR).

An upgraded scheme was temporarily introduced in 2009,[88] as part of the French economic recovery plan, which raised the amount of the incentive from 300 to 1,000 EUR, and lowered the age limit for the scrapped vehicles from 16 to 11 years. According to SOeS (2010), 605,000 new-car sales benefited from the scrappage incentive scheme in 2008 and 2009, 89% of which in the year 2009 alone (the scheme benefited more than one third of total new-car sales in France that year). In 2009, the upgraded scrappage incentive represented between 20% and 500% of the 'bonus' granted to purchasers of low-emitting vehicles (1,000 EUR compared to 200 to 5,000 EUR). The upgraded scheme was further extended to 2010,[89] although its amount was lowered to 700 EUR for the first semester, then 500 EUR for the second semester. The upgraded scheme ended in 2010.

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[87] *Décret n°2007-1873 du 26 décembre 2007 instituant une aide à l'acquisition de véhicules propres*, Art.4. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000017764437.

[88] *Décret n°2009-66 du 19 janvier 2009 modifiant le décret n°2007-1873 du 26 décembre 2007 instituant une aide à l'acquisition des véhicules propres*, Art.12. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000020124258.

[89] *Décret n°2009-1581 du 18 décembre 2009 modifiant le décret n°2007-1873 du 26 décembre 2007 instituant une aide à l'acquisition des véhicules propres et le décret n° 2009-66 du 19 janvier 2009*, Art.2. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000021494476

The original 'super-bonus' scheme (a 300 EUR incentive for the scrapping of a vehicle aged 16 years or more), which had *de facto* remained valid during the whole period from 2008 to 2010, was maintained in 2011 and beyond.

In 2012,[90] the incentive was lowered from 300 EUR to 200 EUR. Since then, the 'super-bonus' has still represented between 3% and 150% of the 'bonus' granted to purchasers of low-emitting vehicles (200 EUR compared to 150 to 6,300 EUR).

Because of its inherent link to the 'bonus' programme, the 'super-bonus' has always had specific conditions for hybrid-electric cars. The emission ceiling for their eligibility was 140 $gCO_2$/km when the scheme started in 2008, instead of 130 $gCO_2$/km for conventional vehicles. Ever since 2011 (and the end of the upgraded 'super-bonus'), it has remained as high as 110 $gCO_2$/km, even though the ceiling for conventional vehicles was lowered from 105 $gCO_2$/km in 2011, 2012 and most of 2013, to 90 $gCO_2$/km in the last two months of 2013 and 2014.[91] It should be noted however that, as with the 'bonus' scheme, corporate car fleets were not entitled to the 'super-bonus' programme for their newly-purchased hybrid-electric cars until 1 August 2012.[92]

The assessment of the incentive effect of the 'super-bonus' programme on corporate car fleets with regard to HEVs is quite straightforward. As of 2014, if a corporation is faced with a choice between two passenger cars, the firsta conventional car and the second a hybrid-electric car, both emitting 110 $gCO_2$/km, the corporation could save an additional 200 EUR (on top of the 3,300 EUR bonus) if it chose the hybrid-electric car over the conventional car, due to the special 'super-bonus' on HEVs.

[90] *Décret n°2011-2055 du 29 décembre 2011 modifiant le décret n°2007-1873 du 26 décembre 2007 instituant une aide à l'acquisition des véhicules propres*, Art.3. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000025059779.

[91] *Décret n°2013-971 du 30 octobre 2013 modifiant le décret n°2007-1873 du 26 décembre 2007 instituant une aide à l'acquisition des véhicules propres*. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000028138550.

[92] *Décret n°2012-925 du 30 juillet 2012*. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000026236984.

<table>
<tr><th rowspan="2">Eligibility conditions</th><th colspan="8">"Super bonus" or scrappage incentive on older vehicles (in EUR),<br>with conditions on the scrapped vehicle (age)<br>and on the newly-registered vehicle (vehicle type and emission class)</th></tr>
<tr><th>2008</th><th>2009</th><th>Jan.-June 2010</th><th>Jul.-Dec. 2010</th><th>2011</th><th>Jan.-Jul. 2012</th><th>Aug.2012-Oct.2013</th><th>Nov.2013-2014</th></tr>
<tr><td>Eligibility status of corporate vehicles</td><td colspan="6">Eligible except for HEVs</td><td colspan="2">Eligible</td></tr>
<tr><td>Eligibility status of State fleet vehicles</td><td colspan="6">Not eligible</td><td colspan="2">Eligible</td></tr>
<tr><td>Age of scrapped vehicle</td><td>16 yrs. or more</td><td>11 yrs. or more</td><td>11 yrs. or more</td><td>11 yrs. or more</td><td>16 yrs. or more</td><td>16 yrs. or more</td><td>16 yrs. or more</td><td>16 yrs. or more</td></tr>
<tr><td colspan="9">Emission class (in $gCO_2/km$) of new passenger car</td></tr>
<tr><td>0 - 90</td><td rowspan="9">300</td><td rowspan="15">1,000</td><td rowspan="14">700</td><td rowspan="14">500</td><td rowspan="5">300</td><td rowspan="4">200</td><td rowspan="4">200</td><td>200</td></tr>
<tr><td>91 - 95</td><td rowspan="4">(HEVs only)</td></tr>
<tr><td>96 - 100</td></tr>
<tr><td>101 - 105</td></tr>
<tr><td>106 - 110</td><td>(HEVs only)</td><td>(HEVs only)</td></tr>
<tr><td>111 - 115</td><td rowspan="11">0</td><td rowspan="11">0</td><td rowspan="11">0</td><td rowspan="11">0</td></tr>
<tr><td>116 - 120</td></tr>
<tr><td>121 - 125</td></tr>
<tr><td>126 - 130</td></tr>
<tr><td>131 - 135</td><td rowspan="2">(HEVs only)</td></tr>
<tr><td>136 - 140</td></tr>
<tr><td>141 - 145</td><td rowspan="5">0</td></tr>
<tr><td>146 - 150</td></tr>
<tr><td>151 - 155</td></tr>
<tr><td>156 - 160</td><td rowspan="2">0</td><td rowspan="2">0</td></tr>
<tr><td>161 or more</td><td>0</td></tr>
<tr><td colspan="9">Emission class (in $gCO_2/km$) of new light commercial vehicle</td></tr>
<tr><td>0 - 60</td><td>0</td><td>1,000</td><td>700</td><td>500</td><td>300</td><td>200</td><td>200</td><td>200</td></tr>
<tr><td>61 or more</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
</table>

*HEV: Hybrid-electric vehicle*

*Sources: Décret n°2007-1873 du 26 décembre 2007 instituant une aide à l'acquisition des véhicules propres, Art.4; Décret n° 2009-66 du 19 janvier 2009, Art.12; Décret n° 2009-1581 du 18 décembre 2009, Art.2; Décret n° 2011-2055 du 29 décembre 2011, Art.3*

**Table 7.8: The 'super-bonus' incentivising the scrapping of older vehicles**

### 7.5.4 The annual tax on higher polluting passenger cars or 'super-malus'

An annual tax on higher polluting passenger cars, also known as 'super-malus', was introduced in 2009,[93] on top of the additional registration taxes based on $CO_2$ emissions previously described, to further discourage the purchase of higher polluting passenger cars. In a sense, the 'super-malus' has rescutitated the annual tax on passenger cars with high taxable horsepower, which was in effect in France from 1956 to 1985, before it was merged into the differential tax on motor vehicles.[94] Like this former tax, the 'super-malus' is a circulation tax, in that it is payable by the vehicle's owner (or by the vehicle's holder in the instance of long-term rental) every year following the year of registration. And like this former tax, the 'super-malus' is not applicable to light commercial vehicles.

As illustrated by Table 7.9, the 'super-malus' annual tax rate has been stable at 160 EUR per vehicle per year since its introduction. The scope of the 'super-malus' initially included passenger cars with emissions in excess of 250 $gCO_2$/km among those newly registered in 2009, and passenger cars with emissions in excess of 245 $gCO_2$/km among those newly registered in 2010 and 2011. Thus, for these vehicles, the annual 'super-malus' would represent a little over 6% of the initial 'malus' paid on first registration of the passenger car (160 EUR compared to 2,600 EUR). Since 2012,[95] all newly-registered passenger cars with emissions in excess of 190 $gCO_2$/km have been included within the scope of the annual tax. Thus, for passenger cars that were first registered in 2012, the 'super-malus' would represent between 4% and 7% of the initial 'malus' paid for exceeding the 190 $gCO_2$/km threshold (160 EUR compared to 2,300 to 3,600 EUR). This ratio would fall to about 3% for passenger cars first registered in 2013 (160 EUR compared to 5,000 to 6,000 EUR), and about 2% for passenger cars first registered in 2014 (160 EUR compared to 6,500 EUR to 8,000 EUR).

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[93] *Loi n°2008-1443 du 30 décembre 2008 de finances rectificative pour 2008*, Art.75. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT 000020014790.

[94] The merged tax, which was linked to the 'vehicle tax sticker' (in French: '*vignette automobile*'), was fully repealed effective 1 December 2006. Private households, non-profit associations and trade unions, had been excluded since 2001. See Section 7.4 for further detail.

[95] *Loi n°2011-1977 du 28 décembre 2011 de finances pour 2012*, Art.55. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000025044460.

This is because the annual 'super-malus' tax rate has remained stable at 160 EUR while the penalties for registering higher polluting vehicles have risen sharply under the 'malus' scheme.

<table>
<tr><th rowspan="2">Vehicle emission class (in $gCO_2$/km)</th><th colspan="6">"Super malus" or annual environmental tax on passenger cars, by vehicle emission class and by year of first registration (in EUR per vehicle and per year)</th></tr>
<tr><th>2009</th><th>2010</th><th>2011</th><th>2012</th><th>2013</th><th>2014</th></tr>
<tr><td>0 - 190</td><td rowspan="3">0</td><td rowspan="2">0</td><td rowspan="2">0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>191 - 245</td><td rowspan="3">160</td><td rowspan="3">160</td><td rowspan="3">160</td></tr>
<tr><td>246 - 250</td><td rowspan="2">160</td><td rowspan="2">160</td></tr>
<tr><td>251 or more</td><td>160</td></tr>
</table>

*Sources: Loi n°2008-1443 du 30 décembre 2008 de finances rectificative pour 2008, Art.75; Loi n°2011-1977 du 28 décembre 2011 de finances pour 2012, Art.55.*

**Table 7.9: The annual 'super malus' on higher polluting passenger cars**

In order to give a preliminary assessment of the dissuasive effect of the 'super-malus' on corporate car fleets, we take the following assumptions: *i)* a corporation is faced with a choice between two passenger cars; *ii)* the first car emits 110 $gCO_2$/km, the second car emits 250 $gCO_2$/km; and *iii)* the corporation plans to use the vehicle for 4 years. Based on these assumptions, the corporation would face an additional cost of 640 EUR in 'super-malus' (over 4 years) – on top of a 'malus' of 8,000 EUR – if it chose the car emitting 250 $gCO_2$/km over the car emitting 110 $gCO_2$/km.

Obviously, because light commercial vehicles are not within the scope of the 'malus' programme, all penalties can be spared if the corporation chooses to register a vehicle in the LCV category instead of the passenger car category.

# 7.6 Summary and discussion

Table 7.10 synthesises the similarities and differences in the terms and conditions of the various tax schemes applicable to corporate car fleets in France as of 2014, as well as the preliminary assessments of their incentive effects on corporate car fleets (based on the method of total costs of ownership, or TCO, computed over 4 years).

| Tax schemes | Year of introduction | Owners (users) included [1] | Stage of vehicle life concerned [2] | Tax base [3] | Specific provisions: Passenger cars vs. LCVs | Specific provisions: Petrol vehicles vs. Diesel vehicles | Specific provisions: AFVs vs. Conventional vehicles | Preliminary impact assessment [4] (TCO over 4 years) |
|---|---|---|---|---|---|---|---|---|
| **Excise taxes on fuels** | **(1920)** | C+H | IU | litres of fuel | - | Lower tax on diesel fuel | - | ΔTCO (petrol / diesel) = + 750 EUR |
| **VAT (rules for deductibility)** | **(1954)** | | | | | | | |
| on vehicle price | 1967 | C | NV/UV /IU | retail price | PCs are penalised (no deduction at all) | - | Full deductibility allowed on LPG, NG, electricity fuels used in PCs and LCVs | ΔTCO (PC / LCV) = + 3,200 EUR . |
| on fuel types | 1982 | C | IU | retail price | PCs are penalised (partial deduction) | Petrol discriminated | Full deductibility allowed on LPG, NG, electricity fuels used in PCs and LCVs | ΔTCO (petrol PC / diesel PC) = + 722 EUR [net of the effect of excise taxes] . |
| **Vehicle registration taxes** | **(1920)** | | | | | | | |
| Regional registration tax | 1983 | C+H | NV/UV | CV | - | - | Half or full discounts possible for AFVs | ΔTCO (HEV / conventional PC, mid-luxury) = - 600 EUR [Paris region] . |
| Parafiscal charge on commercial vehicles | 2004 | C+H | NV/UV | - | LCVs only | - | - | ΔTCO (PC / LCV) = - 38 EUR . |
| $CO_2$ surtax | 2006 | C+H | UV | $gCO_2/km$ | PCs only | (Implicit advantage to diesel through the $CO_2$ tax base) | 40% rebate for PCs propelled by E85 | ΔTCO (PC / LCV, 250 $gCO_2/km$) = + 100 EUR . |
| **TVS** | **(1956)** | | | | | | | |
| on $CO_2$ emissions | 2006 | C | IU | $gCO_2/km$ | PCs only | (Implicit advantage to diesel through the $CO_2$ tax base) | (EVs are *de facto* exempt) 2-year exemption for HEVs | ΔTCO (250 $gCO_2/km$ / 110 $gCO_2/km$, PC) = + 19,740 EUR ; ΔTCO (HEV / conventional PC, 110 $gCO_2/km$) = - 880 EUR ; ΔTCO (PC / LCV, 110 $gCO_2/km$) = + 1,760 EUR . |
| on local air pollutant emissions | 2014 | C | IU | - | PCs only | Higher tax fees on diesel vehicles | EVs are exempt; reduced fee for HEVs ≤ 110$gCO_2/km$ | ΔTCO (diesel PC 10 yrs. / diesel PC, recent) = + 1,040 EUR ; ΔTCO (petrol PC / diesel PC, recent) = - 80 EUR . |
| **Bonus/malus** | **(2008)** | | | | | | | |
| Environmental penalty (malus) | 2008 | C+H | NV | $gCO_2/km$ | PCs only | (Implicit advantage to diesel through the $CO_2$ tax base) | (EVs are *de facto* exempt) | ΔTCO (250 $gCO_2/km$ / 110 $gCO_2/km$, PC) = + 8,000 EUR ; ΔTCO (PC / LCV, 250 $gCO_2/km$) = + 8,000 EUR . |
| Environmental incentive (bonus) | 2008 | C+H | NV | $gCO_2/km$ | All PCs; LCVs ≤ 60$gCO_2/km$ | " | Maximum bonus for EVs Special bonus scale for HEVs | ΔTCO (EV / conventional PC) = - 6,300 EUR ; ΔTCO (HEV / conventional PC, 110 $gCO_2/km$) = - 3,300 EUR . |
| Srappage incentive (super-bonus) | 2008 | C+H | NV | - | All PCs; LCVs ≤ 60$gCO_2/km$ | " | Extended eligibility for HEVs (due to special bonus scale) | ΔTCO (HEV / conventional PC, 110 $gCO_2/km$) = - 200 EUR . |
| Super-malus | 2009 | C+H | IU | $gCO_2/km$ | PCs only | " | - | ΔTCO (250 $gCO_2/km$ / 110 $gCO_2/km$, PC) = + 640 EUR ; ΔTCO (PC / LCV, 250 $gCO_2/km$) = + 640 EUR . |

*LCV: Light commercial vehicle; PC: Passenger car; AFV: Alternative-fuel vehicle; EV: ELectric vehicle; HEV: Hybrid-electric vehicle; VAT: Value-added tax; LPG: Liquiefied petroleum gaas; NG: Natural gas; TVS:* Taxe sur les Véhicules de tourisme de Société*; CV:* Cheval Vapeur *(rated horsepower); TCO: Total costs of owernship*

*Notes: 1. Owners (users) included: Corporate (C), Households (H), or both (C+H). 2. Stage of vehicle life concerned: at the purchase/registration of a new vehicle (NV), at the purchase/registration of a used vehicle (UV), in use (IU). 3. When the tax is a fixed fee, no tax base is specified. 4. Preliminary impact assessments are provided on the basis of total costs of owernship over 4 years and 100,000km. For further detail on other assumptions, please refer to the core of the text.*

Table 7.10: Terms and conditions of the tax schemes applicable to corporate car fleets

### 7.6.1 Uncovering the patterns in the terms and conditions of the various tax schemes

The previous sections have confirmed the complexity of the portfolio of tax schemes that apply to corporate car fleets in France. For a long time now, corporations have been liable to both general tax schemes (e.g. fuel excise taxes or vehicle registration taxes, since 1920) and targeted tax schemes (the annual tax on corporate passenger cars, TVS, since 1956, and the scheme for VAT deduction on corporate vehicles and their related expenses since 1967), for their ownership and use of light-duty vehicles.

As has already been discussed, the implicit connection that existed, back in the 1950s and 1960s, between diesel fuel and corporate vehicles, contributed to shape tax policy under both general schemes and targeted schemes for corporate vehicles, which in turn led corporate car fleets to rely almost exclusively on diesel fuel to this day.

Following a parallel historical construction, it is notable that the two tax schemes specific to corporate car fleets (i.e. VAT deduction and TVS) still explicitly discriminate against passenger cars, thereby suggesting that, in the eyes of policy-makers, these vehicles are not considered as necessary to the operations of corporations as light commercial vehicles may be (OVE, 2014b). More generally, the review of tax schemes has shown that commercial vehicles are subject to fairly light taxation, even under the general schemes.

The evolution in tax bases in the introduction of new tax schemes, or in the reshaping of existing ones, shows a progressive shift in focus towards environmental concerns in general, and $CO_2$ emissions in particular. In 2006, corporate car fleets were precursors in the introduction of $CO_2$ as the tax base of a major scheme (namely: TVS), two years before the introduction of the malus scheme on *all* new passenger car registrations. It should be noted, however, that light commercial vehicles have remained exempt from all taxes with a focus on $CO_2$ emissions (even though LCVs with emissions not exceeding 60 $gCO_2/km$ are entitled to the bonus and super-bonus under the same conditions as passenger cars). In addition, one can argue that taxes based on $CO_2$ emissions provide an indirect competitive advantage to diesel-powered vehicles over petrol-powered vehicles due to their higher performances with regard to $CO_2$ emissions. All of the above would suggest that the recent focus of tax schemes on $CO_2$ emissions only increases the competitive edge of LCVs over passenger cars on the one hand, and that of diesel-powered vehicles over petrol-powered vehicles on the other hand.

### 7.6.2 Discussing the relative effectiveness of various tax incentives

We will now discuss the relative impacts of the schemes reviewed, based on the preliminary assessments we have provided for a series of case studies. As a reference, we will bear in mind that the average total costs of ownership (TCO) computed by OVE (2014d) across French corporate car fleets were, in 2013, approximately 35,300 EUR for passenger cars, and 26,600 EUR for light commercial vehicles (costs are assessed over 4 years and for 100,000 km).

**Old distortions die hard**

As mentioned in our introduction to this chapter, some tax schemes applicable to corporate car fleets have proven very effective in influencing the choices of corporate car fleets with regard to vehicle *energy* types. Indeed, the differentiated excise taxes on fuels and the discrimination against petrol through the VAT deduction rules, have been major drivers of the steady shift of corporate car fleets to diesel-powered vehicles over recent decades (see Chapter 4 and 5). We have shown that these distortions in favour of diesel still prevail: altogether, as of 2014, the two schemes could provide diesel-powered passenger cars a competitive advantage close to 1,500 EUR over petrol-powered passenger cars (assessed over a 4-year period of ownership and under the assumptions made in previous sections).

On top of discriminations based on the fuel type, the discrimination in favour of light commercial vehicles against passenger cars that was introduced by a change in the VAT deduction rules as of 1991, has been so effective as to give rise in France to a *new* vehicle body type, known as the 'passenger-car derivative'.[96] Passenger-car derivatives have gained increasing market share on the LCV market since the early 1990s, as was illustrated in Chapter 5 (see Figure 5.3 in particular). As a matter of fact, as of 2014, the differentiated rules for VAT deduction based on vehicle body type alone, could provide light commercial vehicles a competitive advantage in excess of 3,000 EUR over passenger cars (assessed over a 4-year period of ownership and under the assumptions made in previous sections).

Considering the significant financial amounts involved in the context of currently observed TCOs, we can see how, in the absence of suitable corrections to past distortions introduced by the earliest schemes – fuel excise tax on the one

[96] Passenger-car derivatives result from the conversion of passenger-car body types into commercial vehicles (after removal of any rear passenger seat). Because such conversion is usually carried out for tax purposes, these vehicles are often plainly labelled as 'fiscal vehicles' (OVE, 2014c: p.12).

hand, VAT deduction rules on the other hand – the market for corporate light-duty vehicles is likely to remain *highly unbalanced in favour of diesel fuel*, and *prone to favour light-duty vehicles* over passenger cars.

On the basis of our observations, we can assert that the market for corporate light-duty vehicles is capable of pragmatic adaptation to the fiscal framework when this framework sends clear, stable messages. The question remains, however, as to the *inertia* of this market, now that such strong and prolonged incentives have modelled corporate vehicles and their operational use by fleets over decades.

### A general shift towards more stringent conditions in the *disincentive* instruments focusing on $CO_2$ emissions, but some apparent inconsistencies

The increasing focus of tax policy on the environmental impacts of automotive fleets has resulted in the introduction of $CO_2$ emissions in the tax base of one *existing* scheme – namely, the TVS scheme (as of 2006) – and in the design of *new* tax schemes entirely based on $CO_2$ emissions – namely, the 'malus' and 'super-malus' schemes (as of 2008 and 2009 respectively) for *new* passenger cars, and the $CO_2$ registration surtax on *used* passenger cars (as of 2006).

It is interesting to note that all *disincentive* schemes based on $CO_2$ emissions have evolved quite independently from one another. For instance, the tax scale for the registration 'malus' was revised 5 times between 2008 and 2014, whereas the tax scale for the annual 'super-malus' was only revised twice between 2009 and 2014, and the tax scale for the annual TVS was only revised once between 2006 and 2014.

Yet, both the 'malus' and TVS have progressively shifted towards increasingly costly penalties for high-emitting vehicles. We have shown that the TVS scheme is a particularly strong disincentive against new passenger cars with high emissions. Indeed, the additional TVS costs incurred by a corporation for using a passenger car emitting 250 $gCO_2$/km rather than a passenger car emitting 110 $gCO_2$/km, would be close to 20,000 EUR over 4 years. These additional TVS costs would come on top of the differential costs in 'malus' payable on registration of the vehicle, which would be 8,000 EUR for the same pair of cars. The cumulative effects of the two schemes are something of a double whammy for corporate car fleets, when compared with private households. The differential costs in 'super-malus', which would only be around 600 EUR over 4 years, would apply equally to corporations and private households, but are virtually negligible compared to the previous amounts mentioned.

Altogether, it would seem that both the main two *disincentive* schemes based on $CO_2$ emissions had been progressively reshaped to fight more effectively against high-emitting passenger cars, but without necessarily agreeing on an 'acceptable' level of $CO_2$ emissions. In particular, we note that the 'malus' scheme provides for very gradual penalties up to the level of

190 $gCO_2$/km (from 0 to 4,000 EUR in 10 steps, the next step being at 6,500 EUR), whereas the TVS scheme is only gradual up to the level of 140 $gCO_2$/km (from 0 to 3,080 EUR over 4 years in just 3 steps, the next step being at 6,486 EUR over 4 years). Interestingly, the TVS costs incurred by corporations for the use of a passenger car emitting 141 $gCO_2$/km equate the 'malus' penalty incurred by private households, as well as corporations, for the registration of a passenger car emitting 191 $gCO_2$/km (respectively, 6,486 EUR over 4 years and 6,500 EUR).

The very stringent conditions imposed *specifically* on corporate fleets for their purchase and use of *passenger cars* through the TVS scheme on top of other, general schemes, can be interpreted as a consequence of the general understanding that passenger cars in corporate car fleets are 'luxury goods' (OVE, 2014b) rather than operational tools. To support this, we might note that light commercial vehicles are *exempt from all disincentive schemes* based on $CO_2$ emissions, although their average emissions are, on average, much higher than those of corporate passenger cars (respectively, 145 $gCO_2$/km and 109 $gCO_2$/km in 2013, according to OVE (2014d)), and although LCVs with emissions not exceeding 60 $gCO_2$/km have been eligible for the *same levels of incentives* as passenger cars under the 'bonus' and 'super-bonus' schemes.

In our opinion, such observations further raise the questions of: *i)* whether the assumption that all corporate passenger cars are 'luxury goods' and should be taxed accordingly, is (still) valid; and *ii)* whether the qualification of light commercial vehicles as 'operational tools' should exempt them from *any* taxation with an environmental focus.

**Policies promoting the uptake of AFVs by corporate car fleets have recently focused on EVs and HEVs**

Corporate car fleets have benefitted from the special provisions designed to promote AFVs under the regional registration tax scheme since 1999 (i.e. half or full rebates on the tax rate, depending on the regions). All AFVs are eligible for these tax rebates, including battery-electric vehicles, hybrid-electric vehicles, natural gas vehicles, liquefied petroleum gas vehicles, etc. However, we have shown that the impact of these provisions is limited, except for some AFVs with very high taxable horsepower.

The modification of the TVS scheme in 1996 marked the introduction in that scheme of the first provisions in favour of AFVs. Yet, following its modification in October 2011, the TVS scheme has seen restrictions in its former provisions for AFVs, with a stronger focus on EVs and HEVs. Indeed, battery-electric vehicles have been *de facto* exempt from TVS since then because the tax rate for the 0-50 $gCO_2$/km was set at 0 EUR per $gCO_2$/km (it had been 2 EUR per $gCO_2$/km since 2006). In addition, the 2-year TVS exemption that was formerly granted to all AFVs, has been restricted to hybrid-electric vehicles (both diesel and petrol) with emissions not exceeding 110 $gCO_2/km$. We have shown that, as of 2014, these special exemptions could provide EVs (respectively HEVs) a competitive advantage close to 1,800 EUR (900 EUR) over conventional passenger cars (assessed over a 4-year period of ownership and considering a conventional passenger car with emissions of 110 $gCO_2/km$).

Now, looking at the two *incentive* schemes based on $CO_2$ emissions – namely, the 'bonus' and 'super-bonus' schemes–, it should first be noted that corporate fleets were not fully eligible until August 2012. Indeed, before then, State fleets were not eligible for the 'bonus' scheme, and corporate fleets in general were altogether excluded from the benefit of the special bonus on new hybrid-electric passenger cars.

While these apparent design flaws have since been corrected, it should be noted that the 'bonus' scheme appears to have shifted over time from a simple incentive scheme based on $CO_2$ emissions, to an instrument virtually dedicated to the promotion of EVs and HEVs. Indeed, not only have vehicles propelled by liquefied petroleum gas or natural gas been excluded from the scheme since 2011, but the scheme was also modified as of October 2013 to exclude *all* non-hybrid vehicles with emissions *in excess of 90 $gCO_2/km$*. Thus, we have seen that, as of 2014, the 'bonus' and 'super-bonus' schemes could together provide EVs (respectively HEVs) a competitive advantage of 6,500 EUR (3,500 EUR) over conventional passenger cars with emissions of 110 $gCO_2/km$. These incentives are almost four times as high as the incentives granted to EVs and HEVs under the TVS scheme.

Altogether, these observations raise, in our opinion, the questions of *i)* whether there is a sound justification (environmental or otherwise) for excluding AFVs other than EVs and HEVs from the benefit of special provisions under the schemes reviewed (especially TVS, and the bonus); *ii)* whether corporate car fleets could be a significant potential market for EVs and HEVs (this will be the focus of our next chapter); and *iii)* should the answer to the last question be positive, whether the current tax policy framework can act as an effective trigger to bring this about.

## 7.7 Conclusion

Through a thorough review of the main tax schemes applicable to corporate car fleets in France, we have endeavoured to *unravel the complexity* of the various tax stimuli that are likely to influence the choices of corporations with regard to some of the key features of the vehicles they purchase and use. We have managed to go back to the roots, in tax policy, of the prevalence of diesel-powered vehicles in French corporate car fleets. We have also been able to provide some insights into the fiscal rationale for a new vehicle body type that appeared in the early 1990s, namely the passenger-car derivative.

By analysing the taxes layer after layer, not only have we highlighted the *weight of history* and its corollary, the *possibility of inertia*, but we have also pointed out the capacity of tax policy to adapt to new objectives (e.g. environmental) and to accommodate new policy options (e.g. the promotion of alternative-fuel vehicles) with increasing *flexibility*. Such flexibility, however, added to the initial complexity of the tax portfolio as a whole, puts the system at a risk of missing its objectives, whatever these may be, for lack of legibility, or worse, for lack of consistency. Legibility is clearly at stake when changes occur in the terms and conditions of different schemes with the same tax base (e.g. the TVS scheme and the 'malus' scheme) in a way that appears to lack coordination in time or scale. Issues of consistency can arise, for instance, from variations across schemes in the scope of AFVs which tax policy explicitly seeks to promote.

Unfortunately, we could only provide some preliminary assessments of the impacts on corporate car schemes of the individual schemes reviewed, and have not been able to offer a more holistic perspective in this regard. We anticipate, however, that the present work will provide the necessary background information against which we will be able to assess with greater accuracy the impacts of tax policy on the features of corporate vehicles in France over recent decades, using complementary data sets from the advanced statistical register of road motor vehicles (RSVERO), currently being developed and tested by the French Interior Ministry and the Ministry for Sustainable Development.

Only then will we be able to present a full set of arguments for public policy-makers to consider overhauling the portfolio of taxes that apply to French corporate car fleets (and beyond). Indeed, we postulate, based on our investigations, that a window of opportunity might be about to open in this regard, because of rising concerns over the environmental impacts of corporate vehicles, both globally and locally, and the growing awareness of the many weaknesses and inadequacies of the current tax system (CFE, 2013a; CFE, 2013b: p.34-53; *Voiture Ecologique*, 2013; OVE, 2014d: p.49). Overhauling the portfolio of taxes that apply to corporate car fleets would provide an opportunity to *i)* clarify the objectives of policy-makers with regard to the environmental impacts of fleets, in terms of local and global emissions, *ii)* identify the portfolio of solutions available (or yet to be developed) to achieve – and if necessary, prioritise – such objectives; and *iii)* design the set of (tax) policies that would most efficiently achieve the objectives based on the solutions identified.

As far as alternative-fuel vehicles are considered, and assuming corporate car fleets are viewed as a potential market for them, the available data and literature do not a us to assess whether current tax schemes effectively and efficiently foster their uptake by corporate car fleets. Our next chapter might provide some further insights into the materialisation of the demand for AFVs from the corporate market segment. Yet the matter of the sustainability of the costs incurred by public authorities for creating strong tax stimuli to support alternative-fuel vehicles will remain open to further investigation.

In addition, our view is that tax policy should not be considered independently from other policies. In particular, when analysing the uptake of electric vehicles by corporate car fleets, several policies with a possibly significant influence on the supply side should be included in the scope of analysis. For instance, public support for the deployment of an adequate charging infrastructure can be a powerful enabler of the development of the electro-mobility system. Moreover, on the regulatory side, the effective implementation of the so-called 'right to charge' policy in leased facilities, or the clarification of regulations on charging safety in tertiary sector buildings, have important roles to play in the future deployment of EVs in corporate car fleets. Finally, non-tax policies on the demand side of the electro-mobility system are likely to play a growing part in the uptake of EVs by corporate car fleets. Beyond some initial public procurement initiatives (see, for instance, the joint BEV-purchasing initiative led by La Poste Group and coordinated by the French central office for public purchasing, UGAP, in 2009-2011,[97] or the 2010[98] and 2012[99] governmental notices on the exemplary role of public fleets), national, regional and local public authorities have a role to play in the development of new instruments of mobility management on their respective territories, in conjunction with the corporations established on these territories. In particular, one can assume that reinforcing restrictions on access to the centres of metropolitan areas for conventional vehicles (for reasons of public health and environmental protection), could be a major driver, in the future, of the adoption of electric vehicles by corporate car fleets. The transition, if it is to be massive, can only be operated through a coordinated, integrated approach, encompassing tax policies and mobility management policies (including parking, transit, etc.) at both local and national levels.

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[97] See Chapter 6 for further information.

[98] *Circulaire du 2 juillet 2010 relative à l'Etat exemplaire - rationalisation de la gestion du parc automobile de l'Etat et de ses opérateurs*. Available from: http://legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000022450930.

[99] *Circulaire du 3 décembre 2012 relative à la mise en œuvre du plan de soutien à la filière automobile par les services de l'Etat et ses opérateurs*. Available from: http://circulaire.legifrance.gouv.fr/pdf/2012/12/cir_36155.pdf.

# Chapter 8
# Opportunities and challenges for innovations in corporate car fleets: Trends, prospects and policy implications

## 8.1 Introduction

### 8.1.1 Background

As was illustrated in previous chapters, over recent decades corporate car fleets have been influenced in their composition and patterns of use by a combination of *internal* and *external* factors. The former pertain to fleet management processes, for instance: the increased maturity of the mobility-related decision-making processes with regard to the larger strategic interests of the corporation, the use of management tools to handle the complexity of relations among the various stakeholders in the fleet acquisition process, or the use of monitoring and tracking technologies for the purpose of optimising fleet operations and costs. The latter can stem from either the supply side of the automotive market – e.g. improvements in vehicle and powertrain technology, acceleration of the supply of new makes and models due to the increasing competition from foreign manufacturers, etc. – or from the public policy setting – e.g. changes in tax bases, introduction of new tax schemes, etc.

On the one hand, most of the changes in corporate car fleets we were able to trace based on existing literature and survey results (see Chapters 3, 4 and 5) can be categorised as incremental changes rather than radical technological breakthroughs or disruptive market developments. For instance, we showed in

Chapter 3 how, because of increasingly dissuasive tax rates, corporate car fleets have endeavoured to lower the emissions of their passenger cars by progressively replacing their older vehicles with increasingly energy-efficient vehicles. Illustrating this incremental change in the environmental performances of corporate vehicles, OVE showed that the average $CO_2$ emission level of long-term rental corporate passenger cars in France decreased from 145 $gCO_2$/km in 2007 to 115 $gCO_2$/km in 2013 (OVE, 2013a and 2014c). It seems fair to assume that corporate car fleets will pursue this trend of incremental progress in the environmental performances of their vehicles over the coming years, assuming that tax incentives and other regulations still push in that direction.

On the other hand, we have also mentioned that the large size and high turnover rate of the corporate car fleet market segment in France could be leveraged to foster the uptake of some more radical innovations with potential effects on the wider mobility system. The following two trends can act as potential game changers in the generation and diffusion of systemic innovations in the mobility system: *i)* the *digitization* of the economy (in combination with the diffusion of the Internet and personal mobile devices)[1] (see, for instance: Poirier, 1990; Ayres and Williams, 2004; Carlsson, 2004), and *ii)* the *servitization* of manufacturing industries (i.e. the transition process from the supply of products to the supply of *product-service systems*, also known as servicizing)[2] (see, for instance: Vandermerve and Rada, 1988; Mont, 2002; Baines *et al.*, 2009; Belk, 2014).

Whether they qualify as 'radical innovations' or 'really new innovations' according to the categorisation of technological innovativeness by Garcia and

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[1] We hereafter use the following definition of digitization: '*Digitization, as a social process, refers to the transformation of the techno-economic environment and socio-institutional operations through digital communications and applications*' (Katz and Koutroumpis, 2013). Significant research has been dedicated to the effects of (mobile) information and communication technology on mobility, for instance: Lyons (2002), Banister and Stead (2004), Dal Fiore *et al.* (2014).

[2] Servicizing, or servitization, has also been defined as '*a novel business practice that sells product functionality rather than products*' (Toffel, 2002). The car manufacturing industry already initiated this transition when it launched such value-added services as guaranteed maintenance, tyre management, etc. (Williams, 2007; CAS, 2010; Kessler and Stephan, 2013)

Calantone (2002),[3] several innovations currently affecting the automotive market could end up having significant effects on the wider mobility system, as they not only entail the introduction of new products and/or services into the market, but also affect the historical stakeholders and their interrelations by giving rise to new-entrant players, new business models, new partnership arrangements, etc. Alternative-fuel vehicles make good candidates for such systemic innovations. Indeed, their innovativeness does not lie exclusively in their technological content (be it related to energy storage devices, drivetrains or connectivity), but rather in the changes they entail in the infrastructure supply (e.g. for power or gas distribution), the business models (e.g. for battery lease or vehicle charging), etc. Similarly, the innovativeness of car-sharing solutions does not only lie in the business model of pooling transport means with high upfront costs and low marginal costs, but rather in the information platform that allows for real-time feedback on the location and availability of vehicles, for large-scale matching of supply and demand, etc.

### 8.1.2 Statement of the problem

Innovation is a salient feature of the present era, partly on account of the boom in information and communication technologies (ICTs), and it may carry great potential to meet the challenges of sustainable development facing the mobility system. Yet the prospects for a massive uptake of such innovative solutions as alternative-fuel vehicle (AFV) technologies or car-sharing, still appear uncertain.

Corporate car fleets are potential niche markets for automotive innovations. Building on the literature on strategic niche management (see, for instance: Kemp, 1994; Schot *et al.*, 1994; Kemp *et al.*, 1998; Schot and Geels, 2008; Nill and Kemp, 2009), the adoption by corporate car fleets of innovations with potential systemic effects (e.g. AFVs or car-sharing solutions) could be instrumental in their further adoption by the mass market. Therefore, assessing the potential demand for such innovations by corporate car fleets could provide valuable insights into the likelihood of the expected systemic change.

Moreover, the effects of such innovations on all stakeholders (on the supply, the demand, and the regulatory sides), and the perceptions of those stakeholders,

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[3] According to the categorisation of technological innovativeness by Garcia and Calantone (2002), 'radical innovations' are innovations that cause technology *and* marketing discontinuities on both, macro and micro, levels, whereas 'really new innovations' are innovations that result in a technological discontinuity *or* a marketing discontinuity on a macro level, and in any combination of technological and/or marketing discontinuities on a micro level.

need to be analysed in order to identify the potential drivers of, and barriers to, their adoption by corporate car fleets. From a transition management perspective (see, for instance: Nill and Kemp, 2009; Geels, 2012), such analysis is key to designing efficient policies in accordance with the anticipated/favoured transition path(s).

### 8.1.3 Purpose of the chapter

The objective of the analysis developed in this chapter is twofold. First, it is intended to discuss the credibility of corporate car fleets as a potential niche market for innovative automotive solutions, particularly AFVs and car-sharing. The discussion will not only depict a static picture based on the current conditions of the mobility system and perceptions of its stakeholders, but will also provide insights into the dynamics of the system and envisage possible future developments in it.

Second, the analysis is intended to discuss how public policies can help sway the current innovative context in favour of the uptake of innovations by corporate car fleets, with the ultimate goal of securing, and possibly accelerating, the transition towards a more sustainable mobility system.

### 8.1.4 Methods

We here focus our discussion of the outlook for innovations in corporate car fleets on two different categories of automotive innovations with potential systemic effects. First, we will discuss a portfolio of *product innovations* which have been given the collective label of 'alternative-fuel vehicles' (AFVs). AFVs are usually considered to include all vehicles operating on electricity, liquefied petroleum gas (LPG), compressed natural gas (CNG), biofuels (E85[4] and bio-methane[5]), and other 'clean' fuels (Golob *et al.*, 1997; Wong, 2013; OVE, 2014c).

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[4] E85 (in French: '*Superéthanol*') is an abbreviation for an ethanol fuel blend of 85% denatured ethanol fuel and 15% petrol by volume (the exact ratio of ethanol to petrol may actually vary considerably, from 65% to 85% while still carrying the E85 label, in order to maximise engine performance under local climate conditions). In Europe, E85 is commonly used by flexible-fuel vehicles (FFVs; in French: VCM, standing for '*Véhicules à Carburant Modulable*'), which can run on any blend ratio from 0 to 85% ethanol in petrol. (Kampman *et al.*, 2013)

[5] Bio-methane (applied as bio-CNG or bio-LNG) can be used in both spark ignition engines and compression ignition engines. Bio methane compression ignition engines are indicated as 'dual fuel', these run on a mixture of methane and diesel fuel. Methane share of the fuel is about 75%. (Kampman *et al.*, 2013)

For the sake of our analysis, we will focus more particularly on hybrid electric vehicles (HEVs), plug-in hybrid electric vehicles (PHEVs) and battery electric vehicles (BEVs). Unless otherwise specified, we will thereafter use the term 'electric vehicle' (EV) to refer to both PHEVs and BEVs.[6] It should be noted at this stage that, while HEVs might be considered a purely technological innovation, EVs are generally considered a potential *systemic innovation*, because their large-scale uptake would entail changes in technologies, services, processes, behaviours and policies beyond the traditional scope of the car manufacturing industry (Waller, 2011; CAS, 2011; IEA, 2013; Sadeghian *et al.*, 2013; Sadeghian, 2013; Windisch, 2013; Académie des Technologies, 2013; Breda and Panetier, 2013).

Second, we will discuss a type of *product-service innovation* which is widely known as 'car-sharing'[7] (in French: '*auto-partage*'). When considered in the corporate context, car-sharing may take the form of externally-provided services or in-house schemes. It is usually perceived by corporate car fleets as a way to: *i)* replace all or part of the corporate fleet, and/or *ii)* flexibly supplement the in-house corporate car fleet, and/or *iii)* reduce taxi, short-term rental and car mileage-related expense claims (TCRP, 2005; MOMO Car-sharing, 2009a; *Le Monde* ,2013a; *Le Figaro Magazine*, 2014; OVE, 2014a). Although car-sharing solutions are still in their infancy, the perspective of their large-scale deployment carries potential for a *systemic innovation*, for the same kind of reasons as outlined above for EVs.

In order to discuss the credibility of corporate car fleets as a potential niche market for the targeted automotive innovations (i.e. alternative-fuel vehicles and car-sharing solutions), we will combine the following two approaches: *i)* an

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[6] Unlike HEVs, which can drive in all-electric mode for no more than 2 or 3 km, PHEVs can drive in all-electric mode for 25 km (Toyota Prius Plug-in Hybrid) and up to 80 km (Opel Ampera and Chevrolet Volt), thanks to their larger, rechargeable battery. Source: http://www.avem.fr.

[7] We will use this term, which corresponds to the term 'car club' in British usage, to refer to the practice of sharing vehicles between a number of different users, who may use them at different times. This practice should not be confused with 'ridesharing' or 'carpooling' (in French: '*covoiturage*'), which in North American parlance refer to the shared use of vehicles at the same time (also labelled 'car-sharing' in British English) (TCRP, 2005: p.2-1). TCRP defines car-sharing as '*a membership programme intended to offer an alternative to car ownership under which persons or entities that become members are permitted to use vehicles from a fleet on an hourly basis*' (TCRP, 2005: p.2-2).

exploration of available data on the corporate market for these innovations will allow us to analyse the recent trends observed in the demand for innovations from corporate car fleets, looking at various market segments separately if need be (in particular, passenger cars vs. light commercial vehicles); and *ii)* a review of the literature on how these innovations are perceived by a wide range of stakeholders in the mobility system (be they on the supply side, the demand side, or the regulatory side) will allow us to identify the potential drivers of, and barriers to, their adoption by corporate car fleets.

Ultimately, we will use the information collected on recent trends and strategic positions on the corporate car fleet market for innovations, to discuss the dynamics of this market and envisage its possible future developments. We will develop a dynamic vision of the opportunities and challenges for innovations in corporate car fleets, drawing on the arguments developed in official and academic literature, in professional journals (e.g. *Flottes Automobiles*, *L'Automobile&L'Entreprise*), and in special reports by the general press (e.g. *Le Monde*, *Le Figaro*, *Les Echos*, *La Tribune*, *Le Parisien*). A particular focus will be put on the barriers and disincentives to innovations that can arise from operational and technological considerations on the one hand, or from economic considerations on the other hand.

Based on our analysis of the barriers and disincentives to the uptake of innovations by corporate car fleets, we will also discuss the specific role of public policies in the promotion of alternative-fuel vehicles and car-sharing with corporate car fleets. We will draw on the results of academic research on innovation management, from a strategic niche management perspective (see, for instance: Kemp, 1994; Schot *et al.*, 1994; Kemp *et al.*, 1998; Schot and Geels, 2008; Nill and Kemp, 2009), as well as from a transition management perspective (see, for instance: Nill and Kemp, 2009; Geels, 2012), to propose some policy recommendations.

### 8.1.5 Outline of the chapter

In addition to this introductory section, this chapter is structured into four sections and a conclusion. First, we analyse the recent trends in the demand for alternative-fuel vehicles from corporate car fleets over the period 2006-2013, and we highlight the differences in the demand patterns across various market segments (e.g. passenger cars vs. light commercial vehicles) (Section 8.2). Then, we discuss the perceptions of alternative-fuel vehicles in general, and electric vehicles in particular, by a wide range of stakeholders (namely public policy-makers, car manufacturers and corporate car fleets), and we identify some potential drivers of, and barriers to, their adoption by corporate car fleets (Section 8.3). Then, shifting our focus from alternative-fuel vehicles to car-sharing solutions, we discuss the outlook for these innovative solutions in corporate car fleets, and provide some additional insights into their potential synergies with electric vehicles (Section 8.4). Finally, we propose a joint discussion of the barriers and disincentives to the uptake of innovations by corporate car fleets, and of the role public policies can play to overcome such barriers. We develop two separate sets of policy recommendations for the barriers and incentives stemming from operational and technological considerations on the one hand, and for those stemming from economic considerations on the other hand (Section 8.5).

# 8.2 Recent trends in the demand for AFVs from corporate car fleets

## 8.2.1 The increase in volume and diversity of corporate AFVs (2006-2011)

We will first highlight some recent trends in the uptake of alternative-fuel passenger cars based on the analysis by Wong (2013) of the French national statistical register for motor vehicles. Considering the difference in scope with our present analysis,[8] we will not focus on absolute figures provided by Wong about new passenger car sales to corporate car fleets, but rather report on general trends on this specific market for AFVs between 2006 and 2011.

New registrations of alternative-fuel passenger cars by corporate car fleets in France increased by more than 25% annually on average, from 1,600 units in 2003 to 8,100 in 2010 and 10,000 in 2011. However, the progressive uptake of alternative-fuel passenger cars by corporate car fleets has not been a continuous process. The conversion of the TVS tax scheme, in 2006, from a tax based on engine horsepower to a tax based on $CO_2$-emission levels (see Chapter 7 for further information on this tax scheme) seems to have boosted the corporate

[8] Although it is not explicitly mentioned in the paper, it would seem that the scope defined for corporate car fleets in this analysis by Wong (2013) is larger than the one we chose for our own analysis. Indeed, considering passenger cars only, Wong states that new registrations by corporate car fleets are stable at around 850,000 units annually (except for 2009 and 2010, because of the economic crisis). In keeping with our previous analyses on new passenger car sales to corporate car fleets, such a volume of passenger cars would most likely include sales to the car manufacturers' distribution networks (also called 'tactical sales'), which we decided to exclude from the scope of corporate car fleets for the reasons explained in Section 3.2. According to SNLVLD statistics, 'tactical sales' made up 15% of the total new passenger car sales in France in 2012, i.e. close to 277,000 vehicles (data reconstructed based on SNLVLD, 2012a, 2012b, 2012c, 2012d and 2012e).

market for alternative-fuel passenger cars significantly (with annual growth rates in the range of 55% to 60% in 2006 and 2007). However, the demand for alternative-fuel vehicles from corporate car fleets was significantly hampered by the two years of economic slowdown, in 2008 and 2009, before returning to growth in 2010, albeit at a slower pace (with annual growth rates of about 40% in 2010 and 25% in 2011).

While vehicles powered by LPG were rather successful on the corporate market for new passenger cars after 2006, the changes in conditions for exemption under the TVS tax scheme which occurred in October 2011 caused a rapid decline (-77% in 2011 from 2010 levels) in new LPG passenger car sales to corporate car fleets.

On the other hand, vehicles powered by electricity seem to have found a 'preferred' market with corporate car fleets. From 2006 to 2011, HEVs consistently made up more than 55% of new alternative-fuel passenger car sales to corporate car fleets. Although corporations were not eligible for the special bonus programme for HEVs from its launch in 2008 until August 2012 (see Chapter 7 for further information), HEVs may still have been perceived as attractive options as a result of expected savings in fuel and TVS costs, or as part of broader sustainability considerations. More recently, BEV sales to corporate car fleets seemed to effectively take off in 2011 (2011 sales were 14 times higher than 2010 sales), thereby adding another type of AFV to the shopping list of corporate car fleets.

## 8.2.2 The growing focus of corporate car fleets on EVs and HEVs

Focusing on the year 2012, the professional journal *L'Automobile&L'Entreprise* (2013) provides detailed data on new registrations of alternative-fuel light-duty vehicles by corporate car fleets (including: registrations by companies, public administrations, and short- and long-term rental companies). As illustrated in Table 8.1, 12,123 AFVs were sold to corporate car fleets in 2012: 54% of these were HEVs (6,558 units, distributed 50/50 between petrol hybrid and diesel hybrid), another 36% were EVs (4,315 units), and the remaining 10% (1,250 units) consisted of various alternative drivetrains (mainly: natural gas, E85 and LPG).

New HEV sales to corporate car fleets represented 23% of the total market for new HEVs in France in 2012, which was below the average share of corporate car fleets in new light-duty vehicles sales in 2012 (for the record: 39% in 2012), thereby pointing to the fact that corporate car fleets were lagging behind with regard to the uptake of HEVs. Four factors could account for this limited performance of corporate car fleets on the new HEV sales market: *i)* the list prices for HEVs were still very high compared to conventional cars in the same segments and therefore might not have been compatible with many corporate car policies, except for senior management in some instances (*Le Monde,* 2013a); *ii)* corporations were not eligible for the special bonus programme for HEVs until August 2012; *iii)* the supply of HEVs in the light commercial vehicle category, which is a large part of new light-duty vehicles sales to corporate car fleets (38% in 2012), was (and still is) virtually inexistent;[9] and *iv)* until 2011, HEVs on the market were mostly petrol hybrids rather than diesel hybrids,[10] which might have given HEVs a competitive disadvantage because of unfavourable tax conditions for petrol vehicles in corporate car fleets (*Le Monde,* 2013a; OVE, 2014c).[11]

On the other hand, new EV sales to corporate car fleets represented 46% of the total market for new EVs in France in 2012, which was 7 percentage points

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[9] Some hybrid LCV products are offered by very small manufacturers. For instance, the French manufacturer Goupil, which originally specialised in electric heavy quadricycles (with the Goupil G3, launched in 2001), developed a light commercial vehicle in 2010, the Goupil G5, which exists in a BEV version as well as in an HEV version. However, Goupil sold less than 350 vehicles, including all models, on the French market in 2011 and 2012 (*L'Automobile&L'Entreprise*, 2013). However, neither of the two major French car manufacturing groups had hybrid LCVs in their respective portfolios, except for possible LCVs derived from hybrid passenger cars by PSA Peugeot-Citroën. In 2013, Renault was granted a 20.5 million EUR state subsidy by the French government to help it conduct the 'HYDIVU' (*Hybride Diesel Véhicule Utilitaire*) research and development programme, which aims to develop a hybrid engine that would be specifically designed and optimised overall for commercial vehicles. This was the first state aid approved by the European Commission that sought to support R&D activities for the development of a new system of hybrid engines for commercial vehicles (Source: http://europa.eu/rapid/press-release_IP-13-903_en.htm).

[10] Until late 2011, the supply of HEVs was essentially limited to two models of petrol HEVs by the Japanese car manufacturer Toyota: Toyota Prius (launched in 1997, launched in Europe in 2004) and Toyota Auris (launched in March 2007, launched in Europe in June 2010). In late 2011, the French manufacturer PSA Peugeot-Citroën brought the first diesel HEVs onto the market: Citroën DS5 Hybrid4 (launched in November 2011) and Peugeot 3008 Hybrid4 (launched in December 2011). The same two manufacturers have since launched one additional petrol-hybrid model, Toyota Yaris HSD (launched in June 2012), and one additional diesel-hybrid model, Peugeot 508 RXH (launched in February 2012). Source: http://www.caradisiac.com.

[11] See Chapter 7 for further information on preferential tax treatment for diesel *versus* petrol in corporate car fleets.

above the average share of corporate car fleets in new light-duty vehicle sales in France in 2012 (39%). Thus, corporate car fleets confirmed their status of 'preferred' market for EVs. Part of the new EV sales to corporate car fleets in 2012 proceeded from a joint BEV-purchasing initiative led by La Poste Group and coordinated by the French central office for public purchasing, UGAP (*Union des Groupements d'Achats Publics*). This joint BEV-purchasing initiative was launched in 2009 and resulted in October 2011 in a purchase order for nearly 19,000 BEVs to serve in the fleets of 20 public and private organisations (UGAP and La Poste, 2011). The very first deliveries of BEVs purchased by La Poste Group through this initiative took place in March 2012[12]. New EV sales in 2012 may also have benefited from the recent exemption of EVs (as of October 2011) from the TVS scheme, and from the increase in the incentive for EVs under the bonus programme as of August 2012 (see Chapter 7 for further information).

In addition, when considering the performance of corporate car fleets on the new EV sales market, it should be noted that the 1,545 EVs by the car manufacturer Bolloré that were newly registered in 2012 (*L'Automobile&L'Entreprise*, 2013), were not taken into account as sales to corporate car fleets, but rather as part of the 'tactical sales' of the car manufacturer to its distribution network. Yet, virtually all of these vehicles were to be used in the public car-sharing system Autolib in the Paris region[13].

Altogether, 10,873 new EVs and HEVs were sold to corporate car fleets in 2012 (+112% from 2011 level), which represented 29% of the total market for these vehicles in France in 2012.

Other AFVs met with only little success on the corporate car fleet market in 2012: only 1,250 units were sold including all vehicles powered by natural gas (502 units), E85 (386 units) and LPG (281 units). Corporate car fleets represented a very limited share of new vehicle sales as far as the latter two energy types were concerned (5.2% for E85, 13.8% for LPG). On the other hand, they represented 93% of new natural gas-vehicle sales in France in 2012.

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[12] Source: http://www.france-mobilite-electrique.org/l-ugap-livre-les-premiers-vehicules-electriques-issus-du-groupement-de-commandes,3083.html. [Accessed: 19th August 2014]

[13] Source: http://www.france-mobilite-electrique.org/bluecar-la-voiture-electrique-la-plus-immatriculee-de-france,4221.html. [Accessed: 18th August 2014]

| Vehicle energy type | New registrations of light-duty vehicles (1) by corporate car fleets in France in 2012, by energy type | | |
|---|---|---|---|
| | units | *as a % of new corporate LDVs* | *as a % of new AFV registrations (2), by type* |
| **EVs and HEVs** | **10,873** | ***1.2%*** | ***29.2%*** |
| EVs | 4,315 | *0.5%* | *46.3%* |
| Diesel HEVs | 3,288 | *0.4%* | *33.3%* |
| Petrol HEVs | 3,270 | *0.4%* | *18.1%* |
| **Other AFVs** | **1,250** | ***0.1%*** | ***12.4%*** |
| Natural Gas (3) | 502 | *0.1%* | *93.0%* |
| E85 | 386 | *0.0%* | *5.2%* |
| LPG (4) | 281 | *0.0%* | *13.8%* |
| Miscellaneous | 81 | *0.0%* | *92.0%* |
| **All AFVs** | **12,123** | ***1.4%*** | ***25.6%*** |
| **Petrol vehicles** | **58,442** | ***6.6%*** | ***12.3%*** |
| **Diesel vehicles** | **809,155** | ***92.0%*** | ***45.9%*** |
| **All energy types** | **879,720** | ***100.0%*** | ***38.5%*** |

*LDV: Light-Duty Vehicle; EV: Electric Vehicle; HEV: Hybrid Electric Vehicle; LPG: Liquefied Petroleum Gas; AFV: Alternative Fuel Vehicle*

*Notes: 1. Including passenger cars and light commercial vehicles. 2. Including all new light-duty vehicle registrations by corporate car fleets or otherwise. 3. Including vehicles powered by natural gas only, as well as vehicles powered by natural gas and/or petrol. 4. Including vehicles powered by LPG, as well as vehicles powered by LPG and/or petrol.*

**Table 8.1: New registrations of alternative-fuel vehicles by corporate car fleets (*L'Automobile&L'Entreprise*, 2013)**

### 8.2.3 An apparent 'specialisation': EVs for light commercial vehicles, HEVs for passenger cars?

Finally, on the basis of statistics released by OVE (2014c), which we were able to break down to fit our scope for corporate car fleets (i.e. including fleets held by enterprises, public administrations, and short- and long-term rental companies), we were able to analyse: *i)* the overall development in the uptake of EVs and HEVs by corporate car fleets in 2013, *ii)* the different paces of the uptake of EVs and HEVs in the corporate passenger car fleet on the one hand, and in the corporate light commercial vehicle fleet on the other hand.

As illustrated in Table 8.2, about 19,900 new electric and hybrid-electric light-duty vehicles (15,000 passenger cars and 4,900 light commercial vehicles) were registered by corporate car fleets in 2013. This represented an 83% increase from 2012 (10,873 units), thereby indicating that the market for alternative-fuel vehicles in corporate car fleets may be catching up with its pre-crisis growth trends. New EV registrations alone increased by about 67% year on year, which could result from the combination of an increasingly diversified supply on the one hand, and boosted incentives under the bonus programme on the other hand (see Chapter 7 for further information). New HEV registrations increased by 93% year on year in 2013 (+58% for diesel HEVs, +129% for petrol HEVs). Such figures could point to the removal of all or part of the previously mentioned barriers to the uptake of HEVs by corporate car fleets. In particular, the diversified supply of HEV models and prices, and the recent eligibility (as of August 2012) of corporate car fleets to the special bonus programme for HEVs (see Chapter 7 for further information on recent developments in the bonus/malus scheme and in the TVS tax scheme), no doubt contributed to reduce the competitive disadvantage of HEVs relative to their conventional counterparts.

Because of this good performance of EVs and HEVs on the corporate market, the share of corporate car fleets in the total market for new EVs and HEVs increased from 29% in 2012 to 33% in 2013, gaining 4 to 5 percentage points on each of the three following submarkets: EVs (from 46% to 51%), diesel HEVs (from 33% to 37%), and petrol HEVs (from 18% to 23%).

Analysing in further detail the corporate market for new light-duty vehicle sales in 2013 to point out differences in the uptake of EVs and HEVs between the passenger car segment on the one hand and the light commercial vehicle segment on the other hand, we could make the following observations: *i)* EVs and HEVs altogether represented a similar share of both, LCV and passenger car, market segments (2.3% and 2.9% respectively); *ii)* EVs represented a higher share of the LCV segment (2.3%) than of the passenger car segment (0.4%); *iii)* HEVs were still inexistent on the LCV segment; and *iv)* new EV registrations by corporate car fleets were distributed between passenger cars and light commercial vehicles on a 25% / 75% basis.

These observations raise the questions of: *i)* whether the corporate market for electric and hybrid-electric vehicles could be developing into two specialised submarkets, with an increasing share of EVs sold on the LCV market segment while HEVs would remain confined to the passenger car market segment; and, if this specialisation proves to be substantiated, *ii)* whether it stems from operational considerations (passenger cars could prove to have a more changing and/or mixed patterns of use than light commercial vehicles, which in turn would specialise more in routine and/or urban trips), from differences in the tax regimes applicable to the two markets (there is, in particular, no special bonus programme for hybrid-electric light commercial vehicles, as there is one for hybrid-electric passenger cars), or from both. Yet again, it must be acknowledged that, as of 2013, there was virtually no supply for hybrid-electric light commercial vehicles.

| Vehicle type and energy type | New registrations of electric and hybrid-electric light-duty vehicles (1) by corporate car fleets in France in 2013, by vehicle and energy type | | | | |
|---|---|---|---|---|---|
| | units | *as a % of new corporate* PCs | *as a % of new corporate* LDVs | *as a % of new corporate* LCVs | *as a % of new registrations (2), by type* |
| **EV/HEV Passenger cars** | **15,000** | ***2.9%*** | ***1.8%*** | **-** | ***27%*** |
| EVs | 2,300 | *0.4%* | *0.3%* | - | *26%* |
| Diesel HEVs | 5,200 | *1.0%* | *0.6%* | - | *37%* |
| Petrol HEVs | 7,500 | *1.5%* | *0.9%* | - | *23%* |
| **EV/HEV LCVs** | **4,900** | **-** | ***0.9%*** | ***2.3%*** | ***94%*** |
| EVs | 4,900 | - | *0.9%* | *2.3%* | *94%* |
| **All EV/HEV LDVs** | **19,900** | **-** | ***2.7%*** | **-** | ***33%*** |
| EVs | 7,200 | - | *1.2%* | - | *51%* |
| Diesel HEVs | 5,200 | - | *0.6%* | - | *37%* |
| Petrol HEVs | 7,500 | - | *0.9%* | - | *23%* |

*PC: Passenger Car; LDV: Light-Duty Vehicle; EV: Electric Vehicle; HEV: Hybrid Electric Vehicle*
*Notes: 1. Including passenger cars and light commercial vehicles. 2. Including all new light-duty vehicle registrations, by corporate car fleets or otherwise, for the considered vehicle type and energy type.*

**Table 8.2: New registrations of EVs and HEVs by corporate car fleets in France (OVE, 2014c)**

# 8.3 Benefits expected from the adoption of EVs by corporate car fleets

## 8.3.1 From a public policy standpoint

Corporate car fleets have long been identified by public policy-makers as potential 'early adopters' of EVs and other AFVs – within the meaning of the typology of innovation adopters proposed by Rogers (1962)[14] – as illustrated by the AFV purchase mandates implemented in the US from the 1990s onwards.[15]

[14] Rogers (1962) proposed that adopters of any new innovation could be categorised as innovators, early adopters, early majority, late majority and laggards. He described the category of early adopters as follows: '*This adopter category is generally sought by*

> *'Vehicle fleets operated by businesses and government agencies are a tantalizing market for alternative fuel vehicles (AFVs). Widescale use of AFVs in fleet applications could provide the critical mass necessary to initiate development of a widespread refueling infrastructure and mass production of AFVs. Purchase patterns and vehicle operating practices make fleets a favorite target for policymakers who wish to use AFVs as a means to reduce transportation emissions and petroleum consumption.'*
>
> Nesbitt and Sperling (1998)

In France, as in many other European countries, ambitious targets have been set for the uptake of EVs in response to the challenges posed by oil dependency, global climate change, local air pollution in dense urban areas, increasing global competition in the automotive industry, etc.[16] In 2009, it was a target of the French Ministry of Sustainable Development that the market share of EVs in new vehicle sales should reach 7% by 2015, 16% by 2020 and 27% by 2025 (MEEDDM, 2009a: p.15; MEEDM, 2010a). Such targets would amount to putting around 2 million EVs (BEVs and PHEVs) on French roads by 2020, and 4.5 million by 2025.[17] However, according to recent figures for EV sales in France, recent market developments have not lived up to the initial

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*change agents as a local missionary for speeding the diffusion process. Because early adopters are not too far ahead of the average individual in innovativeness, they serve as a role model for many other members of a social system. Early adopters help trigger the critical mass when they adopt an innovation.' (Rogers, 1962)*

[15] The 1992 Energy Policy Act (EP Act) and the 1990 Clean Air Act Amendments (CAAA) both had provisions requiring fleets throughout the USA to purchase increasing number of alternative fuel or clean fuel vehicles (US Code, 2010a, 2010b and 2010c).

[16] Windisch (2013: Chapter 1) provides an exhaustive overview of the rationale for government support for the development and uptake of EVs in France.

[17] By way of comparison, here is a sample of the national targets set by European countries as regards the uptake of EVs: for Austria, 250,000 electric cars by 2020; for Denmark, 50,000 EVs by 2020; for Germany, 1 million EVs by 2020 and more than 5 million by 2030; for Ireland, 10% of EVs (equivalent to 230,000 vehicles) by 2020; for the Netherlands, 15,000-20,000 EVs by 2015, 200,000 by 2020 and 1 million by 2025; for Norway, 200,000 EVs by 2020 (approximately 10% of the current car fleet); for Portugal, roughly 200,000 EVs by 2020 (Leurent and Windisch, 2011; Windisch, 2013).

expectations. Indeed, according to statistics provided by AVERE-France,[18] less than 36,000 EVs were sold from January 2010 to July 2014 (63% passenger cars and 37% light commercial vehicles), which is not in line with the initially expected ramp up.

According to Windisch (2013), as things stood in 2013, public policies were likely to play an important role in boosting the development of EVs in France, but these would not achieve mass market deployment immediately. Several types of barriers remained, with regard to: *i)* framework conditions (e.g. in the relative prices of fossil fuels and electricity), *ii)* individual consumer behaviour (e.g. consumer preferences; misconception of range requirements; 'one vehicle-for-all' attitude; unawareness of, or insensitivity to, future savings; unfamiliarity with, and misconception of, EVs), and *iii)* BEV characteristics (e.g. high upfront costs, uncertainty about resale value, limited range,[19] duration of recharging, limited availability of recharge infrastructure).

Confronted with similar barriers to the development of EVs on the UK market, The Climate Group (2012) projected that fleets could play a significant role in the market penetration of EVs in the UK because of their high share of new vehicle sales and because they have a higher vehicle turnover rate than private households. Still from a market standpoint, the demand for EVs from fleets was projected to encourage the economies of scale necessary for the overall EV market to expand.[20] Finally, The Climate Group reckoned that the initial demand for EVs from fleets would subsequently fuel a second-hand market for EVs, which could be appealing to an increasing number of buyers in need of economical transport for local business or commuting (this demand for second-hand vehicles would in turn bolster the residual values of the early vehicles, thereby creating a positive feedback loop encouraging the demand for new EVs). In addition, from a behavioural standpoint, The Climate Group

[18] AVERE-France is the French arm of the European Association for Battery, Hybrid and Fuel Cell Electric Vehicles. All figures were retrieved from: http://www.france-mobilite-electrique.org.

[19] As an illustration, the standardised range of the flagship EV by Renault on the passenger car market, Renault Zoé, is 210 km; its range under real-world driving conditions is actually closer to 150 km. The standardised range of the light commercial EV Renault Kangoo Z.E. is 170 km; its range in 'real-life' driving conditions is actually closer to 80 km (Sources: http://www.france-mobilite-electrique.org; http://www.avem.fr).

[20] Such economies of scale are likely to materialise for production levels in excess of 150,000 vehicles per year (OVE, 2014d: p.56).

projected that fleets would contribute on a macro level to increasing the uptake of EVs in the household market too, based on the assumption that positive user experiences within fleets would build wider confidence. On a micro level, the experience of the '*quiet, smooth and relaxing'* drive of EVs in an urban environment was deemed likely to win over drivers, who might then be reluctant to return to a conventional vehicle.

Endorsing these projections and transposing them to the French context, Windisch forecast that the BEV would develop in France starting with niche markets, which she defined as '*markets that are well-adapted to the limitations and needs of BEVs and that can benefit already today from their advantages*' (Windisch, 2013: p.72). Among the niche markets that would eventually enable the mass adoption of EVs in France through the abovementioned network effects, Windisch highlighted the role to be played by private and public corporate fleets on the one hand, and by car-sharing fleets on the other hand. In 2014, the French parliamentary office for evaluating scientific and technological choices issued a report on the development of clean vehicles in France (OPECST, 2014), which provided similar insights into the initiating role to be played by corporate car fleets in general, and by captive fleets and car-sharing fleets in particular.

On top of the expected network effects, several additional reasons, pertaining to the efficiency of public policy, were given by US policy-makers and researchers in the 1990s for targeting fleets as an early market for AFVs (Nesbitt and Sperling, 1998): *i)* the energy and emission benefits of using an AFV as a substitute for a conventional vehicle were expected to be greater for a fleet vehicle than for a household vehicle, because the former was typically used more intensively than the latter; *ii)* the mileage of fleet vehicles was typically accumulated in urban areas where local air pollutant emission reductions were most needed; *iii)* 'captive fleets' (i.e. fleets held by government agencies or regulated companies), when they were specifically targeted, were expected to be more aware of – and more willing to comply with – government rules and regulations than fleets from other market sectors; *iv)* due to the large size of fleets, relatively few decision-makers were deemed to control a disproportionately large number of vehicles; and *v)* the development of in-house refuelling facilities by fleet operators was expected to initiate the deployment of AFVs without relying on a publicly-funded recharging infrastructure.

French public policy-makers to some degree acknowledged the role to be played by corporate car fleets in the diffusion of BEVs as early as 2009, by launching a public-private joint BEV-purchasing initiative led by La Poste Group and coordinated by the French central office for public purchasing, UGAP (*Union des Groupements d'Achats Publics*). This initiative resulted in

October 2011 in a purchase order for nearly 19,000 BEVs to serve in the fleets of 20 public and private organisations (UGAP and La Poste, 2011).[21] Additional public procurement policies have since confirmed that French public policy-makers expect some positive effects from the uptake of AFVs by corporate car fleets. Indeed, a 2012 governmental notice[22] acknowledged the exemplary role of public fleets with regard to the uptake of EVs and HEVs, and made it mandatory for State fleets that 25% of all new light-duty vehicles they would register from 2013 onwards would be EVs or HEVs. The governmental notice encouraged similar efforts on the part of State public establishments, but no mandatory target was set for them.

Despite the efforts made through public procurement, it should be noted that, until recently, some of the major policies aiming to promote AFVs in France, especially tax policies, seemed rather unconcerned with the promotion of AFVs for corporate car fleets specifically. In fact, only since late 2011 have vehicles emitting no more than 50 $gCO_2$/km been *de facto* exempted from payment of the TVS annual tax on corporate passenger cars (the tax rate for this emission category has been set at 0 EUR per $gCO_2$/km). In addition, only since 2012 have *all* corporate car fleets been eligible for the general 'bonus' programme (private corporations and local administrations had been eligible since the introduction of the programme in 2008, but state administrations were not eligible until 1 August 2012) and the specific 'bonus' programme for hybrid-electric passenger cars (all corporations, both private and public, were not eligible until 1 August 2012). Also, to this day, LCVs remain excluded from the specific 'bonus' programme for hybrid-electric technologies.[23]

### 8.3.2 From the car manufacturers' standpoint

The same network effects which are expected by public policy-makers when considering the potential of corporate car fleets for the initial deployment of EVs (e.g. encouraging economies of scale, increasing visibility, awareness and

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[21] The organisations that took part in the 2011 joint BEV-purchasing initiative were: ADP, Air France, AREVA, Bouygues, EDF, Eiffage, ERDF, France Télécom Orange, GDF, Suez, Suez Environnement, GrDF, GrT Gaz, La Poste, RATP, SNCF, SPIE, VEOLIA, VINCI, SAUR, and UGAP. La Poste Group alone ordered 10,000 BEVs, thereby representing more than half of the total vehicles ordered

[22] *Circulaire du 3 décembre 2012 relative à la mise en œuvre du plan de soutien à la filière automobile par les services de l'Etat et ses opérateurs*. Available from: http://circulaire.legifrance.gouv.fr/pdf/2012/12/cir_36155.pdf.

[23] See Chapter 7 for further detail.

confidence, increasing infrastructure density), are important also from the standpoint of the car manufacturers involved in the development of electromobility: they, too, see corporate fleets as a '*launch ramp*' for EVs (*Les Echos*, 2013). Figure 8.1 illustrates the possible positive feedback loops of an increased demand for EVs from corporate car fleets on the larger EV market supply and demand mechanisms.

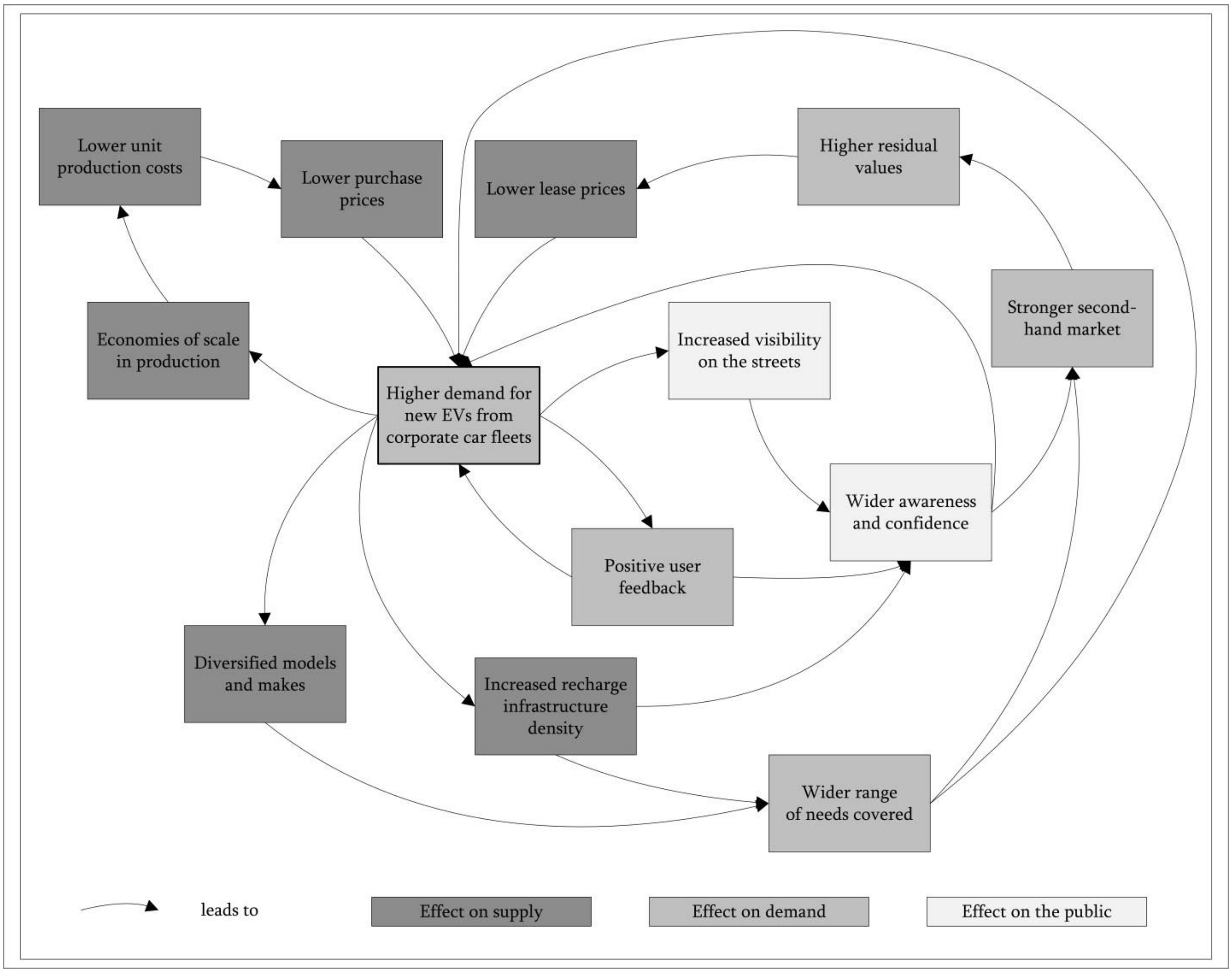


**Figure 8.1: Corporate car fleets as a 'launch ramp' for EVs**

In particular, the issues of visibility and awareness should not be underestimated. Hence, the emphasis placed by Bolloré[24] and Renault on car-

[24] Bolloré has developed a car-sharing offer in order to market the Bolloré Bluecar, which is a three-door BEV with four seats fitted with a lithium-metal-polymer (LMP) battery manufactured by Bolloré that provides an electric range of up to 250 km. After launching the public car-sharing scheme Autolib in the Paris region in December 2011

sharing fleet customers for Evs.[25] Hence also, the importance of such customers as the national postal services, La Poste, for Renault's electric light commercial vehicle, Renault Kangoo Z.E.. Such customers act as both technological showcases and full-scale testbeds for innovative vehicles (for an in-depth discussion of the framework for assessing the prescriptive value of these particular early adopters, see: Von Pechmann, Maniak and Midler, 2012).

On top of these expectations, car manufacturers may also count on the corporate car fleet segment to improve their strategic sales planning for EVs (*Le Monde*, 2013a). Indeed, new vehicle registrations by corporate car fleets are more predictable than new registrations by private households, for the following two reasons: *i)* long-term rental represents a majority share of the new registrations by corporate car fleets (61% in 2012), the contractual support of which allows for some anticipation on the timing of fleet renewal (even though, in times of economic downturn, corporate car fleets sometimes renegotiate contract terms to extend their duration); and *ii)* the period allowed for depreciation of vehicles in national accounting rules may have a major influence on the rate of vehicle renewal by corporate car fleets (see Chapter 5 for an illustration).

Finally, at a time when the car manufacturing industry is facing the double challenge of *i)* transitioning from the supply of products to the supply of *product-service systems* (a transition process which is also known as servicizing or servitization) and *ii)* adapting to the many changes brought about by the *digital era*, the challenges posed by the development of electric vehicles could act as catalysts for this double transition (CAS, 2010). As an illustration, we might note that, in order to overcome the market barriers related to the high upfront costs of EV batteries, car manufacturers such as Renault or Bolloré have developed new business models whereby they rent out the battery rather than selling it outright with the vehicle. In addition, to overcome the barrier of a sparse recharging infrastructure, car manufacturers have cooperated closely with

(2,035 EVs by December 2013, with a target of 3,000 vehicles), Bolloré launched a similar scheme under the label Bluely in Lyon in October 2013 (130 EVs by December 2013, target 150) and another under the label Bluecub in Bordeaux in January 2014 (90 EVs at first, target 200). In May 2014, Bolloré launched its first exported car-sharing service in the City of Indianapolis (US), under the label Blueindy with a target of 500 EVs by June 2015. Source: http://www.france-mobilite-electrique.org/autolib-story,279.html.

[25] Considering their significant success among taxis, we intuit that Toyota may have put a similar focus on the taxi fleet customers for their HEV products. However, we could find no factual evidence to support this intuition.

local authorities to jointly deploy public charging points together with public electric car-sharing services. Finally, the deployment of EVs – especially in large-scale car-sharing schemes – has also fostered the introduction of new information technologies in the vehicle and in the power system. On the one hand, information technologies are needed for electric utilities and grid managers to be able to efficiently manage, in close cooperation with car manufacturers and fleet managers, the power supply and distribution required by the deployment of an increasing EV fleet (ETP SmartGrids, 2010: p.3). On the other hand, car manufacturers have had to develop new information systems to provide EV drivers and fleet managers with information on the current state of charge of the battery, and with advice on energy-efficient driving behaviours. The deployment of EVs in delivery fleets has also fostered the uptake of satellite vehicle tracking and tracing systems, which enable optimising route planning across the fleet given the operational and technical constraints inherent to EVs.

Despite the efforts made by the car manufacturers involved in electromobility to promote EVs and HEVs with their corporate customers, it should be acknowledged that the above-mentioned transitions are a rather painful process for the industry, which gives rise to significant inertia. In addition, the high levels of price discounts applied to ICE vehicles –especially light commercial vehicles– to support sales during automotive industry crises (*Le Parisien*, 2013a; *Le Figaro*, 2014; OVE, 2014a), come at the expense of the cost competitiveness of EVs and HEVs counterparts.

### 8.3.3 From the corporate car fleets' standpoint

#### Spelling out the business case for EVs in corporate car fleets

Notwithstanding the various reasons public policy-makers and car manufacturers may have to be interested in the progressive introduction of EVs in corporate car fleets, the question remains as to whether or not the latter will be convinced of the overall business case for EVs.

It does not seem satisfactory, indeed, simply to acknowledge that, from an operational standpoint, corporate car fleets seem to be the market target with the highest potential for matching such EV-specific constraints as their limited range and recharging requirements. Many analyses, however, confine their operational considerations to mentioning how, on the one hand, the short distances and predictable patterns of use of corporate car fleets and, on the other hand, their centralised refuelling practices, seem most compatible with AFVs in general, and with EVs in particular (Golob *et al.*, 1997; CAS, 2011; The Climate Group, 2012; *Voiture Ecologique*, 2013; Wong, 2013). As well as being only partially verified, given the great diversity observed in the patterns of use and refuelling practices of corporate car fleets (Nesbitt and Sperling, 1998; Hutchins and Delmonte, 2012), these considerations are also not enough, as such, to make a compelling business case for EVs to be used in corporate car fleets. In a 2013 survey of corporate car fleets managers in France,[26] *Flottes Automobiles* (2013c) showed that the range limitations of BEVs were still the primary obstacle to their acquisition by fleets (mentioned by 83% of respondents: 76% in the public sector, 85% in the private sector).

Thus, in line with the findings of Hutchins and Delmonte (2012), we consider the compatibility of EV-specific constraints with the daily operations of corporate car fleets as a *necessary condition* for their uptake by these customers. Yet, in our view, this issue should be addressed with a *dynamic* approach. Indeed, the progressive introduction of monitoring and/or tracking technologies in fleet management processes and, more generally, the expected development of fleet operation management expertise (see Chapter 6, and also: *La Tribune*, 2009: p.20; *Les Echos*, 2013: p.10; *Flottes Automobiles*, 2013h), could broaden the scope of EV operations in corporate car fleets over the short- to mid-term.

In any case, the compatibility of EV-specific constraints with the daily operations of corporate car fleets should certainly not be considered a *sufficient* condition for their uptake on this market segment. The truly essential question to ask when discussing the potential demand for EVs from corporate car fleets would rather be: what *added value* could EVs effectively bring to this particular target market?

### Potential economic gains

Notwithstanding their high upfront costs,[27] the first possible added value of EVs compared with conventional vehicles could stem from potential gains in total

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[26] This survey is labelled '*Baromètre Flottes Vertes*' (Green Fleets Barometer) and has been conducted by the professional magazine *Flottes Automobiles* on a yearly basis since 2010. In 2013, 250 fleet professionals were interviewed (including fleet managers, vehicle procurement managers, etc.), representing a total fleet of close to 400,000 corporate vehicles.

[27] According to the 2013 fleet survey by *Flottes Automobiles* (2013c), the high upfront costs of EVs were still the second greatest obstacle to their acquisition by fleets as of 2013 (mentioned by 67% of all respondents: 71% for the public sector, 59% for the private sector). As for HEVs, their high upfront costs were the *first* obstacle to their acquisition by fleets as of 2013 (mentioned by 83% of all respondents). Other economic obstacles to the purchase of EVs and HEVs would include: *i)* the high costs and short life of EV batteries (mentioned by 60% of respondents from the public sector); and, though to a lesser extent, *ii)* the *uncertainty* about residual vehicle values (mentioned, about EVs, by 22% of the respondents from the private sector and only 14% of the respondents from the public sector, and mentioned, about HEVs, by 25% of respondents from the private sector and only 10% of the respondents from the public sector).

costs of ownership (see Section 3.4 for further information on the concept of TCO).

Comparing the TCO of EVs to those of their conventional counterparts based on a typical long-term rental contract that would be compatible with the limited range of EVs (i.e. 48 months and 60,000 km),[28] OVE (2014d) suggested that, under the market and tax conditions of 2013, EVs could not yet be considered readily cost competitive: indeed, Renault Zoé, for instance, would still cost 14% more than a diesel Renault Clio (26,155 EUR over 48 months, as compared with 22,990 EUR); and Renault Kangoo Z.E. would cost 3% more than a diesel Renault Kangoo (20,071 EUR over 48 months, as compared with 19,441 EUR). Although the gap could seem to be closing on the light commercial vehicle market segment, OVE points out that, following the post-crisis decline of the LCV market, car manufacturers have applied high levels of price discounts on conventional LCVs (down by 30% to 40% from the list price), which would put the TCO differential between electric and conventional LCVs in the range of 20% (20,071 EUR over 48 months as compared with 16,808 EUR) rather than 3%.

Counterexamples exist: the Nissan Leaf, for instance, could effectively cost 9% less than a diesel Peugeot 308 over 48 months and 60,000 km (28,637 EUR, as compared with 31,620 EUR) (OVE, 2014d), mostly due to higher residual value. Furthermore, feedback from early adopters such as La Poste could demonstrate that, when deployed with appropriate assignments, electric LCVs can be readily cost competitive relative to their conventional counterparts[29] (*Le Monde*, 2013a).

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[28] For the record, this is half the average annual mileage of corporate vehicles in long-term rental in 2012 (SNLVLD, 2012e). A 15,000 km average annual mileage could be achieved by travelling 48 km per day, 6 days a week, 52 weeks per year, which would be compatible, for instance, with the use of a pool service vehicle running all year long, holidays included. Alternatively, the same 15,000 km average annual mileage could be achieved by travelling 57 km per day, 5 days a week, 47 weeks per year, which would be consistent, for instance, with the use of an official vehicle running all year long but for 5 weeks of annual paid holiday. Both these patterns of use are, indeed, largely compatible with the range limitations of EVs.

[29] Based on the 2,400 Renault Kangoo Z.E. already deployed by the national postal services by April 2013, La Poste analysed that EVs could compete with ICE vehicles on postal rounds for annual mileages in the range of 12,500 km to 15,000 km (*Le Monde*, 2013a). This would correspond to daily postal rounds in the range of 40 km to 48 km (based on the assumption of 6 weekly rounds, 52 weeks per year).

When comparing the TCO of HEVs with their conventional counterparts, OVE (2014d) suggested that, under the market and tax conditions of 2013, both diesel *and* petrol HEVs could compete on TCO with ICE vehicles. For instance, a diesel-hybrid Citroën DS5 would cost 6% less than a diesel-ICE Citroën DS5 (54,508 EUR over 48 months and 100,000 km[30], as compared with 57,681 EUR). In addition, a petrol-HEV Toyota Yaris would cost 1% less than a diesel-ICE Toyota Yaris (26,963 EUR over 48 months and 100,000 km, as compared with 27,123 EUR). If the governmental bonus granted for the acquisition of a petrol-HEV Toyota Yaris (1,650 EUR as at June 2014) is entirely necessary for this model to break even with its ICE counterpart, the extra capital costs, extra financial costs and extra maintenance and insurance costs entailed by the acquisition of diesel-HEV Citroën DS5 relative to a diesel ICE model (respectively, 1,647 EUR, 233 EUR and 480 EUR over 48 months) are already almost fully offset by the energy and tax savings (respectively 1268 EUR and 955 EUR over 48 months) achieved with the HEV model – the bonus of 3,310 EUR not included. Thus, in this latter example, the bonus granted for the diesel-HEV model could be considered as a windfall profit for the corporate car fleet.

**Potential access privileges in the city centres of large urban areas**

A second possible source of added value of EVs compared to conventional vehicles could result from operational restrictions imposed on the latter in the city centres of some large urban areas (*Le Monde*, 2013a). Because of rising concerns amongst urban policy-makers about congestion and local air pollution in city centres (see Chapter 1 for further information on these issues), several large urban areas in France have imposed the first restrictions on the use of conventional vehicles for delivery purposes.

In Toulouse, for instance, following the failure of the 1997 'Charter for deliveries in the city centre' to reduce peak hour traffic and parking congestion, the City adopted a new charter in 2006 (Mairie de Toulouse, 2006) restricting deliveries in the city centre using conventional vehicles not exceeding 9 metres to one morning slot, from 06:30 to 09:30, and to the night time, from 20:00 to

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[30] HEVs do not present the same range limitations as BEVs do. Therefore, an average annual mileage of 25,000 km is compatible with the use of such vehicles. Although HEVs are not limited in range, they provide greater benefits in an urban environment, where they can rely on their electric engine for the major part of their trips. On interurban, long-distance trips, however, the relative energy gains achieved with HEVs would not be as high as in an urban environment. Thus, it would not necessarily make sense to assign HEVs to missions that would entail travelling more than 25,000 km per year, which already is a significant mileage.

06:00, whereas deliveries using EVs not exceeding 9 metres continue to be permitted 24/7.[31] The City of Paris implemented a first 'Charter of good practice for goods transport and delivery in Paris', in 2006 (Mairie de Paris, 2006), followed by a 'Charter for sustainable logistics' in 2013 (Mairie de Paris, 2013). While the 2013 charter does not provide for access restrictions on conventional vehicles, the new Mayor, elected in 2014, gave her Deputy-Mayor for Transport a clear mandate to extend the work of the 2013 charter in order to reach the target of 50% *non-diesel* last-mile deliveries by 2017, and 100% by 2020 (Hidalgo, 2014). To achieve such targets, the City of Paris could, like the City of Toulouse, decide on new access restrictions for last-mile delivery vehicles with conventional drivetrains. Where such restrictions on ICE vehicle operations exist, the business case for EVs is likely to become more compelling, indeed.

**Potential image benefits**

The third and most commonly mentioned added value of EVs for corporate car fleets stems from an improved sustainability brand positioning (Golob, 1997; Nesbitt and Sperling, 1998; CAS, 2011; OVE, 2011; Hutchins and Delmonte, 2012; The Climate Group, 2012; *Flottes Automobiles*, 2013c; *Le Monde*, 2013a; Wong, 2013), which is expected to favourably influence consumers/citizens in their consumption/voting behaviours.

More broadly, corporate social responsibility (CSR) policies may provide a framework for the deployment of EVs, notably when the implementation of a corporate mobility plan is already underway. For instance, EVs can be deployed in vehicle pools, inter-site shuttle services or corporate car-sharing schemes, in order to provide, together with other transport modes, a broad portfolio of mobility options that would cover the needs of employees and visitors, while minimising the impacts of mobility on the environment. Such a diversity of mobility solutions could be needed for mobility management policies to deliver on expected environmental benefits (*Le Monde*, 2103a).

**Potential driver comfort and safety benefits**

Finally, the fourth added value which EVs could bring to corporate car fleets has to do with driving comfort and safety. Those two issues might be seen as two important aspects of the working conditions of employees who spend a

[31] See: *Arrêté permanent n°2012/127 modifiant et complétant l'arrêté municipal du 16 avril 1984 modifié portant réglementation de la circulation et du stationnement sur le territoire de la commune de Toulouse (Ville de Toulouse, Service Réglementation Circulation).*

significant share of their time driving a corporate vehicle.[32] While driving comfort is a key selling point of EVs (CAS, 2011; The Climate Group, 2012; OVE, 2014a), proper feedback from early adopters on the safety performance of EVs will be crucial to win over those fleet managers who fear for a safety performance degradation because the high power features[33] and the low noise levels of EVs have raised concerns over increased risks of collision.

All in all, it appears that the business case for EVs to be used in corporate car fleets still stands in an in-between place at the time of writing. First, EVs have proved to be compatible with only a restricted portfolio of fleet operations. Then, they could only be cost competitive with ICE vehicles provided that *i)* certain mileage conditions are respected, *ii)* tax incentives are maintained at their current levels, and *iii)* car manufacturers do not apply disproportionate discounts on their ICE models. Also, only a few large urban areas had granted them access privileges to their city centres as at 2014. And finally, their expected benefits with regard to corporate branding and safety are yet to be accurately established.

## 8.4 Short-term prospects for car-sharing in corporate fleets

As already mentioned, car-sharing (in French: '*auto-partage*') is a service innovation that refers to the practice of sharing vehicles between a number of different users, who may use them *at different times*. It should not be confused with ride-sharing, which refers to the shared use of vehicles *at the same time*.[34] As far as corporations are concerned, car-sharing may take the form of

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[32] For the record, we showed in Chapter 4 that close to 53% of all corporate vehicles in household fleets were used for more than 2 hours on weekdays, as compared with 20% for private vehicles (see Table 4.10).

[33] With electric engines, the full torque is instantly available, which contributes to their superior performance in stop-start conditions and during acceleration from low speeds.

[34] These terms are those used in North American parlance. In British usage, 'car club' is used instead of 'car-sharing', and 'car-sharing' is used instead of 'ride-sharing', which can cause some confusion (TCRP, 2005: p.2-1). We deliberately chose to use the North American concepts, which are more common in scientific literature. TCRP defines car-sharing as '*a membership programme intended to offer an alternative to car ownership under which persons or entities that become members are permitted to use vehicles from a fleet on an hourly basis*' (TCRP, 2005: p.2-2).

externally-provided services (i.e. corporate car-sharing members using a regular, public or private, car-sharing network in the same way as other members) or in-house corporate schemes (i.e. corporations being provided with exclusive use of car-sharing vehicles).[35] Car-sharing is usually perceived by corporations as a way to: *i)* replace all or part of the corporate fleet, and/or *ii)* flexibly supplement the in-house corporate car fleet, and/or *iii)* reduce taxi, short-term rental and car mileage-related expense claims (TCRP, 2005; MOMO Car-sharing, 2009a; *Le Monde*, 2013a; *Le Figaro Magazine*, 2014; OVE, 2014a).

## 8.4.1 A growing niche market

**The rise of corporate car-sharing schemes**

There are much fewer statistics to illustrate the recent trends in the demand for car-sharing from corporate car fleets than there are for AFVs. Indeed, as with many other service innovations, the development of car-sharing could only be observed through targeted surveys or by monitoring the activity and turnover of companies specialised in providing the service.

In 2014, the US consultancy Frost & Sullivan released a Europe-wide analysis of (in-house) corporate car-sharing solutions, which estimated that the number of vehicles in operation in corporate car-sharing fleets stood at around 2,000 in 2013, with a forecasted growth up to 75,000 or 100,000 by 2020. Whilst they could identify 13 providers of corporate car-sharing services in Europe in 2013, they forecast that every major car manufacturer and short- and long-term rental company would have a branded solution or partnership in place to meet the corporate demand for car-sharing services by 2020, which resulted in the conjecture that there could be more than 30 corporate car-sharing providers in Europe by then. (Frost & Sullivan, 2014)

According to this analysis, changing urban dynamics (e.g. rising traffic and parking congestion, set against the relative ease of using public transport in most urban areas) and evolving fleet management technology (e.g. increasing numbers of connected cars, diffusion of telematics and fleet management software, deployment of keyless access technologies) would be two of the main external drivers of the uptake of car-sharing services. Other important drivers could come from the changing expectations of both corporations and employees with regard to their mobility options. The search for cost savings and improved efficiency and flexibility could make an increasingly strong business case for the integration of car-sharing solutions into comprehensive corporate mobility portfolios in the coming years (TCRP, 2005; MOMO Car-sharing, 2009a). In particular, the development of corporate car-sharing solutions could also feed on

[35] In-house corporate car-sharing can also be described as 'fleet sharing' (TCRP, 2005).

the wider trend towards *collaborative consumption* that is currently being observed in the field of mobility, with the development of public car-sharing,[36] peer-to-peer car-sharing, ride-sharing,[37] etc. (MOMO Car-sharing, 2009a; CAS, 2010; *Le Monde*, 2013a; *Le Figaro Magazine*, 2014; OVE, 2014a). Moreover, some corporations might be willing to use car-sharing as a means to reduce the need for parking space for corporate cars and/or employee cars (TCRP, 2005).

Interestingly, Frost & Sullivan (2014) see corporate car-sharing solutions as potential 'game-changers' for the status and role of the corporate car in the future. Indeed, when implementing corporate car-sharing solutions to meet professional travel needs during daytime, employers could choose to extend the benefits of these solutions to a wide range of employees (including those who might not have previously qualified for their own official car) for their personal vehicle use at nights and during weekends, for an affordable fee that would cover costs.[38]

In France, providers of (in-house) corporate car-sharing services claim that moving all or part of the traditional pool vehicles and assigned service vehicles to a corporate car-sharing scheme could reduce the fleet size by 30% to 40% because of more efficient utilisation; it could also deliver savings of up to 50% on taxi expenses and up to 30% on short-term rental expenses (*Le Monde*, 2013a; *Le Figaro Magazine*, 2014)

Pioneer in the field since 2008, the business-to-business (B2B) car-sharing solution provider Carbox, which was rebranded as Ubeeqo in 2014, claimed 500 vehicles in operation in corporate car-sharing schemes in 2014 (*Le Figaro Magazine*, 2014). The long-term rental company Arval (206,000 vehicles in operations in France in 2013) claimed 250 vehicles in operation in

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[36] Launched in December 2011, the public EV car-sharing scheme Autolib in the Paris region already had 118,000 subscribers in December 2013, including 40,000 annual subscribers (Source: http://www.france-mobilite-electrique.org/autolib-story,279.html). The scheme was expected to reach 60,000 annual subscribers by the end of 2014 (OVE, 2014a).

[37] According to a household survey by the French consultancy BIPE, ride-sharing was the most popular of non-market services among French households in 2013: 14% of them had already used this type of service in 2013, as compared with 7% in 2010 (BIPE, 2013).

[38] A corporate car-sharing solution in France would typically charge the following fees for the personal use of car-sharing vehicles by employees: *i)* a fixed fee of 3 EUR combined with a variable fee of 0.3 EUR per km at night; *ii)* a fixed fee of 25 EUR combined with a variable fee of 0.3 EUR per km during weekends (*Le Monde*, 2013a).

corporate car-sharing schemes in 2013 (*Le Monde*, 2013a). While these figures remain low, a number of corporations report having plans to deploy corporate car-sharing systems at their facilities: the operator of the Paris airports alone, Aéroports de Paris, could soon transfer 500 of its vehicles to a corporate car-sharing scheme, using the proprietary solution run by its daughter company Hub One (*Le Monde*, 2013a; *Le Figaro Magazine*, 2014). Similarly, the French telecommunications group Orange could increase its corporate car-sharing fleet from 100 vehicles in 2013 to 1,500 vehicles by the end of 2015 (Orange, 2013).[39]

Pooled car-sharing schemes among corporations located in close proximity are also being examined as a way to further optimise fleet utilisation and reduce fleet costs (*Le Monde*, 2013a; Frost & Sullivan, 2014). A pooled scheme of this kind has been piloted since 2013 by 7 corporations in the City of Grenoble, sharing 40 vehicles.[40]

**Public car-sharing schemes targeting corporate customers**

Being both a potential competitor of, and a complement to, in-house corporate car-sharing schemes, public car-sharing schemes also target corporate customers. The Paris region's public car-sharing scheme, Autolib (2,035 publicly shared EVs in the Paris region in December 2013)[41] launched a B2B offer in 2012, with seven different packages according to the volume of car-sharing hours needed by the corporate customer (as of 2014, the monthly packages ranged from 25 hours / 280 EUR to 2,000 hours / 19,500 EUR). It had already taken on more than 150 corporate customers in the region by April 2014 (*Le Figaro Magazine*, 2014).

### 8.4.2 Are EVs fit for corporate car-sharing?

Because vehicles deployed in corporate car-sharing schemes are commonly parked on dedicated parking lots, the deployment of an adequate recharge infrastructure for shared EVs on corporate facilities would seem feasible. Moreover, because EVs are essentially connected vehicles (in particular because of the need to monitor battery charge), the combination of EV technology and car-sharing fleet management software would seem a 'natural' alliance. Furthermore, since a large proportion of car business travel takes place in an urban environment, the use of shared vehicles by employees to meet with

[39] As of September 2013, Orange's corporate car fleet in France consisted of 23,000 vehicles, including 2,000 pool service vehicles (Orange, 2013).

[40] Source: http://www.flotauto.com/mobilite/lisa-isere-mise-auto-partage-31568.

[41] Source: http://www.france-mobilite-electrique.org/autolib-story,279.html.

clients and run other errands could by and large be compatible with the range of BEVs. Finally, because car-sharing increases the individual use of each vehicle, EVs in corporate car fleets could more easily break even with their ICE counterparts when used in such schemes rather than in a standard pool. Therefore, the introduction of EVs into corporate car-sharing scheme would seem altogether technically and operationally feasible, and economically viable, on the basis of a preliminary analysis.

Some operational barriers may remain, however, to the combination of EVs and corporate car-sharing schemes, notably in the following two instances: *i)* business trips exceeding the range of BEVs would require the availability of alternative solutions, such as shared ICE vehicles, or taxis, or short-term rental; *ii)* the intensive use of shared EVs for several business trips in a row would prevent the battery being fully recharged between separate trips in standard-charging mode (6 to 10 hours of charge depending on the vehicle), which could require the availability of faster recharging solutions employing much more costly infrastructure.

# 8.5 Barriers and disincentives to innovation and the role of public policies

Our analysis of recent trends in the demand for automotive innovations from corporate car fleets in France, has revealed several types of limiting factors, which we will summarise here in order to get a clearer view of where corporate car fleets stand, and where they are headed, with regard to innovations. In what follows, we will separately discuss operational and technological barriers, on the one hand, and economic barriers, on the other hand. We will also provide some insights into the role(s) that public policies can play in overcoming such barriers, drawing on the results of our exploratory survey (see Chapter 6), as well as on the findings of research on innovation management and technological transition management (see, for instance: Callon, 1980; Kemp, 1994; Schot *et al.*, 1994; Kemp *et al.*, 1998; Schot and Geels, 2008; Nill and Kemp, 2009; Geels, 2012).

## 8.5.1 The possible roles of public policies in promoting innovations

Following Windisch (2013), we identify three possible roles for public policies, as ‘enablers’, ‘initiators’, or ‘supporters’ of innovations. However, our definition for these categories is more *dynamic* than the one provided by Windisch, for we use them with a view to describing a hypothetical transition process from the current dominant sociotechnical regime to the emergence of a new regime, through the possible influence of niche-innovations (Geels, 2002, 2004, and 2012).[42]

We categorise as *enabling* policies those policies that anticipate the possible large-scale uptake of innovations and remove potential barriers in their way. They usually consist in the design of a new legal framework (through the enactment of new legal provisions and/or the revision of existing ones), *compatible* with the prospect of a large-scale development of the innovations considered. They can also consist in the funding of research on technologies and info- and infra-structure outside the dominant technological regime, which are required for the development and maturation of radical innovations but would otherwise be disregarded by incumbents.

We categorise as *initiating* policies those policies that help to create windows of opportunities for the short-term development of radical innovations in *niches*. They can consist in incentive schemes or technology-forcing mandates. They can also provide for the implementation of demonstration projects (for new technologies, services or infrastructure). Initiating policies are usually designed to be proactive, even voluntarist. Their objective is the materialisation of short-term effects, and they are therefore unlikely to remain in force in the long run. In particular, they are unlikely to remain in force in the event of large-scale uptake of the innovations they promote.

Finally, we categorise as *supporting* policies those policies that enhance the outlooks for a large-scale adoption of innovations over the medium to long term. They can consist in the modification of the legal framework to make emerging innovations as commonly accessible as solutions from the dominant regime, or else in the provision of *sustainable advantages* (privileges) to emerging innovations over the dominant regime.

By nature, supporting policies usually target the demand side of the system rather than its supply side. Enabling policies on the other hand, preferentially target supply. Initiating policies can equally target supply and demand. Figure 8.2 illustrates the various categories of policy instruments that can be

[42] Geels analyses technological transitions using a multi-level perspective (MLP) whereby the change from one sociotechnical regime to another results from alignments between developments at the levels of *i)* the sociotechnical regimes, *ii)* niche-innovations (i.e. the micro-level where radical innovations emerge, usually in unstable sociotechnical configurations with low performance), and *iii)* the sociotechnical landscape (i.e. the exogenous macro-economic, cultural and macro-political environment, which is beyond the direct influence of niche and regime actors in the short run) (Geels and Schot, 2007).

implemented to promote the uptake of electric vehicles in the automobility system.

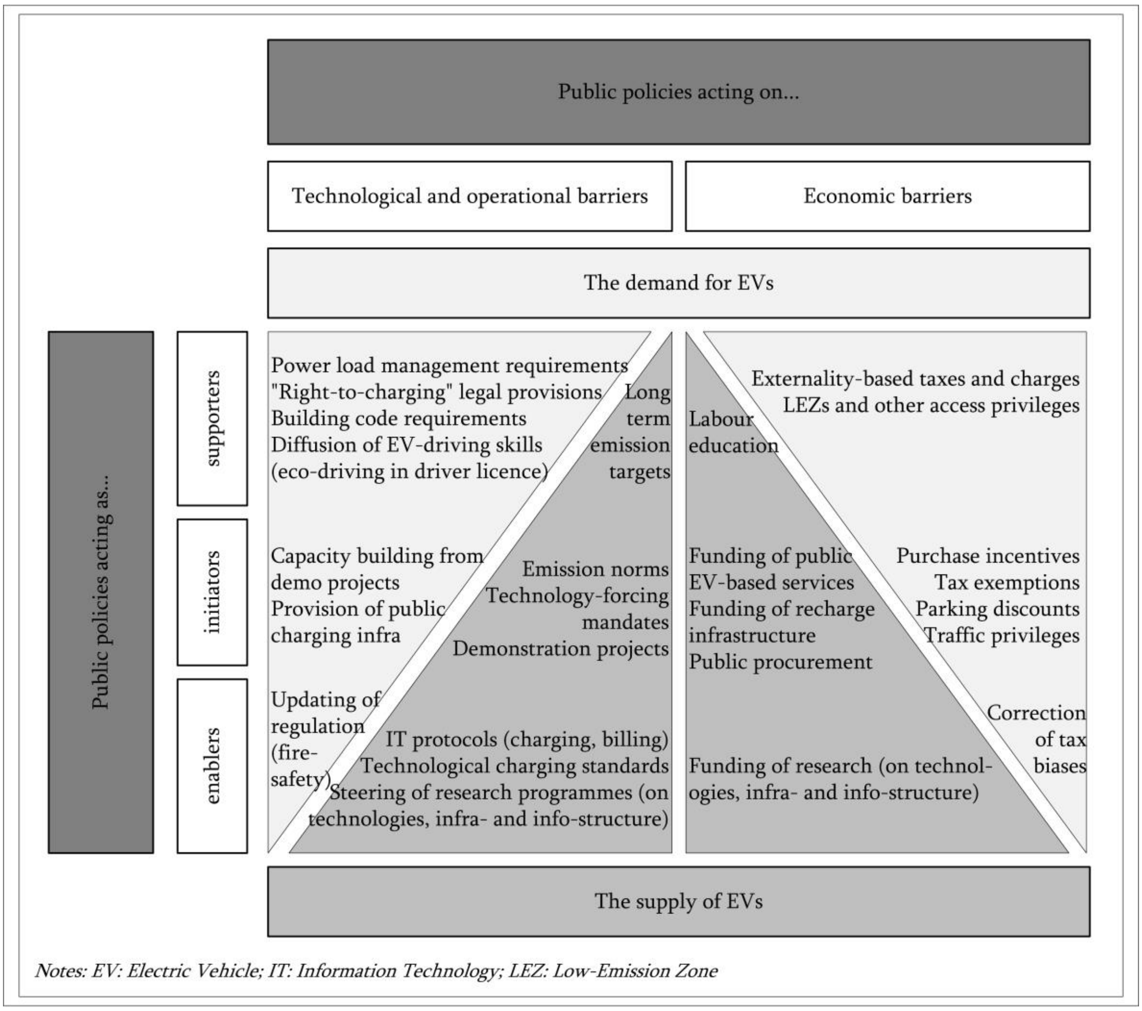


**Figure 8.2: The roles of public policies in promoting innovations: The case of EVs**

This categorisation of policies prompts a number of comments. First, we consider that there is no sharp distinction between the three categories of policies we could identify. For instance, some initiating policies (e.g. provision of infrastructure, vehicle purchase incentives) could turn into supporting policies if they were initially designed so as to be sustainable and effective over the long term, or if they were progressively adjusted to those ends. Similarly, such initiating policies as demonstration projects can be closely tied to research steering and funding policies, which we categorised as enabling policies.

Second, we do not presume to have developed a normative and deterministic vision of public policies, which would allow us to claim that policies 'should' be implemented according to a certain pattern in order to deliver the expected effects. Rather, we present our view, based on the results of our investigation, of what kind of obstacles *may* be tackled through public policies at different stages in the innovation uptake process.

### 8.5.2 Sorting out operational and technological issues

As already mentioned, the issue of whether or not automotive innovations, be they AFV technologies or car-sharing solutions, effectively match the operational requirements of corporate car fleets, is crucial to their uptake by such fleets. Indeed, a corporate car fleet being primarily an operational means to business ends (including potential benefits in terms of benefits, safety, driver comfort, etc.), the innovations considered should improve, and at the very least not alter, the longer term operational performance of the fleet, or else they should be disregarded.

This preliminary point being established, it should be acknowledged that such barriers as the range limitations of BEVs, and/or their recharging time, are likely to be truly limiting factors only for some, not all, patterns of use. Furthermore, there are at least three types of reason for hope of future improvements with respect to these issues. First, with the expected diversification of EV and battery technologies (e.g. PHEVs, EVs fitted with range extenders), it can be anticipated that a growing portion of operations will be compatible with the use of innovative vehicles (*Le Monde*, 2013a; *Voiture Ecologique*, 2013). Second, with the progressive deployment of public recharging infrastructure – in standard, semi-fast and fast charging modes[43] – in city centres and large suburban shopping areas, and along major interurban corridors, it can be expected that 'range anxiety' will decrease, and that route planning will be able to take into account the added charging options (*Flottes Automobiles*, 2013c; *Le Parisien*, 2013b; *Les Echos*, 2013). Finally, thanks to the increasing spread of telematics and fleet management software, it can be anticipated that fleet managers and fleet activity planning managers will develop their expertise and will consequently be better able to identify the geographical zones and specific patterns of use for which innovative vehicles and solutions would be of particular relevance.

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[43] As an illustration, the BEV Renault Zoé could be fully charged in 8 to 9 hours through standard charging (also called 'slow charging': using 3 kW power supply, which is typically available on any normal power socket at home); it could be fully charged in 1 to 3 hours through semi-fast charging (also called 'accelerated charging': using 7 to 22 kW power supply, available in some public or corporate stations); and it could be charged up to 80% battery capacity in half an hour through fast charging (also called 'rapid charging', using 43kW power supply, available in high-power public charging stations). Source: http://myrenaultzoe.com/index.php/zoe-description/charging.

Thus, many of the current operational and technological barriers to the uptake of innovations by corporate car fleets could be progressively sorted out in the coming years through collaborative efforts by all stakeholders, provided that an adequate ecosystem (including the supply of vehicles, services and supporting info- and infra-structure) develops along the operational requirements of corporate car fleets.

From this standpoint, public policies can acts as technological and/or operational 'enablers' by steering research programmes on technologies, info- and infra-structure with a view to raising the level of performance of innovations. They also have an important enabling role to play by creating an adequate legal framework that would be compatible with large-scale development of the electromobility system. In particular, this legal framework should address *i)* the standardisation and interoperability of the recharge infrastructure and services (including data protocols for charging, roaming, etc.), and *ii)* the safety standards of recharge infrastructure (especially in tertiary sector buildings). Indeed, the current inadequacy of the legal framework with regard to technological standards for recharge (multiplicity of standards, lack of legibility),[44] recharge services (multiplicity of proprietary IT protocols, impossibility of roaming), and recharge safety (lack of legibility, possible inconsistence with actual risks involved), could be a major obstacle to the development of a large-scale electromobility system.

On a more proactive basis, some public policies can help initiate demonstration projects for new EV-related (or car-sharing-related) technologies, infrastructure and services. Such demonstration projects can help build capacity among the suppliers of innovations (on vehicle and associated technologies, business models, associated services, etc.) (Midler and Beaume, 2010), and among their potential adopters as well (see Chapter 6). In addition, as already mentioned, public policies can also initiate the development of innovations in niches through the provision of public recharge infrastructure.

[44] For instance, there are three connector standards currently in use in Europe for fast-charging: two for DC charging, also known as 'Mode 4' charging (the CHAdeMO plug and the combined charging system 'Combo 2' plug), and one for the fast AC charging (the 'Type 2' plug). To remedy the multiplicity of fast-charging standards, the recent European directive on the deployment of alternative fuels infrastructure (EC, 2014c) made it mandatory for all DC fast-charging stations to be equipped with at least a Combo connector, and for all AC fast-charging stations to be equipped with at least a Type 2 connector. In addition, a fourth connector for fast-charging exists, based on a proprietary interface (not standardized): the Tesla Supercharger.

Finally, in the long run, public policies can act as 'supporters' of the technological and/or operational development of innovations through the enactment of long-term targets for car manufacturers relating to emission norms or technology mixes, thereby sending a political message about the anticipated rate of spread of innovations such as electric vehicles. More importantly, on the demand side, many additions to the current legal framework (e.g. the 'right-to-charging' provisions for office buildings or mixed-use buildings, the introduction of EV-driving training in the driver's licence curriculum) can help make electric vehicles more commonly accessible to their potential users technically, operationally, cognitively, etc.

### 8.5.3 Economic barriers: from industrial/commercial issues to policy-induced distortions

Many of the economic barriers to the uptake of innovations by corporate car fleets we have identified in our analysis are essentially industrial or commercial issues. For instance, the high list prices of EVs and HEVs (*Flottes Automobiles*, 2013c; *Le Parisien*, 2013a and 2013b; *Les Echos*, 2013), which result from the combination of added technology and small-series production, or from uncertainty about their residual values (*Flottes Automobiles*, 2013c) because of the nonexistence of a second-hand market; or else the low levels of price discount applied by car manufacturers on EVs and HEVs relative to ICE vehicles (*Le Parisien*, 2013a; *Le Figaro*, 2014; OVE, 2014a), which result from lower commercial margins on the former vehicles compared with the latter: all pertain to industrial and/or commercial mechanisms, which are likely to change as the market for EVs and HEVs grows and matures (see Figure 8.1 for a synthetic illustration of the possible positive feedback loops of increased demand for EVs from corporate car fleets on the larger EV market supply and demand mechanisms).

From this standpoint, public policies have a primary role to play as 'enablers' of the uptake of innovations by corporate car fleets, through the correction of existing tax distortions. For instance, the fact that petrol vehicles are at a competitive disadvantage as a result of different VAT conditions applicable to diesel and petrol vehicles in corporate car fleets, is an obvious tax-induced market distortion (OVE, 2014b: p.32; OVE, 2014c: p.49). This market distortion *de facto* constitutes a disincentive for corporate car fleets to take up HEVs, because most HEV models currently on the market are petrol-powered. In addition, the fact that local air pollutant emissions were not included in the tax base of the TVS tax scheme until 2014, has been an additional advantage to diesel engines over petrol engines. Finally, the fact that corporate car fleets have no incentive to reduce the $CO_2$ emissions of their light commercial vehicles further than what is required by the Euro emission standards has led to a two-tier system in which corporate passenger cars (through the TVS tax scheme) are subject to heavy taxation on their $CO_2$ emissions whereas corporate light commercial vehicles are exempt from $CO_2$-based taxation. It is generally acknowledged that, in the absence of an emission-based tax system for light commercial vehicles, the relative gains in vehicle environmental performances achieved on this market segment over the last decades have been limited compared with what might have been achieved (*Le Monde*, 2012; *Voiture Ecologique*, 2013). As far as corporate car-sharing is concerned, public policies could acknowledge the specific status of pooled vehicles (whether in pool or in corporate car-sharing schemes) as 'working tools', regardless of the vehicle type, and align the taxation applicable to such vehicles with the taxation applicable to light commercial vehicles.

Public policies have another major role to play as 'initiators' of possible niches where innovations could develop. Such initiating policies can take the form of purchase incentives (e.g. the bonus scheme), tax exemptions (e.g. the TVS tax scheme),[45] public parking fee discounts, or else traffic privileges (e.g. access to bus lanes in the city centres). While the implementation of purchase incentives and tax exemptions can be partially justified by the superior environmental performance of EVs over ICE vehicles, their overall effects on public finances, like the effects of traffic privileges on the infrastructure they concern, appear to be unsustainable in the long run. Therefore, such policies most probably could not remain in force if EVs were to achieve mass-market deployment.

Finally, with a view to the longer term, public policies can act as 'supporters' with regard to the innovations in question. For instance, reflecting concerns about oil dependency and climate change, they can deliver sustainable improvements to the competitiveness of innovations by revising the tax framework so that taxes (and charges) on vehicle purchase and use (e.g. registration taxes, circulation taxes) would be modulated according to the relative environmental performances of the vehicles. To be effective in the long run, the revision of the tax framework would require an integrated approach so that the various tax layers form a legible, consistent framework.[46] Reflecting concerns about local air quality and public health, public policies can also support the uptake of innovations over the long term through the

[45] See Chapter 7 for further information.

[46] As already mentioned in Chapter 7, legibility is at stake when changes occur in the terms and conditions of different schemes with the same tax base (e.g. the TVS scheme and the 'malus' scheme) in a way that appears to lack coordination in time or scale. Issues of consistency can arise, for instance, from the variations across schemes in the scope of AFVs which tax policy explicitly seeks to promote.

implementation of low-emission zones or other access privileges for low-emission vehicles in the city centres of large urban areas. Such policies could be particularly effective for corporate car fleets, considering the significant share of vehicles that are used for business purposes and could not easily be replaced by alternative modes of transport (e.g. worksite vehicles, delivery vehicles). On the supply side, public policies could act on education and training programmes to provide the workforce in all relevant industries (automotive, energy, transport, urban planning, etc.) with the skills required to support the large-scale deployment of innovations.

## 8.6 Conclusion

On the basis of the observation of recent trends in the demand for alternative-fuel vehicles from corporate car fleets, we have highlighted that corporate car fleets were responsible for 51% of all new-EV registrations and 27% of all new-HEV registrations (37% of diesel HEVs and 23% of petrol HEVs) in the light-duty vehicle market segment in 2013, thereby attesting to the potential of corporate car fleets to take up innovations in their early stage of development.

Analysing in further detail the corporate demand for AFVs, we have found several differences in the features and dynamics of the passenger car market segment on the one hand, and the light commercial vehicle segment on the other hand. It would appear that the corporate market for EVs and HEVs could be developing into two specialised submarkets, whereby an increasing share of EVs might be sold on the LCV market segment, while HEVs might remain confined to the passenger car market segment. The question remains, however, as to whether such dual development would stem from genuinely operational considerations (e.g. greater mileage and more diverse uses for passenger cars), given that distortionary provisions in tax policies (e.g. absence of purchase bonus for hybrid-electric LCVs), combined with specific conditions in market supply (e.g. poor supply of hybrid-electric LCVs), can also greatly influence developments on the AFV submarkets.

When analysing the possible benefits to be expected from the adoption of electric vehicles by corporate car fleets, we have found that the expectations of the various stakeholders involved in the deployment of electromobility (public policy-makers, car manufacturers, corporate car fleets) are not yet stabilised. Several types of network effects can be expected from the uptake of EVs by corporate car fleets (e.g. encouraging economies of scale in manufacturing, increasing visibility, awareness and confidence, increasing infrastructure density), which could play a crucial role in the large-scale diffusion of these vehicles and, thereby, in achieving the ambitious national targets for EV diffusion (2 million EVs on French roads by 2020, 4.5 million by 2025).[47] However, French public policies appear not to hold a strong position regarding the necessity and/or utility of supporting the uptake of EVs by corporate car fleets to pave the way for mass-market diffusion. On the one hand, several measures have been taken to foster the uptake of EVs through public procurement and public-private joint procurement initiatives (e.g. the 2009-2011 public-private joint BEV-purchasing initiative, or the 2012 governmental notice on the exemplary role of public fleets). On the other hand, until 2012, corporate car fleets had received no significant incentives from tax policies to take up EVs and HEVs. The recent changes in the bonus and TVS schemes might point to a shift in the perception by public policy-makers of the role to be played by corporate car fleets in the large-scale uptake of EVs and HEVs. Yet as of 2014, there was still no incentive at all for hybrid-electric LCVs, and some significant tax distortions remained, on the corporate passenger car market segment, between diesel-HEVs and petrol-HEVs.

As well as the network effects already mentioned, we have shown that car manufacturers involved in the diffusion of EVs are likely to expect additional benefits from the adoption of EVs by corporate car fleets, for instance greater reliability in their strategic EV sales planning (corporate decisions with regard to vehicle purchase and renewal are more predictable than household decisions). More importantly, we have suggested that some of the challenges posed by the adoption of EVs could be turned into opportunities by the double transition process the car manufacturing industry has been experiencing as a result of the servitization and digitalization of its historical technologies. However, we highlighted that such transition processes are painful for the industry, which has to deal with conflicting forces and possibly significant inertia. In addition, the high levels of price discounts applied to ICE vehicles – especially light commercial vehicles – to support sales during automotive industry crises, may have come at the expense of the cost competitiveness of EV and HEV models.

From the corporate car fleets' standpoint, we have shown that the compatibility of EV-specific constraints with daily operations was deemed a necessary condition for the uptake of EVs as a 'drop-in' solution in the existing pattern of operations, before new tools can provide more flexibility and/or adaptability to fleet management processes. We however highlighted that, when compatible with all or part of the daily operations of a corporate car fleet, EVs could also bring potential added value to fleet operations, in terms of direct economic gains (through a TCO approach, provided certain mileage conditions are respected and tax incentives are maintained), access privileges to the city

[47] For further information on these targets, see: MEEDDM (2009a: p.15) and MEEDDM (2010a).

centres of large urban areas with traffic restrictions (through low-emission zones, or permanent/temporary access restrictions for last-mile delivery vehicles with conventional drivetrains), image benefits, as well as driver comfort and safety benefits.

When analysing the outlooks for corporate car-sharing as a service innovation with potential effects on the whole corporate mobility system, we found that this niche has been growing under the combined influences of changing urban dynamics (e.g. rising traffic and parking congestion), evolving fleet management technology (e.g. diffusion of telematics and fleet management software, deployment of keyless access technologies), and increasing pressure from corporations to reduce fleet costs as well as other mobility costs (e.g. taxis, short-term rental, car mileage-related expense claims, parking). However, we also highlighted that corporate car-sharing could be feeding on wider trends (e.g. collaborative consumption) that might change the expectations of both corporations and employees with regard to their mobility options. Corporate car-sharing could then be a potential 'game-changer' for the status and role of the corporate car in the future, which could be both 'mutualised' and 'democratised' by extending the benefits of these solutions to a wide range of employees for their professional needs during daytime, and for their personal needs at nights and during weekends (for an affordable fee).

We further highlighted that several types of operational and economic synergies could be found between EVs and car-sharing in corporate car fleets, because both types of innovation require the deployment of adequate info- and infra-structure, which can be easily combined, and because the intensive use of vehicles in a car-sharing scheme can bring EVs closer to the breakeven point with their ICE counterparts. Some operational barriers remained, however, to the combination of EVs and corporate car-sharing schemes, which would require the availability of alternative mobility solutions (e.g. shared ICE vehicles, taxi, or short-term rental) to make trips exceeding the range of BEVs, and/or the availability of fast-charging infrastructure to manage the intensive use of shared BEVs over a day.

On the basis of these observations, we discussed the various roles public policies could play in overcoming the barriers, be they technological/operational or economic, to the uptake of innovations by corporate car fleets. On the technological and operational side, it appears that public policy-makers have well anticipated the large-scale deployment of EVs by implementing 'right-to-charging' provisions and new building code requirements with a view to supporting the deployment of charging infrastructure at corporate facilities. However, public policies are still lagging behind with regard to some aspects of the legal framework that could enable the large-scale deployment of EVs. Issues regarding the standardisation of charging infrastructure and communication protocols (multiplicity of standards, lack of legibility), charging services (multiplicity of proprietary IT protocols, impossibility of roaming), and recharge safety (lack of legibility, possible inconsistence with actual risks involved), could be major obstacles to the development of a large-scale electromobility system.

In addition, on the economic side, although significant efforts have been made to initiate the adoption of EVs by corporate car fleets (e.g. through the 'bonus' and 'special bonus' programmes, or the TVS scheme), there seem to have been little preparation for the longer-term large-scale deployment of EVs. As already pointed out in Chapter 7, the current tax framework applicable to corporate car fleets lacks legibility and consistency as regards the promotion of EVs and other AFVs, be it in the short run or over the long-term. Moreover, the portfolio of possible policies that could be implemented to build the EV business case with corporate car fleets could be much larger than tax policy alone. Traffic (or parking) privileges (e.g. access to bus lanes, in an initiating phase, or low-emission zones, upon large-scale deployment) could send strong signals to corporate car fleets for their adoption of EVs in urban areas. As far as car-sharing solutions are concerned, supporting policies could take the form of new requirements to include car-sharing in the portfolio of solutions considered relevant (or even mandatory) under corporate mobility management policies.

These observations prompt a number of comments on the design and implementation of public policies. First, we want to highlight the fact that policies with a significant influence on the adoption of innovations by corporate car fleets can originate at different *levels*, whether European, national or local. While most enabling policies may be in the hands of European or national policy-makers (e.g. standardisation of recharge infrastructure), some initiating and supporting policies could emerge at the local level that could completely change the prospects for EVs in corporate car fleets over the mid- to long-term (e.g. through local environmental charges, LEZs or other access privileges).

In addition, we want to stress the importance of adopting a *dynamic* approach to *i)* the demand for innovations from corporate car fleets, *ii)* the barriers and disincentives to the development of such demand, and *iii)* the policies that could help overcome such barriers. Indeed, as well as anticipating likely changes in overall economic conditions (e.g. relative prices of energies), it is crucial that all stakeholders can better anticipate such forthcoming developments as those to the legal and fiscal framework, which result from policies implemented at European, national and local levels.

Finally, although we have overlooked policies that can act, over a longer time scale, on the macro-economic, cultural and macro-political environment, i.e. the 'sociotechnical landscape' (Geels and Schot, 2007), public policy-makers should not underestimate the power of such policies (e.g. awareness and education campaigns, carbon taxation) in overcoming resistance to change in the dominant regime and bringing new resilience into the mobility system, through the dissemination of new cultural, economic and political values.

# Conclusion

Our mobility system faces critical challenges and is under increasing pressure – both internal and external– to *transition* towards sustainability. Considering recent trends in greenhouse gas emissions and local atmospheric emissions, a transition towards sustainable mobility would have to be underpinned by an *integrated policy framework* in order to support the major changes that it would most likely entail at system level, in terms of travel behaviour, service and technological portfolios, processes for coordination and cooperation among stakeholders, etc. As a matter of fact, increasing integration between industrial policies (promoting innovation), transport policies (promoting mobility management) and tax policies (promoting behavioural change), can be achieved, provided that they are all designed with *clear and consistent long-term objectives*. In such a scenario, the renewed political support for innovation in the automotive industry that has followed the 2008 economic and financial crisis could contribute significantly, in the short- to medium-term, to the incremental and radical improvements needed to put the French mobility system back on track towards sustainability.

Yet another condition for the transition to happen is the *involvement of all relevant stakeholders*. It is clear that corporations hold a special position in the mobility system. Their decisions influence mobility behaviours well beyond corporate mobility patterns alone. Indeed, they strongly influence the daily commuting needs of their employees through their strategic decisions (e.g. on location, working arrangements) and through the provision of mobility solutions (e.g. public transport season tickets, official vehicles, shuttle buses). In some cases, they even provide mobility solutions for private mobility purposes (e.g. official vehicles). Yet the role that corporations can play in the transition towards sustainable mobility has received little research attention from scientists, and has been leveraged very little by public policy-makers: by and large, corporate mobility and the various forms of mobility on which corporations have a possible influence, are still *blind spots* in the collective understanding of the mobility system. Corporate car fleets provide a striking example of this.

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While French public policy-makers have set ambitious targets for the diffusion of electric vehicles in France (2 million electric vehicles by 2020, 4.5 million by 2025) and have made tremendous efforts to support their uptake (through research funding, purchase incentives, etc.), we could find no research or policy document that had assessed, or at least raised the question of, the role that corporate car fleets could play in this diffusion process. As a matter of fact, we could find virtually no research or policy document on corporate car fleets *at all*. This was the starting point of our investigation into corporate car fleets as potential key players in the transition towards sustainable mobility, and from this derives the main contribution of our research, which is to demonstrate that, given their (current and potential) effects on the wider mobility system, and given their sensitivity to public policy incentives, corporate car fleets *are* a relevant object of research and a relevant matter for public policy discussion.

The first added value of our work on this brand new research object has been to develop a set of definitions as well as an analytical framework. As a matter of fact, we have chosen rather a broad perimeter for our definition of corporate car fleets, which would cover all light-duty vehicles (including passenger cars and light commercial vehicles) *held* by corporations, whether public or private, large or small. Yet, inside this perimeter, we have proposed various typologies of vehicles, including one typology devised by us, based on the 'rights' granted to the employee on the vehicle, which distinguishes between service vehicles, defined as vehicles used exclusively for professional purposes, and official vehicles, which are allowed for private use.

The second added value of our work on corporate car fleets has been to begin the construction of a much needed knowledge base on this new object. Faced with the scarcity of available information, we embarked upon a multi-method investigation to gain insight into the size and composition of corporate car fleets, as well as their main features and use patterns. For this, we used a wide range of academic and non-academic sources (e.g. professional journals, general press, legal archives), and cross-checked quantitative results from large database analysis (e.g. household travel surveys, light commercial vehicle surveys) against qualitative insights gained from face-to-face interviews. According to our preliminary analysis, corporate car fleets could account for about 15% of the total light-duty vehicle stock in France (6 out of 38 million vehicles, including 2.5 million passenger cars and 3.5 million light commercial vehicles), and about 40% of new light-duty vehicle sales every year. Such figures would need to be cross-checked against carefully analysed data from the advanced statistical register of road motor vehicles (RSVERO), an instrument set up in 2009 which is currently being developed and trialled by the French Interior Ministry and Ministry for Sustainable Development. In addition, we found that corporate car fleets could account for close to 25% of the total annual mileage of light-duty vehicles in France (130 out of 520 billion kilometres), and about 25% to 30% of their $CO_2$ emissions (between 23 and 28 out of 92 million tonnes of $CO_2$). Such figures are an important first step towards giving corporate car fleets their rightful place as a component of the larger mobility system.

Our investigation has also revealed various connections between corporate car fleets and private household mobility. On the one hand, our analysis of household travel surveys provided further insights into the holding and use of corporate vehicles in private households. We found that 5.5% of households in the Paris region (and probably close to 3% of French households) have access to a corporate vehicle. Thus, we found new evidence to support our preliminary assumption of the non-negligible influence of corporations on the private mobility patterns of their employees through the provision of mobility solutions such as corporate vehicles. We also found evidence that *not all* corporate vehicles held by private households qualify as 'official vehicles': it appears that a significant share of corporate vehicles in household vehicle stocks could be service vehicles over which employees have exclusive rights, to which they have full-time access and which they can use strictly for professional trips *and* for their daily commute to work. On the other hand, our analysis of light commercial vehicle surveys has provided further insights into the holding and use of corporate vehicles in corporate car fleets. This analysis revealed the instrumental role corporate car fleets can play in the introduction of new trends (e.g. new vehicle features) into France's wider vehicle stock. Indeed, we were able to verify that, because of their large share in new light commercial vehicle sales, corporate car fleets have prompted major changes in the features of the wider light commercial vehicle stock over time. Indeed, they have been responsible for the progressive adoption of passenger-car derivatives as an alternative to ordinary vans. They have also been responsible for the almost complete (and rather rapid) phasing out of all engine types other than diesel from the light commercial vehicle stock in France.

We were able to make two additional observations based on our examination of quantitative surveys. First, the day-to-day patterns of use of corporate vehicles are highly diverse, and a significant proportion of these patterns could be compatible with alternative-fuel vehicles in general, and battery-electric vehicles in particular. Interestingly, a large proportion of corporate vehicles – especially among light commercial vehicles – would seem to have high annual mileage without necessarily travelling long distances on a daily basis. Second, tax policies have significant effects on the dynamics of the spread of innovations in corporate car fleets, and *beyond* corporate fleets into the larger light-duty vehicle stock in France, through the second-hand market. With these two observations, we had laid the foundation for a more in-depth exploration of whether (and, if so, how) corporate car fleets could be leveraged by public policy-makers to foster the dissemination of innovations into the larger light-duty vehicle stock in France.

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By analysing the decision-making processes of large corporations with regard to fleet management (including the acquisition and use of the vehicles), we found evidence that corporate car fleets are a complex system inside the no less complex mobility system: their management involves decision-makers from a wide range of departments and from all hierarchical levels in the organisation. Various tools have been developed over time to handle this complexity, including corporate car policies, which now give structure to the interactions between all stakeholders in the acquisition process. Similarly, expertise is developing in the management of day-to-day fleet operations, with the help of new information and communication technologies (e.g. vehicle monitoring and tracking technologies). By making it possible for overall vehicle ownership costs to be assessed more accurately in advance, this developing expertise could be instrumental, over the mid- to long-term, in fostering the overall efficiency of the fleet optimisation process, and particularly the adoption of alternative-fuel vehicles and car-sharing solutions. In the meantime, appropriate feedback programmes on operational experience would be needed to disseminate good practices and lessons learned from experiments with such innovations in corporate car fleets. In our view, fleet management processes in all kinds of organisations have recently entered a phase of rapid change under the combined influence of growing economic pressure and the increasing role of digital technologies in their operations, which could profoundly change the prospects for innovation in corporate car fleets in the near future.

Because our qualitative survey further supported the hypothesis that taxes have a significant impact on decision-making processes relating to corporate car fleets, we endeavoured to unravel the complexity of the various tax stimuli that might influence the features of corporate vehicles (e.g. vehicle body type, fuel type). Our review of the main tax schemes applicable to corporate car fleets revealed that continuous changes in the tax schemes, together with the original complexity of the tax portfolio, adversely affects the legibility and consistency of the tax stimuli. We see an opportunity in the rising concerns over the environmental impacts of corporate vehicles, and in the growing awareness of the many weaknesses and inadequacies of the current tax system, to consider overhauling the portfolio of taxes that apply to French corporate car fleets (and beyond). However, we believe that further research would be needed to reach a more accurate evaluation of the impacts of tax policy on the features of corporate vehicles in France over recent decades, using complementary datasets from the advanced statistical register of road motor vehicles (RSVERO).

Through our examination of recent trends in the demand for alternative-fuel vehicles in corporate car fleets, we showed that corporate car fleets were responsible for 51% of all new electric vehicle registrations in 2013, attesting to the potential of corporate car fleets to take up innovations in their early stage of development. The large-scale adoption of electric vehicles by corporate car fleets would trigger several network effects, including increased economies of scale in manufacturing, increased visibility, awareness and confidence among potential adopters, and increased infrastructure density. Yet, it would seem that French public policy-makers do not yet have a clear strategy regarding the necessity and/or usefulness of supporting the uptake of electric vehicles by corporate car fleets with a view to paving the way for mass-market dissemination.

This and previous observations prompt a number of remarks on the design and implementation of public policies for sustainable mobility. First of all, having set a long-term strategic objective for the spread of electric vehicles in France's light-duty vehicle stock, public policy-makers would now need to *assess the tactical opportunity* of leveraging the large size and high turnover rate of the corporate car fleet market to foster uptake of these innovations. Moreover, if public policy-makers grasped this tactical opportunity, they could *seek further integration* between industrial policies concerned with the spread of innovations, transport policies concerned with mobility management (e.g. low-emission zones), and tax policies concerned with behavioural change (e.g. the carbon tax). Recent developments in the tax framework suggest that the convergence process has started, yet much progress could still be made. Moreover, on the assumption that policies with a significant influence on the adoption of innovations by corporate car fleets could also originate at local level, policy-makers could seek *greater coordination* between the various levels of government. Such coordination would at least provide an adequate framework for local experimentation (including appropriate experience feedback programmes and dissemination of good practices) and could further provide additional national support for local initiatives (as has been done for the deployment of the charging infrastructure). The *phasing* of public policies seems an important condition of effective design and implementation. While most significant 'enabling' policies for the diffusion of electric vehicles have now been enacted (e.g. on recharge standardisation, 'right-to-charging'), *more transparency is needed* on how long current 'initiating' policies will last (e.g. purchase incentives), and how strong the 'supporting' policies will be in the medium- to long-term (e.g. access privileges in urban areas). To that end, policy-makers need to adopt a *dynamic approach* to the demand for electric vehicles and to the barriers and disincentives to the development of such demand. Finally, public policy-makers should not underestimate the power of policies that can act on the long-term macroeconomic, cultural and macro-political environment (e.g. awareness raising and education campaigns, a generalised carbon tax). Such policies can be key to overcoming resistance to change in the dominant regime and bring new resilience into the mobility system, through the dissemination of new cultural, economic and political values.

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This research has shed light on one of the 'blind spots' of research on mobility. However, many aspects of our work could be investigated in greater depth and several new questions have arisen in the course of our investigation, which we think would provide interesting directions for further research.

Focusing on the quantitative analysis of corporate car fleets in France, further research would be needed to investigate the patterns of use of corporate vehicles nationwide (based on the national household transport and travel survey, ENTD), because significant differences might exist between the Paris region and other urban areas, as well as between urban areas and rural areas. The robustness of using ENTD results for such an analysis is yet to be tested. A more in-depth analysis would also be needed of the diversity of patterns of use among corporate vehicles in order to test the validity of our proposed typology and further assess the compatibility of corporate vehicle use patterns with the specific limitations of alternative-fuel vehicles (e.g. the limited battery range of electric vehicles). Furthermore, one particular 'blind spot' remains after corporate vehicles have been investigated through household travel surveys and light commercial vehicle surveys: the proportion of corporate passenger cars that are *not* held by private households would have to be surveyed independently. New research questions could also emerge regarding the readjustments between corporate mobility and private mobility that may result from the provision of a vehicle (or any other means of transport) by the employer.

Further analysis would also be needed to understand the process of renewal of the corporate vehicle fleet, including, but not limited to: *i)* the relation between the intensity of use and the period of use of the vehicle before resale on the second-hand market; *ii)* the relation between the mode of acquisition (outright purchase, long-term rental, or otherwise) and the intensity and duration of use; *iii)* the second life of corporate vehicles (proportion of vehicles resold in France in each vehicle market segment, proportion of vehicles resold to households or corporations, etc.). On all these issues, the advanced national statistical register of road motor vehicles (RSVERO) could provide valuable insights. In addition, we believe that access to detailed data from this national register would allow us to assess with greater accuracy the impacts of tax policy on the features (e.g. engine horsepower, emissions, fuel type) of corporate vehicles in France over recent decades. Lastly, the national register could provide further information on the distribution of corporate car fleets by size.

On a related topic, we consider that a qualitative analysis of fleet decision-making processes in *small enterprises* would produce very different findings from those of our exploratory survey of decision-making processes in large corporations. A new exploratory survey would be needed to shed light on the specific composition and use patterns of corporate fleets in smaller companies, the specific tools used for fleet monitoring and optimisation (in terms of use patterns and costs), as well as the specific perceptions of automotive innovations (e.g. electric vehicles). For both large and small corporations, more in-depth analysis would be needed to understand how decision-making power is distributed in the organisation, and who are the main influential agents, inside and outside the organisations, with regard to the promotion of innovations.

Finally, we believe that our work would provide useful background for international comparisons. In particular, comparisons with other European countries where corporate vehicles account for a large share of new light-duty vehicle sales (e.g. Germany, United Kingdom), might reveal differences in the political tactics employed in the promotion of innovations through corporate car fleets, and differences in the policy instruments used. Comparisons between the *pathways of change* in different countries or different cities could provide valuable insights into the effects of various combinations of policy instruments.

# Annex

# Annex A – The European legislative framework for action against local air pollution caused by motor vehicles

**European legislation on air quality**

Europe started building a legislative framework for air quality with a view to protecting human health and the environment in the 1980s, first with Directive 80/779/EEC on air quality limit values and guide values for sulphur dioxide and suspended particulates, then with Directive 82/884/EEC on a limit value for lead in the air, Directive 85/203/EEC on air quality standards for nitrogen dioxide, and Directive 92/72/EEC on air pollution by ozone (EEC, 1980, 1982, 1985a, and 1992d).

A first Air Quality Framework Directive on ambient air quality assessment and management was enacted in 1996: Directive 96/62/EC. Several daughter-directives were implemented subsequently: Directives 1999/30/EC (setting out limit values for sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter $PM_{10}$ and lead), 2000/69/EC (setting out limit values for benzene and carbon monoxide), 2002/3/EC (setting out limit values for ozone), and 2004/107/EC (setting out limit values for arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons). (EC, 1996a, 1999a, 2000, 2002a, and 2004e)

Following the publication of the 'Clean Air For Europe' (CAFE) programme in 2001 and of the 6th Environmental Action Programme (EAP) in 2002[1], Europe officially enacted a strategy on air pollution in 2005, which led to the introduction of new air quality standards for fine particulate matter ($PM_{2.5}$) and the recasting of existing legislation in a new framework directive: Directive 2008/50/EC (EC, 2001a, 2002b, 2005b, and 2008a).

Europe also enacted in 2001 the first National Emission Ceilings Directive (NECD): Directive 2001/81/EC (EC, 2001b). This directive set national ceilings for emissions of the following four pollutants: sulphur dioxide ($SO_2$), nitrogen oxides (NOx), volatile organic compounds (VOC), and ammonia ($NH_3$). It also enacted the following obligations for States: *i)* to draw up national programmes for the progressive reduction of $SO_2$, NOx, VOC and $NH_3$ emissions by October

[1] The 6th EAP called for the development of a thematic strategy on air pollution with the objective to attain '*levels of air quality that do not give rise to significant negative impacts on, and risks to human health and the environment*'. (EC, 2002b)

2002; and *ii)* to update and revise the programmes as necessary by October 2006 with the aim of ensuring compliance with the national ceilings by 2010 at the latest. The revision of the initial NECD was still under preparation at the time of writing. It should set emission ceilings to be respected by 2020 for the four abovementioned pollutants and for $PM_{2.5}$ emissions as well.

Pursuant to Directive 2001/81/EC, France adopted an initial national programme for the progressive reduction of $SO_2$, NOx, VOC and $NH_3$ emissions in 2003[2], and a revised programme in 2007[3]. Having failed to comply with the legally-binding limit values set by European legislation for air quality, France was therefore taken to the EU Court of Justice by the European Commission in 2011 for infringing EU laws on air quality (EC, 2010b and 2011a).

**European legislation on air pollution caused by motor vehicles**

Even before the development of a legislative framework addressing air quality as a generic concern, the emissions of local air pollutants from motor vehicles – starting with carbon monoxide and hydrocarbons – have been regulated at European level since the 1970s (EEC, 1970).

With the toxicity of diesel engine exhaust becoming public knowledge (WHO, 1989), the dominant position of the diesel engine on the large goods vehicle market segment[4] led Europe to legislate in order to combat atmospheric pollution caused by the emission of gaseous pollutants from diesel engines in *large goods vehicles* (LGVs)[5].

As illustrated in Table A.1, the limit values set by the European legislation on some of the local air pollutants emitted by diesel-powered LGVs – namely: nitrogen oxides, carbon monoxide, hydrocarbons, and particulate matter – have

[2] Available from: http://ec.europa.eu/environment/air/pdf/200181_progr_fr.pdf. [Accessed: 5th July 2014]

[3] Available from: http://ec.europa.eu/environment/air/pdf/nat_prog/france_fr.pdf. [Accessed: 5th July 2014]

[4] The diesel engine was invented in 1898 by Rudolf Diesel. Mainly used in marine applications in the early twentieth century, it was then increasingly used in large goods vehicles in Europe from the 1920s onwards. It had become the exclusive engine in railroad locomotives by the early 1950s, and in large goods vehicle by the 1960s. (WHO, 2013: p. 40)

[5] Vehicles qualifying for the categories $N_2$ and $N_3$ under EC regulation, i.e. vehicles designed for the carriage of goods and with an Authorised Gross Weight (AGW) exceeding 3.5 tonnes. (EC, 2007b)

been increasingly stringent. Since 1990, these regulatory limit values have been commonly known as the 'European emission standards', or 'Euro norm emissions': the standards set by the Council Directive of 1988 (EEC, 1988) are sometimes referred to as 'Euro 0'; subsequent standards are labelled from 'Euro I' to 'Euro VI'.

| Euro norm | Legislative reference | Implementation date (1) | Limit values for local air pollutants emitted by new diesel LGVs | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | NOx (g/kWh) | CO (g/kWh) | HC (g/kWh) | $NH_3$ (ppm) | PM (g/kWh) | PM (#/kWh) |
| (Euro 0) | EEC (1988) | 1 October 1990 | 14.4 | 11.2 | 2.4 | - | - | - |
| Euro I | EEC (1991b) | 1 October 1993 | 8 | 4.5 | 1.1 | - | 0.36 | - |
| Euro II | EEC (1991b) | 1 October 1996 | 7 | 4 | 1.1 | - | 0.15 | - |
| Euro III | EC (1999b) | 1 October 2001 | 5 | 2.1 | 0.66 | - | 0.13 | - |
| Euro IV | EC (1999b) | 1 October 2006 | 3.5 | 1.5 | 0.46 | - | 0.02 | - |
| Euro V | EC (1999b) | 1 October 2009 | 2 | 1.5 | 0.46 | - | 0.02 | - |
| Euro VI | EC (2009b, 2011b) | 31 December 2013 | 0.4 | 1.5 | 0.13 | 10 | 0.01 | $8.0*10^{11}$ |

*LGV: Large Goods Vehicle; NOx: Nitrogen Oxides; CO: Carbone monoxide; HC: HydroCarbons; PM: Particulate Matter; ppm: parts-per-million*
*Notes: 1. Implementation dates in this table refer to the dates when all type approvals (both newly-approved and previously-approved vehicle models) are submitted to the limit values upon first registration of the vehicle. The directives usually specify a second date (one year earlier) which applies only to new type approvals. 2. Limit values are given for tests under steady-state conditions.*

**Table A.1: European emission standards for large goods vehicles (MEDDE, 2014; EC, 2011b)**

In line with regulations on the LGV segment, the EU has set increasingly stringent limit values for the local air pollutants emitted by *light-duty vehicles*, including passenger cars and light commercial vehicles, diesel and petrol engines[6]. Table A.2 presents the legislative references for standards Euro 1 to Euro 6 applicable to light-duty vehicles, their respective dates of entry into force, and the development in the scope of the pollutants subject to emission limit values.

[6] The European regulations use the more accurate terms of 'compression-ignition engine' instead of 'diesel engine', and of 'positive-ignition engine' (which encompasses any engine powered by natural gas, liquid petroleum gas or ethanol) instead of 'petrol engine'.

| Euro norm | Legislative reference | Implementation date - all types (1) | Limit values for local air pollutants emitted by new diesel \| petrol light-duty vehicles (2) | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | CO (g/km) | HC + NOx (g/km) | NOx (g/km) | THC *(NMHC)* (g/km) | PM (g/km) | PN (units/km) |
| Euro 1 | | | | | | | | |
| Passenger cars | EEC (1991a, 1993a) | 31 December 1992 | 2.72 | 0.97 | - | - | 0.14 \| - | - |
| LCVs (3) (4) | EEC (1993a) | 1 October 1994 | | | | | | |
| Euro 2 | | | | | | | | |
| Passenger cars | EC (1994, 1996b) | 1 January 1997 | 1.0 \| 2.2 | 0.70 \| 0.50 | - | - | 0.08 \| - | - |
| LCVs (3) (4) | EC (1996b) | 1 October 1998 | | | | | | |
| Euro 3 | | | | | | | | |
| Passenger cars | EC (1998a) | 1 January 2001 | 0.64 \| 2.3 | 0.56 \| - | 0.5 \| 0.15 | - \| 0.2 *(-)* | 0.05 \| - | - |
| LCVs (3) (4) | | 1 January 2002 | | | | | | |
| Euro 4 | | | | | | | | |
| Passenger cars | EC (1998a, 2002c) | 1 January 2006 | 0.5 \| 1.0 | 0.30 \| - | 0.25 \| 0.08 | - \| 0.1 *(-)* | 0.025 \| - | - |
| LCVs (3) (4) | | 1 January 2007 | | | | | | |
| Euro 5 | | | | | | | | |
| Passenger cars | EC (2007a) | 1 January 2011 | 0.5 \| 1.0 | 0.23 \| - | 0.18 \| 0.06 | - \| 0.1 *( - \|0.068)* | 0.005 (5) | $6*10^{11}$ \| - |
| LCVs (3) (4) | | 1 January 2012 | | | | | | |
| Euro 6 | | | | | | | | |
| Passenger cars | EC (2007a, 2012a) | 1 September 2015 | 0.5 \| 1.0 | 0.17 \| - | 0.08 \| 0.06 | - \| 0.1 *( - \|0.068)* | 0.005 (5) | $6*10^{11}$ (5) |
| LCVs (3) (4) | | 1 September 2016 | | | | | | |

*NOx: Nitrogen Oxides; CO: Carbone monoxide; THC: Total HydroCarbons; NMHC: Non-Methane HydroCarbons; PM: Particulate Matter; PN: Particulate Number; LCV: Light Commercial Vehicle*

*Notes: 1. Implementation dates in this table refer to the dates when all type approvals (both newly-approved and previously-approved vehicle models) are submitted to the limit values upon first registration of the vehicle. The directives usually mention a second date (usually 12 to 16 months earlier) which applies only to new type approvals. 2. Light-duty vehicles include both passenger cars and light-commercial vehicles. 3. Limit values provided in this table are those for light commercial vehicles with a reference mass up to 1.250 tonnes (Euro 1-2) or 1.305 tonnes (Euro 3-6); higher limit values are otherwise set for heavier LCVs. 3. Implementation dates provided in this table are for LCVs with an authorised groww weight (maximum mass) in excess of 2.5 tonnes; implementation dates for LCVs with authorised gross weights up to 2.5 tonnes are similar to those for passenger cars. 4. Limit values for PM and PN shall only apply to those gasoline engines with direct injection.*

**Table A.2: European emission standards for light-duty vehicles (EC)**

# Annex B – The European legislative framework targeting $CO_2$ emissions from light-duty vehicles

As part of its action to mitigate climate change, the European Union has endeavoured to foster the reduction in $CO_2$ emissions by light-duty vehicles with a set of legislation targeting the *supply side* of the automotive market.

The EU first put the responsibility of the negotiation of voluntary agreements with the car manufacturing industry. Two agreements were signed, in 1998 and 1999, which initiated a downward trend in $CO_2$ emission levels of new *passenger cars*, although the targets set under the voluntary agreements were eventually not met (Michelin, 2011a). The EC adopted a new regulation in 2009 to enforce the $CO_2$ emission standards on the European market for new passenger cars. The fleet average to be achieved by all new passenger cars sold on the European market is 130 $gCO_2$/km by 2015 –with the target phased in from 2012 (75% in 2013, 80% in 2014, and 100% from 2015 onwards– and 95 $gCO_2$/km by 2021, phased in from 2020 (95% in 2020, 100% from 2021 onwards)[7].

Mandatory emission targets for new light commercial vehicles sold on the European market have been set at 175 $gCO_2$/km by 2017 –with the target phased in from 2014 (70% in 2014, 80% in 2016, and 100% from 2017 onwards)– and 147 $gCO_2$/km by 2020 (effective in 2020 with no phasing)[8].

[7] These targets compare with an average of almost 160 $gCO_2$/km in 2007 and 132 $gCO_2$/km in 2012 on the European market for new passenger car sales (Source: http://ec.europa.eu/clima/policies/transport/vehicles/index_en.htm). The relevant policy references are: Regulation (EC) 443/2009 (EC, 2009g) and Regulation (EU) 333/2014 (EC, 2014a).

[8] These targets compare with an average of 203 $gCO_2$/km in 2007 and 180 $gCO_2$/km in 2012 on the European market for new light commercial vehicle sales (Source: http://ec.europa.eu/clima/policies/transport/vehicles/index_en.htm). The main policy reference is: Regulation (EU) 510/2011 (EC, 2011f).

# Annex C – Research programmes on mobility management funded by the European Union

Mobility management aroused much interest from European public policy-makers from the 1990s. In order to help clarifying the concept of mobility management and to better understand the potential benefits of its implementation, the EU funded several research programmes, which we describe shortly hereafter[9]:

1) *MOSAIC (Mobility Management Applications in the Community, January 1996 – December 1998, 4th RTD Framework Programme)*: the programme had three main objectives: *i)* to improve understanding of mobility management by clarifying key concepts, organisational roles and user needs; *ii)* to demonstrate these concepts and evaluate their potential for wider implementation; and *iii)* to disseminate the findings and recommendations. The emphasis was on encouraging voluntary change in behaviour, through the use of specific centres and co-ordinators at a regional, local or site level (MOSAIC, 1999).
2) *MOMENTUM (Mobility Management for the Urban Environment, February 1996 – January 1999, 4th RTD Framework Programme)*: the programme aimed at identifying and defining good practice in mobility management, demonstrating and evaluating mobility management strategies and tools, and promoting the concept of mobility management across Europe. The emphasis was on encouraging the private sector to share responsibility in promoting sustainable mobility, and on a voluntary change in individual behaviour, through the use of mobility management centres/ co-ordinators at a regional, local or site level (MOMENTUM, 2000).
3) *MOST (Mobility Management Strategies for the Next Decades, January 2000 – December 2002, 5th RTD Framework Programme):* the programme aimed to further develop and spread the concept of mobility management in several ways: *i)* analysing existing mobility management strategies, especially their impacts; *ii)* developing innovative mobility management strategies; *iii)* initiating mobility management in regions of Europe where it was not so well established; *iv)* developing and applying

[9] Information on the EU-funded projects was retrieved from the Transport Research & Information Portal: http://www.transport-research.info/web/ [Accessed: 27th July 2014]

a European monitoring and evaluation strategy that enabled comparisons between all MOST research and demonstration sites in order to draw general conclusion; *v)* analysing framework conditions for mobility management, and, on this basis, formulating policy recommendations and implementation strategies and scenarios; *vi)* producing a framework and recommendations for the design and implementation of future mobility management applications; and *vii)* spreading the concept of mobility management through sophisticated dissemination, training and exploitation strategies, and by using synergies with the European ECOMM and EPOMM initiatives (MOST, 2003).

4) *MAX (Successful Travel Awareness Campaigns and Mobility Management Strategies, October 2006 – September 2009, 6th RTD Framework Programme)*: the programme set out to link mobility management and travel awareness in one comprehensive research project to exploit synergy effects in order to: *i)* improve the quality and impact of mobility management; *ii)* contribute to proving the validity and success of mobility management; *iii)* achieve the necessary standardisation (especially for evaluation); and *iv)* open new fields, especially in connection with planning (MAX, 2009).

The European Conference on Mobility Management (ECOMM) was initially founded as the final conference of the MOMENTUM research project, in 1997. It was then decided to develop it into an annual event, and to provide some continuity through the creation of a dedicated platform: the European Platform on Mobility Management (EPOMM), born in 1999 (first as a European project, and since 2003 as an international non-profit organisation with seat in Brussels), is a network of governments in European countries that are engaged in mobility management[10]. EPOMM has 11 members among European countries in 2014, and 15 additional partner countries as part of the EPOMM-Plus project[11].

[10] Source: http://www.epomm.eu/index.php?id=2632. [Accessed: 27th July 2014]

[11] EPOMM-PLUS was a three year project running from 2009 to 2012, supported by the EU in the frame of the Intelligent Energy - Europe (IEE) Programme.

# Annex D – Company-car fringe benefit taxation in France

The use of corporate vehicles for *private* purposes is considered a benefit in kind under French law, i.e. a non-wage benefit provided in addition to the employee's normal wage (also described as a fringe benefit, or 'perk').[12] It is therefore subject to personal income tax and to employer's and employee's social security contributions.

On the other hand, the use of corporate vehicles for *commuting* purposes alone can be construed as a natural extension of professional trips if the vehicle is otherwise necessary to the employee's activity. It is therefore not considered as a benefit in kind in its own right.

Various methods exist to assess – for tax purposes – the value of benefit in kinds relating to corporate vehicles, either on the basis of actual cost recovery or by applying flat rates to the vehicle purchase price. Table D.1 illustrates the variety of methods applicable to value company-vehicle fringe benefits, depending on whether the vehicle is purchased or leased, whether the vehicle is old or new, and whether the fuel expenses for private vehicle use are covered by the employer or not.

[12] *Arrêté du 10 décembre 2002 relatif à l'évaluation des avantages en nature en vue du calcul des cotisations de sécurité sociale*, Art.3. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000000417638

| Vehicle ownership and age | Benefit-in-kind valuation methods (on an annual basis) | | | |
|---|---|---|---|---|
| | Actual cost recovery $\left(\alpha = \frac{Private\ mileage}{Total\ mileage}\right)$ | | Flat rate assessment | |
| | **Private fuel covered** | **Private fuel not covered** | **Private fuel covered** | **Private fuel not covered** |
| Purchase (1) (3) | | | | |
| up to 5 years old | α<br>* [20% of purchase price<br>+ Insurance costs<br>+ Maintenance costs]<br>+ Private fuel costs | α<br>* [20% of purchase price<br>+ Insurance costs<br>+ Maintenance costs] | 12% of purchase price<br>*or*<br>9% of purchase price<br>+ Private fuel costs | 9% of purchase price |
| 5 years old or more | α<br>* [10% of purchase price<br>+ Insurance costs<br>+ Maintenance costs]<br>+ Private fuel costs | α<br>* [10% of purchase price<br>+ Insurance costs<br>+ Maintenance costs] | 9% of purchase price<br>*or*<br>6% of purchase price<br>+ Private fuel costs | 6% of purchase price |
| Long-term rental (2) (3) | α<br>* [Annual rental costs<br>+ Insurance costs<br>+ Maintenance costs]<br>+ Private fuel costs | α<br>* [Annual rental costs<br>+ Insurance costs<br>+ Maintenance costs] | 40%<br>* [Annual rental costs<br>+ Insurance costs<br>+ Maintenance costs]<br>*or*<br>30%<br>* [Annual rental costs<br>+ Insurance costs<br>+ Maintenance costs]<br>+ Private fuel costs | 30%<br>* [Annual rental costs<br>+ Insurance costs<br>+ Maintenance costs] |

*Notes: 1. The purchase price used for calculation should be the actual purchase price paid by the employer, inclusive of tax and possible discounts (the 20% rate applicable to the purchase price reflects the annual depreciation of the vehicle). 2. The valuation of the benefit in kind in case of a long-term rental should not in any case be higher than the valuation that would result from an outright purchase of the vehicle (on the basis of the actual purchase price paid the long-term rental company). 3. Maintenance costs should include maintenance expenses under business-as-usual conditions (e.g. tyre replacement, oil change), but should not include repair costs following an accident.*

**Table D.1: Valuation methods for vehicle fringe benefits (OVE, 2014c)**

# Annex E – The French legal framework for calculating the taxable horsepower of vehicles

### Taxable horsepower of passenger cars

Since 1998,[13] the taxable horsepower of passenger cars $P_f$ (measured in HP, or CV in French, for '*Cheval Vapeur*') has been calculated from the sum of a $CO_2$ emission figure (the standardised $CO_2$ emission value $C$ of the vehicle type over 45), and a power figure (the net power $P$[14] of the engine in kiloWatts over 40, to the power of 1.6). The calculation formula is:

$$P_f = \frac{C}{45} + \left(\frac{P}{40}\right)^{1.6}$$

On the other hand, a specific rule has been in force since 1998[15], whereby the taxable horsepower of electric vehicles is calculated from a single power figure (the maximum 30 minutes power $P_{30}$[16] of the electric drivetrain in kiloWatts over 40, to the power of 1.6), while $CO_2$ emissions are neglected:

$$P_f = \left(\frac{P_{30}}{40}\right)^{1.6}$$

On the basis of this formula, the taxable horsepower of virtually all electric passenger cars brought to the market has been 1 HP, e.g. the Renault Fluence

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[13] *Loi n°98-546 du 2 juillet 1998 portant diverses dispositions d'ordre économique et financier*, Art.62. Available from: http://www.legifrance.gouv.fr/jo_pdf.do?cidTexte=JORFTEXT000000572192.

[14] Regulation No.85 of the UNECE defines the 'net power' as '*the power obtained on a test bench at the end of the crankshaft […], and determined under reference atmospheric condition*'. Source: http://www.unece.org/fileadmin/DAM/trans/main/wp29/wp29regs/2013/R085r1e.pdf.

[15] *Circulaire n°98-58 du 3 juillet 1998 relative au mode de calcul de la puissance administrative des voitures particulières*. In: *Bulletin officiel du ministère chargé des transports*, 25 August 1998, n°98/15, p. 50-51.

[16] Regulation No.85 of the UNECE defines the 'maximum 30 minutes power' as '*the maximum net power of an electric drive train at DC voltage […], which a drive train can deliver over a period of 30 minutes as an average*'. Source: http://www.unece.org/fileadmin/DAM/trans/main/wp29/wp29regs/2013/R085r1e.pdf.

Z.E. ($P_{30}$ = 50 kW) or the Tesla Roadster ($P_{30}$ = 40 kW), which is much lower than the taxable horsepower of conventional vehicles in similar segments.

**Taxable horsepower of electric light commercial vehicles**

Between 1974 and 1998, the taxable horsepower of all electric vehicles – passenger cars and light commercial vehicles –relied on a single formula[17]:

$$P_f = 1 + 0{,}136 * P_{30}$$

This formula has remained valid for electric LCVs to this day. On the basis of this formula, the taxable horsepower of the Renault Kangoo Z.E. is 7 HP, which is higher than the taxable hosepower of conventional diesel vehicles in the Renault Kangoo family (5 HP)[18].

[17] *Circulaire du 31 décembre 1974 relative à l'évaluation de la puissance administrative des différentes catégories de véhicules*. Available from: http://www.legifrance.gouv.fr/jopdf/common/jo_pdf.jsp?numJO=0&dateJO=19750115&pageDebut=00639.

[18] Source: http://www.renault.fr/e-brochure/KQ2_2/pdf/fullPDF.pdf (p.17&35).

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# Abbreviations

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| **AAGR** | Average Annual Growth Rate |
| **ABS** | Anti-lock Braking System |
| **AC** | Alternating Current |
| **ACA** | *Automobile Club Association* |
| **ADEME** | *Agence de l'Environnement et de la Maîtrise de l'Energie* (French Environment and Energy Management Agency) |
| **ACEA** | *Association des Constructeurs Européens d'Automobiles* (European Automobile Manufacturers Association) |
| **AFSSET** | *Agence française de sécurité sanitaire de l'environnement et du travail* (French agency for environmental and occupational health and safety); later: ANSES |
| **AFV** | Alternative-Fuel Vehicle |
| **AGW** | Authorised Gross Weight (in French: PTAC for *Poids Total à Charge*) |
| **ANFA** | *Association Nationale pour la Formation Automobile (French National Association for Automotive Education*) |
| **ANSES** | *Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement du travail* (French agency for food, environmental and occupational health and safety) ; formerly : AFSSET |
| **AOT** | *Autorité Organisatrice des Transports* (urban regional transport authority) |
| **APE** | *Activité Principale Exercée* (Principal Activity Code of an institution) |
| **ARENE Île-de-France** | *Agence Régionale de l'Environnement et des Nouvelles Energies Île-de-France* (Paris regional agency for the |

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| | environment and new energies) |
| **ASRDLF** | *Association de Science Régionale de Langue Française* (French-Language Association of Regional Science) |
| **AVEM** | Association pour l'Avenir du Véhicule Electrique Méditerranéen (Association for the Future of the Electric Vehicle in the Mediterranean) |
| **B2B** | Business to business |
| **BEV** | Battery Electric Vehicle |
| **BNF** | *Bibliothèque Nationale de France* (French National Library) |
| **BRT** | Bus Rapid Transit |
| **CAE** | *Conseil d'Analyse Economique* (French Prime Minister Council for Economic Analysis |
| **CAFE** | 'Clean Air For Europe' programme |
| **CAS** | *Centre d'Analyse Stratégique* (French Strategic Analysis Center); formerly: CGP; later: CGSP |
| **CBA** | Cost Benefit Analysis |
| **CBD** | Central Business District |
| **CAAA** | Clea Air Act Amendments (US) |
| **CCFA** | *Comité des Constructeurs Français d'Automobiles* (French Automobile Manufacturers' Association) |
| **CCTN** | *Commission des Comptes des Transports de la Nation* (French Commission for National Transport Accounts) |
| **CEBR** | Centre for Economics and Business Research |
| **CERTU** | *Centre d'Etude et de Recherche sur les Transports et l'Urbanisme* (French National Centre for Studies on Road Networks, Transport, Urban Planning and Public Structures) |
| **CFE** | *Comité pour la Fiscalité Ecologique* (French National Committe for environmental tax policy) |
| **CGDD** | Commissariat Général au Développement Durable (French General Commission for Sustainable Development) |
| **CGP** | *Commissariat Général du Plan* (French National Policy Planning Commission); later: CAS, then CGSP |
| **CGSP** | *Commissariat Général à la Stratégie et à la Prospective* (French National Policy Planning Commission); formerly: CGP, then |

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| | CAS |
| **CHSCT** | *Comité d'Hygiène, de Sécurité et des Conditions de Travail* (workplace health and safety committee) |
| **CIQA** | *Comité Interministériel de la Qualité de l'Air* (French national committee for air quality) |
| **CITEPA** | *Centre Interprofessionnel Technique d'Etudes de la Pollution Atmosphérique* (French National Centre for Air Pollution Studies) |
| **CMM** | Company Mobility Management |
| **CMMS** | Computerised Maintenance Management System (in French: GMAO for *Gestion de Maintenance Assistée par Ordinateur*) |
| **CNAMTS** | *Caisse Nationale d'Assurance Maladie des Travailleurs Salariés* (French National Health Insurance Fund for Employees) |
| **CNG** | Compressed Natural Gas |
| **CNIL** | *Commission Nationale Informatique et Libertés* (French data protection authority) |
| **CNPA** | *Conseil National des Professions de l'Automobile* (French National Council of Automotive Business) |
| **CO** | Carbon monoxide |
| **$CO_2$** | Carbon dioxide |
| **CSR** | Corporate Social Responsibility (see also: RSE) |
| **CTP** | Corporate Travel Plan (see also: PDE, *Plan de Déplacements d'Entreprise*; WTP, Workplace Travel Plan |
| **CU** | Consumption Unit |
| **CV** | *Cheval vapeur* (Taxable horsepower rating; see also: HP) |
| **DC** | Direct Current |
| **DGDDI** | *Direction Générale des Douanes et Droits Indirects* (French Directorate General of Customs and Excise) |
| **DPF** | Diesel exhaust Particulate Filter |
| **DRIEA** | *Direction régionale et interdépartementale de l'Equipement et de l'Aménagement en Île-de-France* |
| **EAP** | Environmental Action Programme |
| **EBA** | Emergency Brake Assist |

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| **EC** | European Commission |
| **ECMT** | European Conference of Ministers of Transport |
| **EDGT** | *Enquête Déplacements Grand Territoire* (household travel survey for territories mixing dense areas and periurban, or even rural, areas) |
| **EDVM** | *Enquête Déplacements Villes Moyennes* (household travel survey for medium-sized cities) |
| **EEA** | European Environmental Agency |
| **EGCI** | European Green Cars Initiative |
| **EGT** | *Enquête Globale de Transport* (Paris region‘s household transport survey) |
| **EGVI** | European Green Vehicles Initiative |
| **EMD** | *Enquête Ménages Déplacements* ((local) household travel survey) |
| **ENTD** | *Enquête Nationale Transports et Déplacements* (French National Transport and Travel Survey) |
| **EP Act** | Energy Policy Act (US) |
| **EPA** | *Etablissement Public à caractère Administratif* (Public Administrative Establishment) |
| **EPIC** | *Etablissement Public à caractère Industriel et Commercial* (Public Industrial and Commercial Establishment) |
| **ERP** | Enterprise Resource Planning |
| **ESC** | Electronic Stability Control |
| **ETP** | European Technology Platform |
| **EUR** | Euro |
| **EV** | Electric Vehicle |
| **FFV** | Flexible Fuel Vehicle |
| **FHWA** | Federal Highway Administration (U.S. DOT) |
| **FRF** | French Francs (as of 2002, 1 EUR = 6.55957 FRF) |
| **FTA** | Federal Transit Administration (U.S. DOT) |
| **GC** | *Grande Couronne* (administrative subdivision of the Paris region including the 4 districts of the outer suburbs of Paris: Seine-et-Marne, Yvelines, Essone et Val d’Oise) |

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| **GDP** | Gross Domestic Product |
| **GMAO** | *Gestion de Maintenance Assistée par Ordinateur* (see also: CMMS) |
| **GPS** | Global Positioning System |
| **GWP** | Global Warming Potential |
| **HCB** | HexaChloroBenzene |
| **HEV** | Hybrid Electric Vehicle |
| **HFC** | Hydro-Fluoro Carbon |
| **HGV** | Heavy Goods Vehicle (UK) (see also: LGV, Large Goods Vehicle; PL, *Poids Lourd*) |
| **HH** | Household |
| **HP** | Taxable Horse Power rating (see also: CV, *Cheval Vapeur*) |
| **HR** | Human Resources |
| **IARC** | International Agency for Research on Cancer |
| **IA-HEV** | Implementing Agreement for co-operation on Hybrid and Electric Vehicle Technologies and Programmes (of the IEA) |
| **ICT** | Information and Communications Technology |
| **IDF** | *Île-de-France* (Paris region) |
| **IEA** | International Energy Agency |
| **IEE** | Intelligent Energy Europe |
| **INSEE** | *Institut National de la Statistique et des Etudes Economiques* (French National Institute of Statistics and Economic Studies) |
| **IPCC** | Intergovernmental Panel on Climate Change |
| **IPTS** | Institute for Prospective Technological Studies |
| **IT** | Information and Technology |
| **ITF** | International Transport Forum |
| **JRC** | European Commission's Joint Research Centre |
| **LAURE** | *Loi sur l'Air et l'Utilisation Rationnelle de l'Energie* (French air quality and rational energy use act) |
| **LCV** | Light Commercial Vehicle (in French: VUL, standing for *Véhicule Utilitaire Léger)* |
| **LEZ** | Low-Emission Zone (in French: ZAPA, standing for *Zone* |

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| | *d'Action Prioritaire pour l'Air*) |
| **LMP** | Lithium-Metal-Polymer battery technology |
| **LNG** | Liquefied Natural Gas |
| **LGV** | Large Goods Vehicle (see also: HGV, Heavy Goods Vehicle (UK); PL, *Poids Lourd*) |
| **LOTI** | *Loi d'Orientation des Transports Intérieurs* (French 1982 guidelines for internal transport organisation) |
| **LPG** | Liquefied Petroleum Gas |
| **LV** | Light Vehicle (in French: VL for *Véhicule Léger*) |
| **LULUCF** | Land Use, Land-Use Change and Forestry |
| **MEDDE** | *Ministère de l'Ecologie, du Développement Durable et de l'Energie* (French Ministry of Ecology, Sustainable Development and Energy); formerly MEDDDAT, MEEDDM then MEDDTL |
| **MEEDDAT** | *Ministère de l'Ecologie, de l'Energie, du Développement durable et de l'Aménagement du territoire* (French Ministry of Ecology, Energy, Sustainable Development and Land-Use Planning) later MEEDDM, then MEDDTL, then MEDDE |
| **MEEDDM** | *Ministère de l'Ecologie, de l'Energie, du Développement durable et de la Mer* (French Ministry of Ecology, Energy, Sustainable Development and the Sea); later MEDDTL, then MEDDE |
| **MEDDTL** | *Ministère de l'Ecologie, du Développement Durable, des Transports et du Logement* (French Ministry of Ecology, Sustainable Development, Transport and Housing); later MEDDE |
| **MLP** | Multi-Level Perspective |
| **MM** | Mobility Management |
| **MPV** | Multi-Purpose Vehicle |
| **MRP** | *Ministère du Redressement Productif* (French Ministry of Production Recovery) |
| **MRT** | Mass Rapid Transit |
| **MTEFD** | *Ministère du Travail, de l'Emploi, de la Formation professionnelle et du Dialogue social* (French Ministry of Labour, Employment, Professional Training, and Social |

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| | Dialogue) |
| **MVR** | Motor Vehicle Registration |
| **n.d.** | not documented |
| **NAF** | *Nomenclature d'activités française* (French classification of economic activities) |
| **NBER** | National Bureau of Economic Research |
| **NECD** | National Emission Ceilings Directive |
| **NGO** | Non-Governmental Organisation |
| **$NH_3$** | Ammonia |
| **NMVOC** | Non-Methan Volatile Organic Compound |
| **NOx** | Nitrogen Oxide |
| **OECD** | Organisation for Economic Co-operation and Development |
| **OEST** | *Observatoire Economique et Statistique des Transports* (French Observatory for Transport Economics and Statistics) |
| **OPSTE** | *Observatoire des Politiques et Stratégies de Transport en Europe* (French observatory for transport policies and strategies in Europe) |
| **OVE** | *Observatoire du Véhicule d'Entreprise* (French Corporate Vehicle Observatory) |
| **PAH** | Polycyclic Aromatic Hydrocarbon |
| **PC** | *Petite Couronne* (administrative subdivision of the Paris region including the 3 districts of the inner suburbs of Paris: Hauts-de-Seine, Seine-Saint-Denis, and Val-de-Marne) |
| **PCE** | Passenger Car Equivalent |
| **PDA** | *Plan de Déplacements d'Administration* |
| **PDE** | *Plan de Déplacements d'Entreprise* (see also : CTP or WTP) |
| **PDES** | *Plan de Déplacements d'Etablissement Scolaire* |
| **PDIE** | *Plan de Déplacements Inter-Entreprise* |
| **PDU** | *Plan de Déplacements Urbains* (urban mobility plan) |
| **PHEV** | Plug-in Hybrid Electric Vehicle |
| **PL** | *Poids Lourd* (Large Goods Vehicle (EU), Heavy Goods Vehicle (UK) or Heavy Truck (US)) |

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| **PM** | Particulate Matter |
| **POP** | Persistent Organic Pollutant |
| **PPA** | *Plan de Protection de l'Atmosphère* (Atmospheric Protection Plan) |
| **PPP** | Public-Private Partnership |
| **PREDIT** | *Programme de Recherche Et D'Innovation dans les Transports terrestres* (French national programme for land transport research) |
| **PTAC** | *Poids Total Autorisé en Charge* (Authorised Gross Weight) |
| **PTU** | *Périmètre de transport urbain* (urban transport zone for which a regional transport authority –see: AOT- is appointed to organise public transport) |
| **R&D** | Research and Development (see also: RTD) |
| **RF** | *République Française* (French Republic) |
| **RSE** | *Responsabilité Sociale d'Entreprise* |
| **RSVERO** | *Registre Statistique des Véhicule Routiers* (French national statistical register of road vehicles) |
| **RTD** | Research and Technological Development (see also: R&D) |
| **SD** | Sustainable Development |
| **SES** | *Service d'Economie et de Statistique* (Economics and Statistics Division of the French Ministry responsible for transport matters), later SESP |
| **SESP** | *Service Economie, Statistiques et Prospective* (Economics, Statistics and Prsopective Studies oft he French Ministry in responsable for transport matters), previously SES |
| **SME** | Small and Medium Enterprise |
| **SNCF** | *Société Nationale des Chemins de fer Français* (French National Railway Company) |
| **SNIT** | *Schéma National des Infrastructures de Transport* (French National Scheme for Transport Infrastructure) |
| **SNLVLD** | *Syndicat National des Loueurs Longue Durée* (French National Association of Long-Term Car Rental Agencies) |
| **$SO_2$** | Sulphur dioxide |
| **SOeS** | *Service de l'Observation et des Statistiques* (Observation and |

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| | Statistics Service of the Ministry for Sustainable Development) |
| **SRU** | *Loi relative à la Solidarité et au Renouvellement Urbains* (French urban solidarity and renewal act) |
| **STIF** | *Syndicat des Transports d'Île-de-France* (urban regional transport authority for the Paris region) |
| **SUV** | Sport Utility Vehicle |
| **TCO** | Total Costs of Ownership |
| **TCRP** | Transit Cooperative Research Program |
| **TCSP** | *Transport en Commun en Site Propre* (see: MRT) |
| **TDM** | Transport Demand Management |
| **TfL** | Transport for London |
| **TICPE** | *Taxe Intérieure de Consommation sur les Produits Energétiques* (French domestic consumption tax on energy products, known as TIPP up until 2011) |
| **TIPP** | *Taxe Intérieure de consommation sur les Produits Pétroliers* |
| **TMV** | *Transport de marchandises en ville* (urban freight transport) |
| **toe** | Tonne of oil equivalent |
| **TRB** | Transportation Research Board of the US National Academies |
| **TVA** | *Taxe sur la Valeur Ajoutée* (see: VAT) |
| **TVS** | *Taxe sur les Véhicules de tourisme de Société* (French annual tax on corporate passenger cars) |
| **UGAP** | *Union des Groupements d'Achats Publics* (French central public procurement office) |
| **UN** | United Nations |
| **UN** | United Nations Economic Commission for Europe |
| **UNECE** | United Nations Economic Commission for Europe |
| **UNFCCC** | United Nations Framework Convention on Climate Change |
| **UNWCED** | United Nations World Commission on Environment and Development |
| **Urssaf** | *Unions de recouvrement des cotisations de sécurité sociale et d'allocations familiales* (French Social Security and Family Allowance Contribution Collection Offices) |

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| **USA** | United States of America |
| **US DOT** | United States Department of Transportation |
| **US EPA** | United States Environmental Protection Agency |
| **UTAC-OTC** | *Union Technique de l'Automobile du motocycle et du Cycle - Organisme Technique Central* (French national technical inspection agency for motor vehicles and motorcycles) |
| **VAT** | Value-Added Tax |
| **VCM** | *Véhicule à Carburant Modulable* (see: FFV) |
| **VL** | *Véhicule Léger* (see also: LV, Light Vehicle) |
| **VOC** | Volatile Organic Compound |
| **VT** | *Versement Transport* |
| **VUL** | *Véhicule Utilitaire Léger* (see also: LCV, Light Commercial Vehicle) |
| **WHO** | World Health Organisation |
| **WTP** | Workplace Travel Plan (see also: CTP, Corporate Travel Plan; PDE, *Plan de Déplacements d'Entreprise*) |
| **WTTC** | World Travel & Tourism Council |