Upscaling Electric Freight Vehicles

Issue

The use of Electric Freight Vehicles (EFVs) has not yet been upscaled. This factsheet considers the preconditions and current roadblocks for the upscaling of EFVs.

Solution

Electricity needs to be cheaper than fossil fuels for further freight electrification, so that investment in EFVs can be earned back in good time. Appropriate charging infrastructure is also a precondition.

Charging infrastructure must be upscaled in line with the number of EFVs in use, meaning that timely upgrades in electricity grids and production are necessary. Increased sales of EFVs are needed to push the demand for this infrastructure.

The current generation of EFVs are not commercially viable, but governments can play a role in encouraging their use through subsidies for their purchase, eliminating road tax on EFVs, and making certain emission zones or time windows EFV-only.

Results & Benefits

- A steady growth in the number of EFVs, leading to more pertinent data
- Planning tool developments
- Standardisation and installation of fast charging infrastructure supported by a smarter and improved electricity grid
- A growing number of EFVs will create more confidence and more experience around the use of EFVs by drivers, maintenance personnel and planners

Context

Large electric freight vehicles are currently only available through retrofitting companies and are at least twice the price of conventional counterparts. Making operational costs lower will mean that EFVs are cheaper to own over their lifetime, despite the up front cost. Costs can be lowered through cheaper energy and maintenance.

There is considerable uncertainty about how much batteries will cost in the next few years, but economies of scale are expected to have a significant impact on battery prices.
The lifetime of batteries will grow, with an expected increase in charge cycles from 3000 in 2016 to 5000 in 2024, which will reduce the total cost of ownership.

Energy cost per kilometre is key for determining whether the total cost of ownership is lower for an EFV than a conventional one. Tables 1 and 2 show these costs for EFVs and diesel equivalents, including the bare electricity price, transport costs, grid connection costs and the presumed depreciation, plus maintenance costs of the charger.

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<tbody>
<tr>
<td>Slow charging (€/kWh x3)</td>
<td>0.423</td>
<td>0.438</td>
<td>0.450</td>
<td>0.465</td>
<td>0.477</td>
<td>0.489</td>
<td>0.498</td>
<td>0.510</td>
<td>0.519</td>
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<tr>
<td>Fast charging (€/kWh x3)</td>
<td>0.555</td>
<td>0.570</td>
<td>0.582</td>
<td>0.597</td>
<td>0.609</td>
<td>0.621</td>
<td>0.630</td>
<td>0.642</td>
<td>0.651</td>
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<tr>
<td>Diesel (€/l)</td>
<td>1.062</td>
<td>1.100</td>
<td>1.130</td>
<td>1.167</td>
<td>1.198</td>
<td>1.228</td>
<td>1.250</td>
<td>1.280</td>
<td>1.303</td>
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Table 1. Projection of expected average electricity and diesel prices

These costs differ within Europe. In Sweden the electricity price is 0.06 €/kWh, ex. VAT, compared to 0.24 €/kWh, ex. VAT in Germany, which means the total cost of ownership of an EFV will differ between countries. This is also true, however, for conventional vehicles, due to differing diesel prices across the continent.

When regarding fuel costs, the vehicles used in the FREVUE project used 3.5 kilowatt hours to travel the same distance that diesel-powered vehicles would cover with one litre of diesel, meaning that if the cost of 3.5 kilowatt hours is lower than the cost of one litre of diesel, the EFVs would be cheaper to fuel than equivalent diesel vehicles. Another factor to consider is the number of kilowatt hours that a battery can provide over its lifetime, as the longer this time is, the lower the overall operational costs will be, due to savings on the purchase of new batteries. This is known as the depreciation cost.

Once EFVs are produced on the same scale as diesel equivalents, the material cost of production should be a similar level for both, not including the battery pack. For mass uptake of EFVs, it is therefore important that the price of the battery pack decreases over time.
Table 3 shows the expected purchase prices for converted and in-series produced EFVs in 2019 and the mileages required to earn back the corresponding extra investment in the EFV (compared with a conventional freight vehicle (CFV)).

<table>
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<th>Vehicle class</th>
<th>Expected purchase price difference</th>
<th>Required mileage for TCO conventional = TCO EFV (km)</th>
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<tbody>
<tr>
<td></td>
<td>Converted EFV</td>
<td>Series EFV</td>
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<tr>
<td></td>
<td>Slow charging</td>
<td>1x fast charging</td>
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<tr>
<td>&lt;3.5 tonne</td>
<td>46,000</td>
<td>40,000</td>
</tr>
<tr>
<td>13 tonne</td>
<td>111,000</td>
<td>97,000</td>
</tr>
<tr>
<td>19 tonne</td>
<td>159,000</td>
<td>142,000</td>
</tr>
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</table>
On the other hand, as long as there are no in-series produced EFVs on the market, the use of these converted EFVs is important for:

1) gaining experience with integrating EFVs in daily fleet operations, which is especially important if fast charging needs to be well-planned (often planning software needs to be updated in order to support this in an efficient way)

2) gaining experience with suppliers of charger equipment and electricity grid operators

3) Standardising automated charger equipment

4) gaining experience with maintaining EFVs, which requires different skills, tools and safety standards

5) gaining confidence in the capabilities of EFVs, which is especially important for future drivers and planners

6) Building confidence with charging equipment manufacturers and potential EFV manufacturers that electrified freight transport will take off in the near future.

Further information

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