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Technical and operational obstacles to the adoption of electric vans in France and the UK: An operator perspective

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ABSTRACT

Since the mid-1990s European urban freight transport has undergone several major changes with direct impact on vehicle use patterns. These include (i) freight vehicle downsizing and (ii) the dieselisation of van fleets (formally referred to as light commercial vehicles or LCVs). More recently, a new possible trend has started to emerge, mainly related to alternative fuelled LCVs for reducing air pollution emissions in urban areas. Electric LCVs up to 3.5 tons are considered a suitable option for last mile operations, yet only a few last mile operators are replacing their diesel fleets with electric vans. In order to probe electric LCV acceptance in the freight transport sector, we conducted 15 experiment-oriented interviews with urban freight transport and service operators who tested and adopted electric vans, exploring technical and operational obstacles in daily operations in Paris and London. Additional interviews (8) have been conducted with policymakers, to update the initial survey. The results show that, in addition to range concerns issues, last mile operators' perception and acceptance of electric vans are affected by other concerns, such as queue, payload and grid anxieties. A number of financial and non-financial incentives to foster the adoption of electric vans are identified and compared by considering the cities of Paris and London. The research also explored potential policy tools for mitigating the detected barriers.

1. Introduction

Two major trends have profoundly changed the urban freight transport system across Europe over the last twenty years. The first trend concerns the downsizing of freight vehicles, conditioned by size-related vehicle restrictions adopted at the city level. The second trend refers to the dieselisation of light commercial vehicles (LCVs), such as vans up to 3.5 tons, as a result of taxation schemes and incentives applied to fuel types at the national level. Recently, under the European Parliament initiative (Directive, 2014/94/EU), new low-emissions policies are further shaping the freight transport system, encouraging the use of alternative fuelled vehicles in densely populated areas. Indeed growing concerns about air quality have led to additional calls for restrictions on diesel vehicles in European cities, such as the progressive old diesel-vehicles ban in Paris established in July 2015 and the Ultra-Low Emission Zone (ULEZ) in London which will come into force in April 2019. At national level, France defined areas with restricted traffic in major cities, together with the introduction of the Crit'Air Vignette to classified vehicles that are allow to enter. In the UK, the forthcoming Clean Air Zones Plan will be implemented in various large UK cities to fight the persistent air pollution crisis.

Electric LCVs have been identified as a clean alternative to diesel promoted by local and national governments through trials, grant schemes, investments in charging infrastructure and a range of complementary measures. Despite this increasing commitment to fostering electro-mobility, the uptake of electric LCVs is still limited and only few operators are replacing their diesel fleets. In 2015 just 0.5% of 1.7 million newly-registered vans in Europe were equipped with plug-in electric technology (EAFO, 2016; ACEA, 2016).

Compared to five years ago, when the market offered no electric LCVs, automotive manufacturers now offer for sale numerous models of vehicles, such as the Nissan *e-NV200*, Renault *e-Kangoo*, StreetScooter *Work* and Peugeot *Partner Electric*. Moreover new formats for urban freight vehicles, such as electrically-assisted cargo tricycles and mini-vans, represent a new segment with high potential sales in heavily congested European cities (Morganti et al., 2015).

Although a larger selection of products stimulates sales, a wide variety of factors influence the transition from the testing stage of electric LCVs towards full-scale commercialization. On the economic side, the buyer is influenced by the upfront retail costs of electric vehicles (EVs)

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and the dramatic and sustained downturn in oil prices, dating back to the second half of 2014. The market is also affected by regulatory factors, such as the European strategic plan attempt to reduce carbon dioxide (CO_2) emissions from transport, which set the enforcement of average emissions target at 175 g CO2/km from new LCVs by 2017 (European Parliament Regulation, 2011/510/EU). Consumer awareness of emissions performance may also be on the rise due to recent events like the US trial against Volkswagen about diesel emissions violations in September 2015 and the consequent requirement for the manufacturer to invest in electric vehicle promotion.

In the last mile sector, fleet managers' preferences result from a combination of the above-mentioned factors and technical and operational obstacles associated to electric LCVs, such as limited range (Feng and Figliozzi, 2012) and limited payload (Browne et al., 2014). Although recent studies have begun to clarify which EV features represent a concern for the operators, the topic is not yet fully explored. There is a consistent lack of knowledge on specific technical and organizational issues faced by early adopters of electric LCVs. Moreover considerable uncertainty exists regarding the nature of policy interventions that could mitigate these barriers.

Given the growing concern about the link between air quality and health and the dramatic rise in the use of LCVs in cities it is timely to present the results of a comparative study that assesses opportunities for change in two major cities (Paris and London). This paper looks at the last mile sector, covering product deliveries to businesses and end-customers as well as service activity, and it focuses on operators who tested electric vans, with a partially or totally renewed fleet. It provides an understanding of the technical and organizational issues observed and perceived by operators in their daily operations. The analysis was carried out in Paris and London, two metropolitan areas that set up specific measures on electro-mobility and where early adopters of EVs (including taxi, car-sharing projects and buses) represent a growing share of the existing fleet.

The remainder of the paper is organized as follows. The second section introduces the previous literature. Section Three presents the methodology. Section Four focuses on market trends and grant scheme programs in Paris and London. Section 5 describes interview results. Section 6 explores policy measures. Final remarks are presented in section 7.

2. Barriers to the adoption of electric vans

The city logistics sector, also known as "last mile" logistics, is increasingly reliant on vans. In European urban areas, the number of tasks accomplished with vans has progressively expanded and last mile operators currently use vans to provide a wide range of essential services (e.g. repair and maintenance of road infrastructure) and to carry goods (e.g. parcel deliveries). Van usage has surged following the evolution of the retailing sector and consumer preferences, such as just-in-time deliveries and the rise of online shopping consequently increasing home deliveries (Browne et al., 2010). As a result LCVs are the fastest growing source of road traffic in the UK (4.2% growth in 2015 compared with 3.7% for trucks and 1.1% for cars) and van emissions represented 15% of total emissions in 2014, compared with 9% in 1990 (DfT, 2016a). Last mile operators 'perceptions and acceptance' of low-carbon vehicles and electric LCVs in particular are therefore crucial for researchers and practitioners to understand, in order to identify suitable measures to encourage increased adoption leading to higher sustainability.

In transport policy, the LCV segment has been overlooked as there are far fewer vans than cars, respectively 10% and 83% of the total licensed vehicles in the UK (DfT, 2016b). Referring to the freight sector, the limited amount of official data and statistics on vehicles up to 3.5 tonnes represents a limitation for in-depths studies in various European countries and in the UK (CfIT, 2010). Despite growing interest in sustainable transport, issues related to electric LCVs have received limited attention (Pelletier et al., 2014). Available studies on urban freight transport and the corporate van fleet sector (Enclose, 2014; Feng and Figliozzi, 2012; Quack et al., 2016) partly mirror some of the results about the adoption of EVs in the private car sector. Parameters such as relative price increases of new vehicles, the relative prices of oil and electricity developments in the availability of recharging infrastructure are all relevant both in the private car and professional LCV market segments (Rezvani et al., 2015).

Among the biggest barriers hindering the EVs deployment, literature identifies cost competitiveness (whether in terms of total cost of ownership or purchase price). However the EV industry evolves quickly and the price per kWh for lithium-ion batteries experienced a strong drop in 2015, having fallen by 60% since 2010 (Blomberg, 2015). As a result, economic barriers are expected to decrease especially in countries where the remaining price gap is covered by incentives.

Range is widely identified as a major concern by potential EV buyers however significant recent improvements in battery technology and in charging infrastructure are expected to enhance EV performance and to mitigate concerns in the coming years (Morganti et al., 2015). The novelty perception is another barrier to EVs adoption, represented by the lack of knowledge about the vehicle's capability and performance (Thiel et al., 2012).

The literature identifies some barriers concerning electric LCVs and potential buyers operating in the last mile sector. Quack et al. (2016) argue that maintenance issues and reliable customer service from van manufacturers represent significant concerns. Uncertain resale values and long charging times contribute to the low penetration rate of electric vans as described by Noon (2015). He also identified major issues related to the British energy grid renovation and supply adequacy of local sub-stations, suggesting that mitigating the grid-related barriers can have a significant influence on EV adoption by large fleets. Browne et al. (2014) compared UK and France LCV growth patterns and CO_2 reduction opportunities and observed that payload limitations are a problem for 3.5 tons electric vans. Additional insights on the LCV segment in the UK are provided by the Commission for Integrated Transport (CfIT) report (2010), where the cycle of new van design and replacement by manufacturers is depicted as a long process. Moreover, on the buyer's side, preferences about model, size and fuel source depend on the long-term relationship between the manufacturer and the operator (CfIT) report (2010).

Previous research on the EV market, mostly focused on the passenger car segment, has explored the intention and the willingness to adopt the innovation. In France various investigations on cost parameters, technological developments and vehicle acceptance were assessing the potential buyers (von Pechmann et al., 2015; MEEDDAT, 2010). Windisch (2012) tested policy scenarios to derive a set of financial policy measures that encourage the adoption of electro-mobility by French households. Boutueil (2016) provided an outlook for large-scale uptake of EVs where French corporate fleets are identified as potential leading force, if supported with adequate policy measures.

In the UK, perception and acceptance of EVs from private consumers has been documented through surveys on policies (Lane and Potter, 2007). On perceived and actual barriers Skippon and Garwood (2011) assessed consumers' level of understanding of vehicle technologies, environmental impacts, car costs and economic incentives following a direct experience on driving a EV. Sierzchula (2014) explored fleet managers' behavior, and identified 'testing new technologies' as the most important driver on the adoption of EVs, followed by lowering environmental impacts, governmental grants, and improving the organization's public image.

Kaplan et al. (2016) carried out a study in Germany, Denmark and Austria to explain fleet managers purchase intentions for electric vehicles. Their model based on the theory of planned behavior describe the impacts of positive attitudes towards EVs, perceived familiarity and perceived operational ease on purchasing commercial EVs.

In more general terms, Mock and Yang. (2014) suggested that there