FREIGHT ELECTRIC VEHICLES IN URBAN EUROPE

FREVUE Results and Guidance for Electricity Network Operators

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This project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement no 321622

FRevue

1. Introduction

Electricity network operators are preparing for a significant uptake in electric passenger cars and buses. Because of this uptake, there will be a rise in demand for electricity consumption. Network operators have to invest in the right places and identify innovative solutions to ensure they can keep the lights on while, at the same time, allow for electric vehicles to be charged.

In addition to buses and cars, freight vehicles are also going electric. They have different consumption and charging patterns, providing both a new challenge but also an important opportunity for network operators.

Based on the 4.5-year Freight Electric Vehicles in Urban Europe (FREVUE) project, this document provides an overview of results and guidance for electricity network operators.

1.1. The FREVUE Project

FREVUE is a 4.5-year EU-funded project that started in March 2013. It involved 32 partners and deployed over 80 fully electric vans and trucks in eight European cities. Data from the project provides an evidence base on the technical and operational suitability of electric freight vehicles; their environmental, transport and social impacts; their economics; and policy/governance changes that are required to increase their uptake. For further information as well as detailed project reports, factsheets and other resources, please see www.frevue.eu.

Figure 1. FREVUE Demonstrations

2. The case for electric freight vehicles

The road transport sector is a major contributor not only to greenhouse gas emissions but also to local air pollutants. According to the European Environment Agency, in 2013 approximately 436,000 premature deaths in the EU28 were due to long-term exposure to PM2.5 (particulate matter) concentrations and 68,000 premature deaths due to NO_2 (nitrogen dioxide) exposure. Most local air pollutants stem from diesel vehicles and freight vehicles significantly contribute to this.

With zero tailpipe emissions and significant reductions in well-to-wheel CO_2, electric vans and trucks can significantly contribute to addressing the negative environmental and health impacts of freight movements.

2.1 Positive experience with Electric Freight Vehicles (EFVs)

The FREVUE project proved that the current generation of fully electric vans and trucks is well suited for most inner city freight operations.

The experience FREVUE industry partners have made with electric freight vehicles throughout the project has been very positive. Most operators have increased the number of electric vehicles in their fleet following the initial trial. For example:

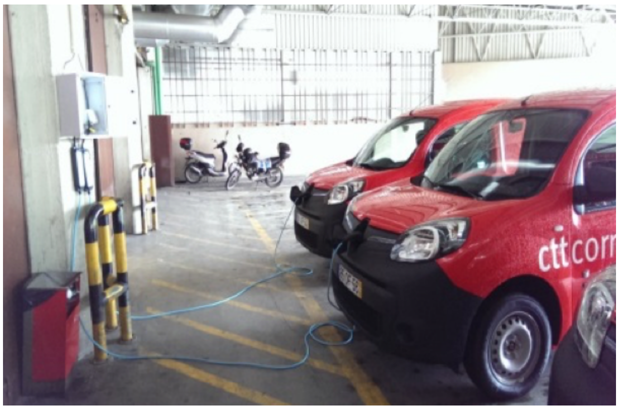
Heineken initially trialled four vehicles and now successfully run a 19t truck in Rotterdam, and one 12t and seven 13t trucks in Amsterdam to distribute beer. Heineken slow charge these vehicles at their own depot overnight.

UPS trialled 16 electric freight vehicles as part of the FREVUE London demonstrator (in addition to the 18 EFVs previously deployed) and have increased the total number of EFVs to 52 as of early 2017. This represents nearly a third of the central London fleet and UPS are looking to increase this share further. UPS slow charge these vehicles at their own depot overnight.

The Lisbon Post, CTT, started with 10 electric vans in 2013, this increased to 17 vehicles during the project, and it has plans to add 10 vans per year over the next two years. In addition, CTT are increasing their number of electric quadricycles in Lisbon from 50 in 2017 to 100 by 2020. CTT vehicles are slow charged at their own Postal Distribution Centres with plans to install fast chargers in the near future.

Overall, FREVUE surveys showed that at the beginning of the vehicle trials only 39% of participating fleet managers thought electric vans and trucks were a viable alternative to their diesel equivalents. At the end of the trial, this rate had nearly doubled. Now 72% of fleet managers believe that electric freight vehicles are indeed a viable alternative.

Procurement costs for EFVs remain high, especially for electric trucks. However, battery prices are decreasing and vehicle availability is improving. Furthermore, an increasing number of European cities are implementing incentives and regulation supporting EFVs (e.g. exemptions from road charges and extended access rights) all of which have a positive impact on the total cost of ownership of these vehicles.



2.2 The challenge

Electricity network operators have to prepare for an uptake in fully electric vans and trucks in European cities. However, extensive research on the demand from a wider uptake of EFVs in addition to that of electric cars and buses is lacking. Charging implications of EFVs differ from passenger cars in two important ways:

2.2.1 Electricity demand

Electricity requirements are high. The FREVUE analysis shows that an 18t single-shifted truck with a 200kW battery in daily operation requires an average of 163 kWh per day to charge. In comparison, a medium-sized van requires less energy of approximately 30kWh per day.

UPS ELECTRICITY GRID INFRASTRUCTURE UPGRADE

Issue

- Existing electricity grid infrastructure for electric freight vehicle charging can be insufficient.
- Requirement to make a considerable investment to upgrade the local electrical infrastructure.

Solutions

- Upgrade the grid capacity and relevant infrastructure to allow for a maximum of 68 electric vehicles to be charged simultaneously
- Close cooperation with local electricity distribution network operator (UKPN) and landlords.
- All electric vehicles currently operational in the UPS fleet can be charged simultaneously even at peak electricity demand.

Next steps

- As UPS further increase their electric fleet, this upgraded infrastructure will no longer be sufficient, and alternative solutions will be sought from built and non built solutions.
- Costs and requirement to invest in third-party assets prohibit further upgrades.
- The Smart Electric Urban Logistics project is developing innovative solutions to address this issue including Smart Charging technology (UPS) and Timed Connections (UK Power Networks).

Critical investment is required in specific locations where transport operators want to electrify their fleets and need significant additional capacity. This issue is demonstrated in the example above.

2.2.2 Charging patterns

One of the main challenges posed by larger EFVs is the timing of charging events: both, large (over 12 tonnes) and medium (3.5 tonnes to 7.5 tonnes) EFVs within FREVUE tended to be charged only once a day in the late afternoon at the operator's depot.

This differs from cars or light commercial electric vehicles where the diversity in charging patterns is high. The charging profiles of medium and large freight vehicles are less heterogeneous since most of them require to be charged at the same time every weekday with a sudden peak around 6pm. This also coincides with household electricity demand, potentially putting a significant strain on the network.

Some of the smaller EFVs in the project had the opportunity to charge during the day, often at lunchtime. In the example below, a fully charged vehicle starts out from the depot in the morning with the battery state of charge (SoC) falling until lunchtime when the vehicle is recharged during a slightly longer stop.

Fast charging is an important means to achieve the maximum exploitation of the battery system, thereby reducing the initial investment and costs associated with a loss in payload.

Currently, not many logistics operators use public fast chargers, even if available, as this requires extra planning. However, this is expected to change with increased availability of charging infrastructure availability and growing experience and confidence with this type of vehicle.

In FREVUE the charging power ranged from 2.3kW to 50kW but with a rise in opportunity fast charging, this can be expected to increase. The new fast chargers in Oslo, for example, are all prepared for the new generation of chargers of more than 150 kW. In comparison, a fast charging station for buses can require a connection of up to 400kW.

2.3 The opportunity

Results from the FREVUE surveys show that most of the responding distribution network operators agree that future EFV deployment offers many opportunities if the additional demand is well managed.

Little variability in charging and driving of EFVs facilitates the planning of appropriate infrastructure and anticipation of demand. Furthermore, this lack in variability in EFV deployment is similar to that of buses, opening up opportunities to share charging infrastructure. Examples here could include the charging of electric trucks at bus stops or depots.

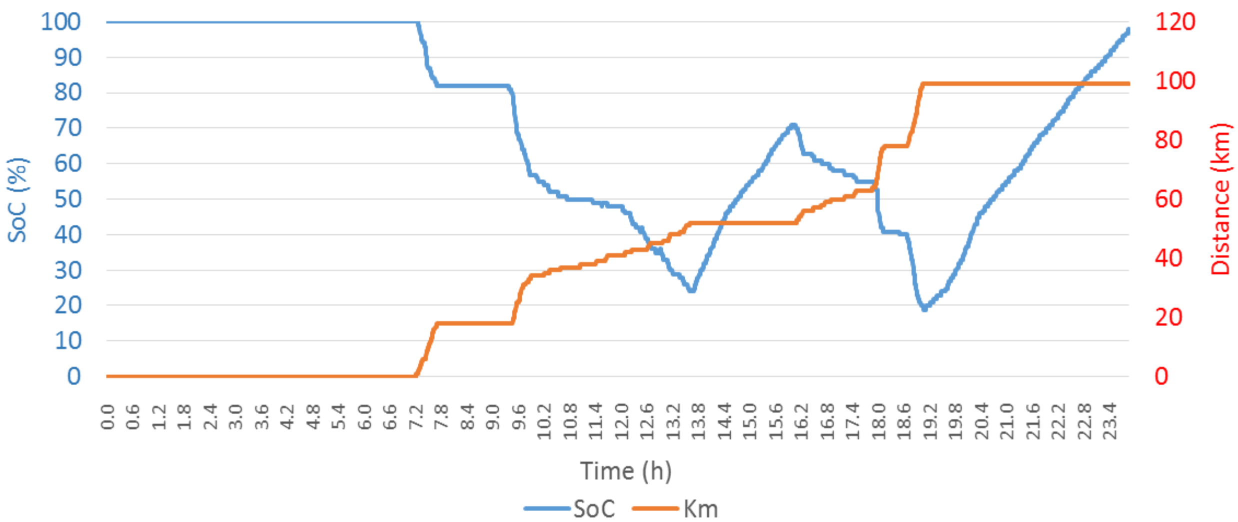


Figure 2. Example of charging pattern of EFV <3.5t

Smart charging will help avoid peak loads on the power grid, promote renewable energy and can ensure the most efficient use of existing supply. Different smart charging strategies can be applied depending on the chosen goal of electric vehicle demand management. These include:

- Network-oriented charging reducing grid constraints by smoothing load profiles
- Renewable energy-orientated charging to maximise the utilization of renewable energy production to reduce CO2 emissions
- Cost-oriented charging by minimizing charging cost through shifting charging to low-cost periods of electricity generation.

Further, vehicle-to-grid (V2G) systems offer an opportunity to fully integrate EV charging infrastructure into a power network by allowing connected vehicles to sell electricity back into the grid rather than just drawing from it. Many V2G projects are now being implemented but the technology is not yet mature enough for distribution network operators to deploy and rely on it to support grid capacity constraints.

2.4 Future steps The 4-Stage Plan

As shown above, the expected increase in EFVs and their related power requirements pose challenges for electricity network providers but, if well managed, also offer important opportunities. FREVUE partner UK Power Networks, are proposing a 4-stage plan to assist electricity network providers in realising these benefits.

4-STAGE PLAN

1.Engage and educate: Electricity network operators should actively engage with fleet operators who want to deploy a large number of EFVs. It is important to raise awareness of potential grid constraints to local businesses and to understand their operational needs. This will help fleet operators make an informed decision before they are committed to a large-scale deployment of EFVs.

2. Evaluate: Electricity network operators will always provide a connection to satisfy customers' needs, even if there is a capacity issue. However, a new or upgraded connection comes with a cost and it is important to understand whether this cost is acceptable to the customer.

3. Expand Choice and Convenience: Electricity network operators should explore intelligent smart solutions with the customer. This includes, for example, smart charging to spread charging demand and thereby reduce peak capacity requirements. For EFVs, the potential for smart charging is both viable and significant. UK Power Networks Electric Vehicle Work group is developing the companies offerings to best align with the customers' needs.

Electricity network operators should explore other demand-side management options, for example timed or profiled connections. Based on historical data analysis, timed connections are offered by understanding the conditions, which would adversely affect the network and limiting the output during certain time periods. As a result, connections have the potential to be accommodated without the need for significant network reinforcement (UKPN, 2017).

4.Develop Policies, Procedures and Guidance: Electricity network operators should develop position papers on key subjects to ensure stakeholders have a reliable source of information when making decisions on their electric fleet requirements. UK Power Networks have published an Electric Vehicle Policy (EDS 08-5050), and also developed a Guide for Fleet Operators, both of which are available on their website.

COORDINATION

Cross River Partnership

CITIES AND AUTHORITIES

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Lisboa Câmara Municipal
EMT ¡Madrid!
Milano Comune di Milano
City of Rotterdam
Stockholms stad
emel
Trafikverket
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FURTHER INFORMATION

For more information about the FREVUE project, reports, publications and useful links, please see www.frevue.eu.