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Evolution of EV/PHEV market
Market trends and potential market for electric vans

Eleonora Morganti, Virginie Boutueil

Task 4.1	Evolution of EV/PHEV market

Final Report

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List of acronyms

AVERE	European Association for Battery, Hybrid and Fuel Cell Electric Vehicles
BEV	**Battery-Electric Vehicle**
CCFA	Comité des Constructeurs Français d'Automobiles
CIT	Commission for Integrated Transport
EC	European Commission
EEA	European Environmental Agency
GVM	Gross Vehicle Mass
INEA	Innovation & Networks Executive Agency
HGV	Heavy Goods Vehicles
LCV	**Light Commercial Vehicle**
OEM	Original Equipment Manufacturer
PEV	Plug-in Electric Vehicle (including BEV and PHEV)
PHEV	Plug-in Hybrid-Electric Vehicle
RCN	Rapid Charge Network
UNECE	United Nations Economic Commission for Europe
TEN-T	Trans European Network - Transport

1. Introduction

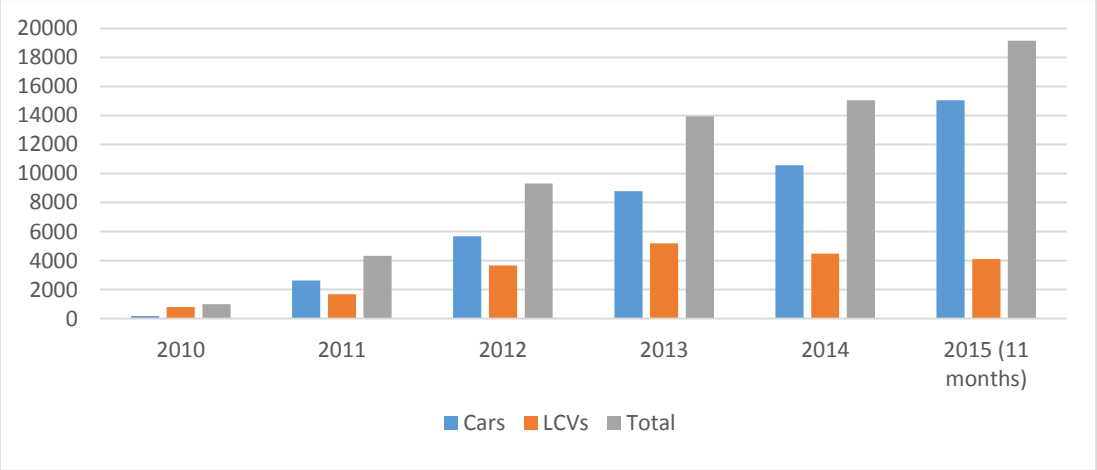
France has firmly established itself as a European leader in zero-emission automotive transportation. As of November 2015, more than 65,000 plug-in electric light-duty vehicles (including cars and light commercial vehicles up to 3.5t) have been registered in France and around 1,300 additional plug-in electric vehicles (PEVs) are sold in the country every month (AVERE France 2015a). Market penetration has been steadily over 1% of new monthly sales since September 2015. Significant growth trends have been registered in new PEV registrations in France over the last four years (Fig.1). In particular, passenger car registrations have increased by an average rate of 55% per year over the period 2011-2015. PEV sales have remained on an upward trend in spite of the low performance of the automotive sector, which has experienced a slow recovery since the economic crisis of 2008[1].

In 2015, electric light-duty vehicles are expected to reach 20,000 units (AVERE France 2015b). Over the first 11 months of 2015, new registrations of electric passenger cars rose by 50% compared to the same period in 2014, reaching 15,043 units as illustrated in Figure 1. Battery electric vehicles (BEVs) sales for 2015 alone have accounted for 30% of total BEV sales in France over the six-year period from 2010 to 2015.

The French market for electric passenger cars in 2015 is dominated by six models: Renault Zoe, Nissan Leaf, Smart Fortwo ED, Tesla Model S, Volkswagen eUp!, BMW i3, which altogether accounted for more than 90% of the PEV market in 2015 (Automobile Propre 2015). It is worth noting that the second position in PEV top sellers is held by the Bluecar by Bolloré (roughly 1,200 units) selected by car-sharing projects in different French cities (Automobile Propre 2015).

Electric vans made their first steps in the market five years ago. However, their market share is still low (0.3% in 2014). In 2011, a consortium of large corporate fleets, including La Poste, Electricité de France and Air France, purchased an initial order of 15,600 electric vans to promote low-carbon last-mile operations (La Poste 2011). From 2012 to 2013, electric van sales rose by 42%, to 5,200 units, but they declined by 13% in 2014 (CCFA 2015). A positive trend is registered in 2015: indeed, as of November new LCVs reached 4,106 units, up by 5.3% from 2014 levels.

Figure 1. Electric light-duty vehicle registrations in France



Source: own elaboration on ACEA 2015, AVERE 2014, 2015b

France is the largest market for new light commercial vehicles (LCVs) in Europe (370,000 in 2014), and one of the countries with the highest proportion of LCVs in new light-duty vehicle sales (around 15%-16%), just behind Norway and Portugal (Boutueil 2015). Annual sales of new LCVs in France

[1] For a detailed analysis of the current market trends, see the Corri-Door 4.1. Intermediate Report (March 2015) available at http://www.lvmt.fr/IMG/pdf/CorriDoor_4-1_Interim_Report_ParisTech.pdf

had increased by 40% between 1980 and 1990. However, as a result of successive economic downturns, the market has recently fluctuated around levels well under the record-high 461,462 units of 2007, with 372,074 units sold in 2014 (CCFA 2015).

Currently the large majority of vans in France are powered by diesel. Over the last decade, diesel engines have become increasingly popular among van operators, rising from 73% of the existing fleet in 2000 to 93% in 2013 (Boutueil 2015). Expanded use of diesel vehicles is motivated by the greater fuel efficiency offered by diesel fuel and by supporting tax policies (CCFA 2015).

Diesel engines are also associated with a number of environmental and health-related impacts (EEA 2015). In particular, old diesel vehicles have been identified as a significant contributor to air pollution in urban areas. The French government and the European Commission have thus committed to phase out high polluting diesel vehicles while providing the infrastructure and incentives required to support the uptake of low-emission alternatives, such as electric vehicles.

At the European level, in 2014 just over 0.5% of the newly-registered vans in Europe (1.4 million) were equipped with plug-in electric technology (EEA 2015). However, according to the Original Equipment Manufacturers (OEMs) representatives interviewed, this new market has near-term high potential sales in the European countries. This includes electric LCVs and also new format vehicles for urban freight transport such as electrically-assisted cargo tricycles, minivans, etc. As an evidence of the manufacturers' interest on electric van segment, new models have recently been released by Renault, Nissan, Peugeot, Citroën and Mercedes, and additional options exist for plug-in hybrid electric vehicles.

As of 2015, there remain economic, technical, and social obstacles to the widespread uptake of electric vehicles. Some of these obstacles relate to high upfront costs, uncertain resale values, limited driving ranges, and long charging times (Frevue 2015). Other obstacles stem from the fact that users are still unfamiliar with electric vehicles, are uncertain about their overall performance as well as their costs and benefits, and have diverse transport needs which the current electric-engine vehicles might only partially fulfil (NRC 2013). More generally, the transition towards electro-mobility is a complex process which can be influenced by a wide variety of factors, such as the enforcement of the European community target of average emissions of 120 g CO_2/km from new LCVs by 2012 (Regulation EC, No 443/2009), the downturn in oil prices occurred in the second half of 2014, and the Volkswagen's emission-fraud reported by the American Environmental Protection Agency in September 2015.

Even if professional van users travel average daily distances below the typical electric van battery range (80 km), limited range and long charging times are major concerns of the potential buyers of PEVs today. A wider, more intensive coverage of charging infrastructure is thus needed on urban, ex-urban and highway roads in order to overcome range anxiety. What are the obstacles for professional users and, in particular for transport operators? How can fast-charging stations improve the use of electric vans at regional and local level?

This study is organized as follows. The next section presents the methodology. The third section describes the last-mile patterns for professional users of LCVs in France. The fourth section describes financial and non-financial measures to foster electro-mobility in France. The fifth section presents feedbacks from electric vans pilot projects implemented by transport operators. The seventh focuses on barriers to the adoption of electric vans revealed by the interviews. Final sections present conclusion and recommendations.

2. Methodology

Our investigation combined a literature review with survey activities. Our fieldwork, which started in November 2014 and was completed on October 2015, comprised the following: (i) desktop research

and analysis of publicly available information relevant to the objective of the study, and (ii) twenty seven interviews with professional van users (freight transport operators) and electro-mobility stakeholders.

The desktop research set out to collect insights into the current state of the PEV market from various stakeholders, including European and French government agencies, industry associations, consumers' community. It included an analysis of data from scientific literature and grey literature sources (e.g. official documents, reports by research institutions, consulting studies), and articles from the trade press.

Individual face-to-face (21) and phone (6) interviews were conducted based on four different interview guides according to the stakeholder category, as illustrated in Table 1: transport operators; automotive OEMs – mostly partners of the Corri-Door project –; policymakers and industry associations; and finally, energy suppliers.

Professional vans in France are widely used by a large range of heterogeneous business sectors, including infrastructure maintenance (e.g. gas and water maintenance), service providers (e.g. plumbers and builders) and goods collection and delivery (e.g. retail store deliveries and express couriers), as described by the "Enquête Véhicules Utilitaires Legers" (2011). Within the professional vans market, our analysis focuses on the goods collection and delivery sector, characterized by some early adopters of electric vans for last-mile operations in European cities, such as postal operators and express deliveries companies. Respondents were thus selected among transport operators with different activities: parcel services and home deliveries (5), food and perishable goods deliveries (2), retail store deliveries (3).

Part of the investigation was carried out in the United Kingdom (UK), where vans are an important and growing part of road traffic, as they are in France (Browne et al. 2014). In both countries there are policy objectives to reduce the CO_2 emissions from transport and grant schemes for low-carbon emission vehicles have been adopted in the last five years. These initiatives contributed to boost the sales of PEVs, which reached 15,360 units in the UK and 12,490 units in France in 2014 (Morganti et al. 2015). Moreover the deployment of fast-charging stations has been promoted respectively by Corri-Door in France and by the project Rapid Charge Network (RCN) in the UK, both co-financed by INEA.

Table 1. Number of interviews by stakeholder category and by country

Respondents	**France**	**UK**
Transport operators	5	5
Policymakers and industry associations	2	6
OEMs	5	2
Energy suppliers	1	1
TOTAL	13	14

A selection of common topics was discussed through semi-structured questions:

- What are the key factors driving growth in the electric light-duty vehicles market in Europe and especially in France? What are the specific drivers for the LCV segment?
- What are the European, national and regional policies that affect electric LCV sales in France?
- What are the existing advantages and obstacles to the adoption of electric LCVs?
- How will the uptake of electric LCVs be affected by fast-charging infrastructure deployment?

3. Current trends in last-mile operations

Vans are an ever-more important element of freight transport, both for goods delivery and for the provision of a wide range of critical services, such as service providers, goods deliveries, infrastructure maintenance (including utility firms), construction, and the public sector (Browne et al. 2010). In this context, we observe that two major trends have profoundly changed the European last-mile system over the last three decades:

i. The downsizing of freight vehicles influenced by size-related vehicle restrictions (municipal level);
ii. The dieselisation of vans up to 3.5 tons, as a result of taxation and incentives based on fuel types (national level) (Browne et al. 2014).

The resulting impact on last-mile operations is greatest in European urban areas where, in order to reduce emissions from road freight traffic, policymakers have tightened access restrictions for heavy-duty trucks and/or diesel vehicles. Implemented in 2003, the London Lorry Control Scheme, also known as the 'lorry ban', was one of the first programs of this kind. More recently, in January 2015, the City of Paris announced the creation of a Low-Emission Zone ("Zone à basse émission") in the inner city, targeting at first old diesel trucks. According to this initiative, the City of Paris will gradually ban old diesel vehicles beginning June 2016 for Euro 2 norm vehicles, with a goal to allow only Euro 5 and 6 vehicles by 2020 (Mairie de Paris 2015).

Despite the great diversity characterizing operations of services and freight deliveries, some basic logistics and organizational patterns (delivery frequency, stops per roundtrip, etc.) and technological features (body and engine types of vehicles) are provided to describe the complexity of the last-mile system and, therefore, to assess potential suitability of electric commercial vehicles for daily operations[2].

There are over 3 million registered vans used by professional users in France, representing approximately 8% of all light-duty vehicles (CCFA 2015). Up until the mid-1990s the majority of vans in France were powered by petrol. Later on, national policy favouring diesel over petrol – through taxing gasoline more than diesel and through subsidizing the purchase of new diesel vehicles – led to a LCV segment currently dominated by diesel vans, which represent up to 97% of the fleet.

The average age of professional LCVs in France is 6.6 years (SOeS 2012). Some professional users have long van replacement cycles, as reflected by the fact that 49% professional vans were older than 5 years in 2011. For urban freight operators, the renewal can be slower than for other sectors, given that the last-mile system involves numerous competing small operators that cut costs as much as possible (Dablanc 2009). Nevertheless the sector is heterogeneous and there are some very large fleets, such as express delivery companies, which are capable of investing in faster renewal.

On a daily basis, professional LCVs are used approximately 2 hours and 45 minutes, including loading and unloading operations, they are operated mainly in urban areas, for an average travelled distance of 80km daily. More precisely, 90% of professional LCVs cover less than 150km daily and 62% of them cover less than 50km (SOeS 2014). On average, professional LCVs cover 18,200 km per year: 6,800 km in urban areas; 7,700 km in ex-urban areas and 3,300km on highways. Professional LCVs used for goods delivery travel with an average load of 325 kg. One third of delivery trips carry less than 100kg and only 7% carry goods for one ton or more. The average distance travelled when loaded is 54km.

There are many LCV body types under the N1 classification[3]. Four weight and size categories are identified: city vans, passenger-car derivatives[4] and small vans, medium vans and large vans. As

[2] For an in-depth analysis of corporate fleets management strategies and large-scale uptake of electric vehicle, see Boutueil 2015.
[3] Vehicles used for the carriage of goods and having a maximum mass not exceeding 3.5 tons, according to the

illustrated in Table 2, almost half of the fleet circulating in France are passenger-car derivatives and small vans (1.6 tons to 2.5 tons), having a typical load space between 2 and 4 m^3. The second largest category is the medium van category, with a typical load space between 4 and 8 m^3. It accounts for one fourth of the total fleet and it increased by almost 10 percentage points from 2000 to 2010. We observe that there has been a gradual shift away from lighter, smaller vans towards heavier, larger vans since 2000.

Table 2. Distribution of LCVs across GVM* categories

Type	GVM category	2000	2005	2010
City van	< 1.5 t	31.6%	13.6%	10.2%
Small van	1.6< 2.5 t	37.9%	50.3%	47.9%
Medium van	2.6< 3.4 t	15.5%	19.6%	24.4%
Large van	3.5 t	14.9%	16.3%	17.5%
		100%	100%	100%

*Gross Vehicle Mass
Source: Boutueil 2015

4. Measures to foster the adoption of electric vans

Transport operators state the relevance of reliable, timely services at a competitive price as fundamental assets for their business Therefore to make decisions about alternative-fuel vans, the van buyer needs long-term confidence in the pattern of future costs, which (partly) depends on government taxation of different fuels and possible incentives for technology innovation.

Over the last five years, the French government has raised its commitment on enhancing the adoption of clean vehicles and, under the French environmental roadmap defined by the Energy and Sustainable Development Ministry, up to 750 million of Euros can be assigned to initiatives aiming at the development of EVs. Indeed, France has set the ambitious target of having 2 million plug-in electric vehicles on the roads by 2020 (Borloo and Estrosi 2010) and about 7 million private and public charging stations by 2030 (MEDDE 2015).

As part of this roadmap, an incentive (6,300 EUR bonus) which directly reduces the purchase price of an electric light-duty vehicle have been offered to private customers and businesses since 2008[5]. Since May 2015, the government has granted an additional bonus ("prime à la conversion"): when trading-in a diesel car registered before January 1st 2001, BEVs customers receive 3,700 EUR on top of the existing grant (reaching 10,000 EUR discount). It is worth noting that only cars are eligible for the additional incentive, whereas LCVs are not included. The differentiation on incentives among the two segments of light-duty vehicles can influence professional user purchase preferences. As of November 2015, six months after the new grant scheme adoption, it is not possible to assess contingent effects of this measure.

National, regional and city-level measures influencing professional users' preferences have been identified in Table 3. Financial and non-financial incentives adopted by the French government, by the Ile-de-France region and by the City of Paris are presented.

United Nations Economic Commission for Europe (UNECE) definition.

[4] Passenger-car derivatives result from the conversion of passenger-car body types into commercial vehicles (after removal of any rear passenger seat).

[5] LOI n°2007-1824 du 25 décembre 2007 Art. 63.

Transport operators state that purchase incentives (e.g. bonus and "prime à la conversion") are crucial incentives in this transition phase from full dieselization to an engine mix including electro-mobility. Moreover, some of the transport operators suggest that use incentives, e.g. through tax rebates on maintenance or fuel, can also have a strong impact on vehicle-purchase decisions. Initiatives adopted at regional and city level, including purchase and use incentives, non-financial incentives and traffic restrictions such as the old diesel vehicles bans are included among the criteria of fleet renewal by the managers of transport companies.

Table 3. Incentives to foster the adoption of electric vans by professional users

Type of incentive	Specific measure	France	Ile-de-France	Paris
Purchase incentives (financial)	Rebate	✓		✓
	Exemption from registration taxes		✓	
	TVA			
Use incentives (financial)	Exemption from motor fuel taxes	✓		
	Reduced roadway tolls or taxes			
	Exemption from company car tax	Tax not applicable to LCVs		
	Free charging on public stations			✓
	Free on-street parking			✓
Infrastructure upgrade incentives	Installing publicly accessible charging stations	✓ (QC)		
	Installing in-house stations			✓
Other non-financial incentives	Access to restricted lanes			
	Wider time windows for delivery			✓
	Access to city centre during high pollution days			✓
	High pollutant vehicles ban			✓

5. Feedbacks from electric vans trials

Nine transport operators we interviewed had partially or totally renewed their fleet with electric vehicles and they had implemented pilot initiatives related to the last-mile operations. As a general comment, these operators give positive feedbacks on their experience, although most trials were small-scale projects. The 6 largest operators in our sample, with average fleets of 2,000 vehicles, adopted electric vans (1 to 10% of the fleet) for short delivery routes, not exceeding 80km. In economic terms, the viability of the trial strongly depends on:

- Purchasing (or leasing) an electric van eligible for national grant. Not all electric vehicles are eligible for grants, or it takes time for the manufacturer to include prototypes in grant scheme lists;
- Selecting the electric van model and combining the new vehicle with the most suitable delivery route, i.e. electric city-vans in charge for deliveries in dense areas within the inner centre. An electric van can have a reduced load capacity / payload compared to its thermic counterpart. This results in a lower amount of parcels delivered and thus a higher cost per unit.

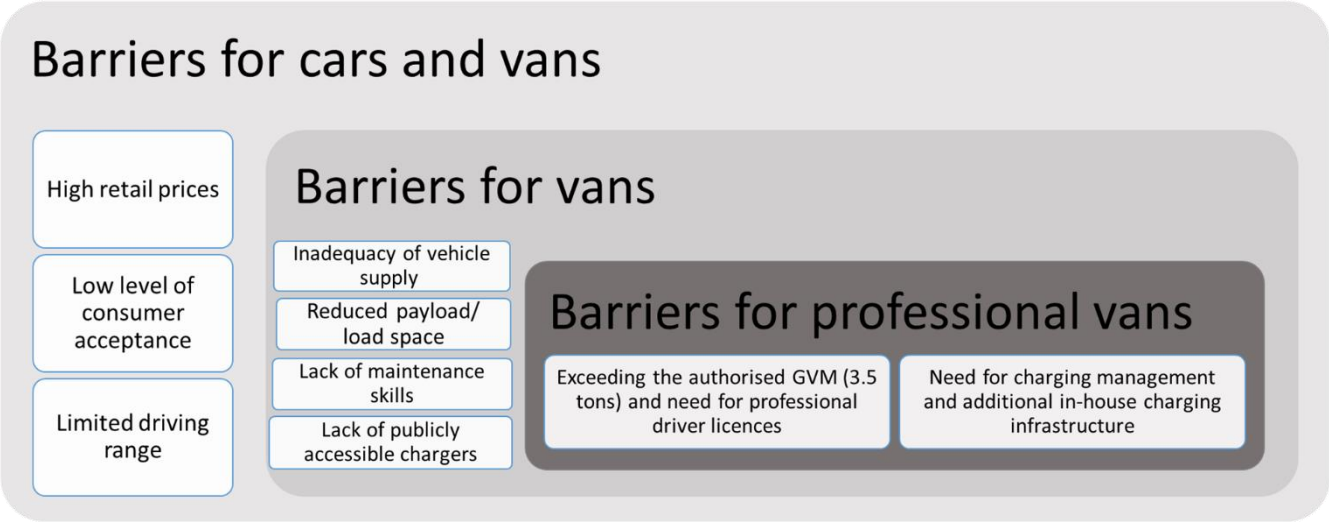
- Being willing to (partially) re-design delivery operations and re-think logistics platform localization. The most successful initiatives include the adoption of micro-platforms near the high-density delivery areas (within a 20-30 kilometres range) to reduce the distance travelled by electric vans.

6. Barriers to the adoption of electric vans by transport operators and the role of fast-charging stations

The demand for electric LCVs may be influenced in the near-term future by a wide range of variables, such as, for example, the relative price increases/decreases of new vehicles, the relative prices of oil and electricity, new developments in battery prices and range, changes in customer acceptance, or yet changes in the supply of recharge infrastructure. In the following paragraphs we present specific barriers to the adoption of electric vans by transport operators.

Our investigation reveals that the upfront retail price of electric vans (a financial barrier) and the low consumer familiarity with the new technology (a non-cost barrier) are among the obstacles frequently mentioned by respondents (8). Numerous respondents (9) also refer to the limited driving battery (a physical/operational barrier) as a major constraint. These barriers are confirmed by various studies in fleet management strategies (Enclose 2014, Frevue 2015) and by investigations on the preferences of private customers' preferences. They are summed up in Figure 2.

Figure 2. Barriers to the adoption of electric vehicles



The interviews revealed the following four specific concerns of transport operators:

1. Inadequacy of vehicle supply

Whereas the market offered very few battery-electric LCVs only four years ago, the largest automotive OEMs now market plug-in electric version of existing models such as Mercedes Vito E-Cell, Peugeot e-Partner, Citroën e-Berlingo, Nissan e-NV200, and Renault Kangoo Z.E. Although the supply has improved, the cycle of new van design and replacement by industry is a long one (Commission for Integrated Transport 2010) and electric medium vans are not yet widely available. This category of vans, having a load space up to 8 m^3 and payload between 2.6 and 3.4 tons, represents more than 24% of the existing van fleet in France (see Section 4). Seven respondents mentioned vehicle availability and the lack of medium vans as a disincentive to transfer to electro-mobility.

Box 1. Interoperability
A common key theme recurring across respondents relates to the charging infrastructure, which is at an early stage in development and dependent on a number of relatively local initiatives and is perceived to lack reliability. Interoperability among the different charging networks, at local, national and international scales, is thus requested by PEV potential users. Respondents are concerned not only the charging modes and plugs, but also procedures of identification and billing systems for electric vehicle drivers. In practice, the charging infrastructure implemented in Europe have to comply with: (a) two charging systems and plug designs, (b) EU protocols that allow to identify the registered driver and to provide the charging service. Although in many countries it is still possible to charge the vehicle for free at various publicly accessible stations in the near-term future EV users will most likely be billed for the charging time and/or energy use. *Ad hoc* payment systems (using SMS or contactless card or payback payments) and special plans for private and professional users will foster the adoption of electric vehicles.

2. Reduced payload/load space

Batteries for electric vans are heavier and bigger than batteries in tanks in diesel vehicles. Consequently, an electric van is typically one to two hundred kilos heavier than its diesel equivalent and also its load space is reduced for some models (Enclose 2014). In order to avoid exceeding authorised gross vehicle mass (GMV), transport operators need to reduce the total amount of goods transported and eventually re-organise deliveries and journeys. This discourages potential electric vans users unless weight dispensations, to allow operators to go above 3.5 tonnes with the same licensing permissions, are granted.

Three respondents were aware of existing electric vans weight dispensations at local/national level, where public authorities decided to exempt certain road transport operators from the requirements of the regulation due to the nature of the goods carried or the short distances involved. Although, according to the European Commission, no exception can be given for the total weight of electric vehicle[6].

3. Lack of maintenance skills

Among the barriers identified by the respondents, there are challenges related to the adoption of new technology and the limited availability of services such as product support and maintenance. Even if maintenance services offered by OEMs are improving, in the case of small manufacturers the national coverage of specific services is sometimes perceived as weak.

4. Lack of publicly accessible chargers

Charging infrastructure is expanding fast but coverage is not yet homogeneous throughout the territory. Various initiatives are developed at local and regional level, thus areas are covered by different service levels in terms of number of available stations, type of charging stations (standard, semi-accelerated or fast) and type of plug (e.g. Combo 2, CHAdeMo, Type 2, etc.). Respondents are in general aware of increasing availability of publicly accessible chargers and this contributes to reduce *range anxiety* concerns and to provide confidence to buyers. Although five operators were concerned by the opportunity to find for an available socket when needed and the eventual risk wasting time

[6] See the Parliamentary question and answer by the Commission, 31 October 2014 http://www.europarl.europa.eu/sides/getAllAnswers.do?reference=E-2014-007534&language=EN

waiting at the charging station. Defined as *queue anxiety*, this disquietude raises with the popularity of EVs among private and business users. It includes the loss of time while in line, but also the risk that the previous EV driver stays plugged in longer than needed.

Transport operators and professional van users are particularly interested on real-time information about access restrictions, traffic congestion, road works and other eventual events which impact their delivery routes, in order to plan and eventually re-schedule their journey accordingly. Being informed about available sockets and being able to book the charging time are thus mayor concern for this category of users.

Box 2. Fast-charging stations and *queue anxiety*
Fast-charging stations, such as Corri-Door stations, may benefit both long distance drivers, and drivers with more local mobility patterns. At a regional level, particularly relevant for professional LCV users and transport operators, the fast-charging stations are located along the main motorways and the most relevant roads to access metropolitan areas. According to the players interviewed in France and the UK, these fast-charging points can help to reduce range anxiety on daily transport operations from the warehouse to the urban areas. Moreover they consider this network as an opportunity to extend their catchment area on a daily basis (e.g. by charging the delivery vehicle during the driver's lunch break). However, with the increasing sales of electric vehicles, new concerns emerge about queue anxiety, i.e. the risk of wasting time waiting for an available socket. For professional users, this could be a crucial variable in the adoption of electric vans. It is thus essential that fast-charging providers, OEMs and transport planners recognise the developments in service-related activities and take appropriate actions focused on professional users. Fast-charging service for professional users could include advance booking for charging, dedicated sockets, or yet customized subscription fees, also taking into account the possibility of longer charging times for bigger vans.

Moreover an additional concern of professional van users and fleet managers deal with driving licenses restrictions and the lack of professional drivers for vehicles exceeding the authorized GMV of 3.5 tons (as a result of the excess weight of batteries). Vans weighing more than 3.5 tons are subject to the same legal scrutiny as heavy goods vehicles (HGVs), and they are thus classified under N2 or N3 categories. Drivers of electric vans are likely requested to have at least a driving license for light trucks (category C1). Directive 2002/15 adopted by the European Commission applies to these categories and it defines specific requirements related to working time in order to preserve health and safety of drivers. Five respondents stated the lack of professional drivers and the risk of increased costs in case of new recruitments.

Finally, six respondents referred to the need for additional charging infrastructure to be installed at the warehouses or in other facilities. Depot based charging is a common solution adopted by fleets interested in transferring to electric vehicles. Indeed, being equipped with charging stations improves autonomy on charging management but it also means that potential users also have to take on the costs of charging equipment, depots have to be large enough to accommodate such stations and fleet managers developed skills on planning the charging times.

7. Conclusions and recommendations

The demand for electric vans may be influenced in the near-term future by a wide range of variables, such as: the charging infrastructure deployment, the relative price increases/decreases of new vehicles, the relative prices of oil and electricity, new developments in battery prices and range and changes in customer acceptance.

An additional driver lies in the adoption of new regulations and restrictions on conventional vehicles in some major European cities. Examples of initiatives to reduce air pollution are the progressive ban on old diesel vehicles enacted by the City of Paris in July 2015 and the project for an Ultra-Low Emission Zone in London, which will come into force in 2020. In such contexts where public policies promote low-carbon alternatives through both financial and non-financial incentives and where adequate charging infrastructure is deployed, electric LCVs are likely to become a highly relevant option for transport operators.

Using a variety of primary sources from France and the UK, this study has identified the main barriers on the electric LCVs market and the impact of fast-charging stations on the potential uptake of this technology. Among the transport operators interviewed, nine companies had partially or totally renewed their fleets with electric vans or small trucks. A recurring theme throughout these interviews has been the opportunity/need to re-organise the last-mile delivery operations according to the performance of electric LCVs. In the most successful cases (two non-perishable goods deliveries companies), the operator had combined the adoption of electric vans with a new logistics platform, located close to the delivery area. The micro-platform, equipped with charging stations, represents a functional element of the renewed last-mile delivery system. For these operators, publicly accessible fast-charging stations increase the reliability of their delivery service.

Potential customers for electric vans include transport operators traveling between industrial and warehousing sites and urban centres. Improving the supply of fast-charging stations could impact freight transport operations at urban, metropolitan and regional levels. Fast-charging infrastructure helps to reduce the *range anxiety*, although additional commercial services should be implemented to avoid *queue anxiety* issues for professional users.

Our findings give rise to a set of recommendations that consist of actions that need to be taken by government, OEMs, fast-charging providers and transport operators. In some cases joint action between these parties is required.

✓ It is necessary for government to provide clear information on current and future taxation and grant schemes development for electric vans. Initiatives at regional and city level also influence professional van users' preferences and a joint plan should be drafted.

✓ Given the importance of the van (LCV) segment in the light-duty vehicle market, it is essential that OEMs improve the supply of models, including medium vans with load space up to 8 m^3.

✓It is essential that fast-charging providers include within their offer special services for professional users, e.g. advance booking for charging, dedicated sockets, customized subscription fees, also taking into account the possibility of longer charging times for bigger vans.

References

ACEA (European Automobile Manufacturer's Association) (2015), New electric vehicle registration in the European Union http://www.acea.be/uploads/press_releases_files/ACEA_Electric_Vehicle_registrations_Q4_14-13.pdf [Accessed: 6th February 2015]

Automobile Propre (2015), Chiffres de vente & immatriculations de voitures électriques en France http://www.automobile-propre.com/dossiers/voitures-electriques/chiffres-vente-immatriculations-france/ [Accessed:16th November 2015]

AVERE France (2014), Les ventes de véhicules électriques en hausse en 2013, 9th May 2014 http://www.avere-france.org/Site/Article/?article_id=5842&from_espace_adherent=0 [Accessed: 26th November 2015]

AVERE France (2015a), Immatriculations de véhicules électriques en Europe, 30th January 2015 http://www.avere-france.org/Site/Article/?article_id=5985 [Accessed: 26th November 2015]

AVERE France (2015b), Nouvelle poussée de la voiture électrique, 2nd November 2015 http://www.avere-france.org/Site/Article/?article_id=6345&from_espace_adherent=0

Borloo, J.L., Estrosi, C. (2010). Grenelle Environnement http://www.developpement durable.gouv.fr/IMG/pdf/Dossier_de_presse-final-2.pdf [Accessed: 23th October 2015]

Boutueil, V. (2015), Towards a sustainable mobility system: Leveraging corporate car fleets to foster innovation, PhD dissertation, Université Paris Est, France

Browne, M., Allen, J., Nemoto, T., Visser, J. (2010), Light Goods Vehicles in Urban Areas, Procedia—Social and Behavioral Sciences, 2, pp. 5911–5919

Browne M., Rizet, C., Allen, J. (2014), A Comparative Assessment of the Light Goods Vehicle Fleet and the Scope to Reduce its CO2 Emissions in the UK and France Procedia - Social and Behavioral Sciences 125. pp. 334 – 344

CCFA (Comité des Constructeurs Français d'Automobiles) (2013), L'industrie automobile française – Analyses et statistiques 2012 http://www.ccfa.fr/IMG/pdf/ccfa_ra12_bat-2.pdf [Accessed: 8th September 2015]

CCFA (Comité des Constructeurs Français d'Automobiles) (2014), L'industrie automobile française – Analyses et statistiques 2013 http://www.ccfa.fr/IMG/pdf/ccfa_ra13_bat-2.pdf [Accessed: 8th September 2015]

CCFA (Comité des Constructeurs Français d'Automobiles) (2014), L'industrie automobile française – Analyses et statistiques 2014 http://www.ccfa.fr/IMG/pdf/ccfa_ra14_bat-2.pdf [Accessed: 8th September 2015]

CIT (Commission for Integrated Transport) (2010), Vans and the Economy Report https://z.mines-telecom.fr/service/home/~/?auth=co&loc=fr&id=13382&part=2 London: CfIT [Accessed: 14th October 2015]

Dablanc L. (2009), Freight Transport, A Key for the New Urban Economy, Report for the World Bank as part of the initiative Freight Transport for Development: a Policy Toolkit, 2009, p 52

Dablanc L., Rakotonarivo D. (2010), The impacts of logistics sprawl: How does the location of parcel transport terminals affect the energy efficiency of goods' movements in Paris and what can we do about it? Procedia - Social and Behavioral Sciences Volume 2, Issue 3, 2010, Pages 6087–6096

EC (European Commission) (2009), Regulation (EC) No 443/2009 setting emission performance standards for new passenger cars. http://eurlex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0063:008:en:PDF. [Accessed: 25th November 2014]

European Parliament (2002), Directive 2002/15 of the European Parliament and of the Council of 11 March 2002 on the organisation of the working time of persons performing mobile road transport activities http://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:32002L0015 [Accessed: 19th December 2015]

EEA (European Environmental Agency) (2015), Van manufacturers must make new models more efficient by 2020 http://www.eea.europa.eu/highlights/van-manufacturers-must-make-new [Accessed: 9th November 2015]

Elcidis (2002), Electric Vehicle City Distribution, Final Report. European Communities, DG TREN Energy and Transport. Rotterdam, Netherlands.

Enclose (Energy Efficiency in City Logistics for Small and Mid-Sized European Historic Towns) (2014) Electric Fleets in Urban Logistics Report, AustriaTech

French Ministry of Transport (2011), *Enquête national Véhicules Utilitaires Légers* (Survey on the use of LCVs for the year 2010)

Frevue (2013): Freight Electric Vehicles in Urban Europe. http://frevue.eu [Accessed:17th November 2015]

INEA (Innovation & Networks Executive Agency) (2014), TEN-T 2013 Annual Call Proposal for an Implementing Decision on the selection of projects http://inea.ec.europa.eu/download/publications/2014/2013_ap_final_web.pdf [Accessed: 13th September 2015]

London Council (2015), London Lorry control http://www.londoncouncils.gov.uk/services/londonlorrycontrol/history.htm?showpage=2 [Accessed: 15th February 2015]

La Poste (2011), Résultats de la démarche d'achats groupés de véhicules électriques – Communiqué de presse http://legroupe.laposte.fr/espace-presse/liste-des-communiques/resultats-de-la-demarche-d-achats-groupes-de-vehicules-electriques [Accessed: 19th December 2015]
Mairie de Paris (2015), Plan de lutte contre la pollution liée au trafic routier http://presse.paris.fr/wp-content/uploads/2015/02/Dossier-de-presse-Plan-Anti-pollution.pdf [Accessed: 15th February 2015]
MEDDE (2015), Projet de loi relatif à la transition énergétique pour la croissance verte, 29 January 2015 http://www.senat.fr/leg/pjl14-264.html[Accessed: 17th February 2015]
Morganti E., Boutueil V., Leurent F. (2015), BEVs and PHEVs in France: Market trends and key drivers of their short-term development Corri-Door 4.1. Intermediate Report http://www.lvmt.fr/IMG/pdf/CorriDoor_4-1_Interim_Report_ParisTech.pdf
NRC (National Research Council) (2013), Overcoming Barriers to Electric-Vehicle Deployment: Interim Report *The National Academies Press, Washington* pp.68 http://gabrielse.physics.harvard.edu/gabrielse/papers/2013/OvercomingBarriersToElectricVehicleDeployment.pdf
SOeS (2012), Les véhicules utilitaires légers au 1er janvier 2011. Chiffres et statistiques. No. 310. ISSN: 2102-6378. [Online] April 2012. Available from: http://www.developpement-durable/gouv.fr/IMG/pdf/CS310.pdf. [Accessed: 30th November 2015]
SOeS (2014), Les véhicules utilitaires légers : une bonne complémentarité avec les poids lourds.http://www.statistiques.developpement-durable.gouv.fr/fileadmin/documents/Produits_editoriaux/Publications/Le_Point_Sur/2014/lps190-vul.pdf [Accessed:17th November 2015]