Towards zero emission city logistics

FREVUE – demonstrating freight electric vehicles in urban distribution

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Agenda

1. Introduction zero emission city logistics
2. Current status FREVUE
3. FREVUE’s state of the art study
4. Concluding remarks
Introduction

TNO
Netherlands Organisation for Applied Scientific Research

7 research themes
- Transport and Mobility
  Urban freight transport

Hans Quak
Senior scientist @ TNO
Guest researcher @ TU Delft
1. Introduction zero emission city logistics

- Air quality is a problem in cities and CO₂ reduction an ambition

- Cities are increasingly affected by significant air and noise emissions as well as increasing congestion

- The logistics industry is a significant driver of economic growth, as well as a major contributor to these issues. Improvements in this sector are required to ensure that cities fulfill their potential.

- The uptake of EFVs in the logistics industry does not go easily; experience and knowledge transfer is needed!

- Ambition European Commission: zero emission urban logistics in 2030
1. Introduction zero emission city logistics

FREVUE

- FREVUE will demonstrate to industry, consumers and policy makers, how electric freight vehicles can provide a solution to air and noise emissions caused by the logistics industry.

- Aim: to test with 127 electric vehicles before 2017.
- Demonstrate projects in 8 cities; covering a broad range of conditions:
  - good deliveries (including food, waste, pharmaceuticals, packages and construction goods)
  - vehicle types (from small vans to large 18 tons goods vehicles)
  - novel logistics systems and associated ICT (with a focus on consolidation centers which minimize trips in urban centers)
  - climates (from Northern to Southern Europe)
  - diverse political and regulatory settings that exist within Europe
1. Introduction zero emission city logistics

FREVUE

Oslo
- Benchmarking of EVs against alternate fuels

Rotterdam
- EVs in beverage distribution

London
- End user consolidation centres
- EV charging and grid interaction

Lisbon
- Positive discrimination for EV logistics in a historical centre.

Zaragoza
- ICT + EV consolidation centres

Beja

Madrid

Stockholm
- New development area consolidation centres + fast charging

Frankfurt

Suceava

Stockholm

FP7-TRANSPORT-2012-MOVE-1

Demonstration of Urban freight Electric Vehicles for clean city logistics (theme: GC.SST.2012.1-7)
1. Introduction zero emission city logistics

FREVUE partners
1. Introduction zero emission city logistics

*FREVUE*

- A variety of logistic organizations will implement the freight EVs in their day-to-day operations, for at least one year.

- The local authorities are involved in the demonstrations, to support the demonstrations and to explore supporting measures for the uptake of EFVs.

- The research partners will assess the impacts and analyze the results.

- Vehicle manufacturers and power companies to support and work on improved business model for EFV uptake.
2. Current status FREVUE
Key challenges at this moment

Procurement
- Procurement of reliable electric freight vehicles of 12 or 18 ton (including maintenance and service)
- Overcome equipment availability issues
- Meeting operational and performance requirements within range of the EFV

Financing
- What determines the residual value of EVs?
- Leasing and financial issues with acquiring EFVs
- What is the difference (in practice) between the TCO of an EFV and ICE vehicle?

Measuring, data collection and comparability
2. Current status FREVUE

What did we find so far?

- State of the art study

- Demonstrators and cities have been visited by the research partners to gain insight in the objectives, criteria, KPIs, and measurement methods; and start local FREVUE communities.
3. FREVUE’s state of the art study

Context
3. FREVUE’s state of the art study

Objectives

- **Provide feedback and lessons learnt** from past and on-going initiatives to the FREVUE demonstrators
- **Support** the production of Central Evaluation Framework

Show cases of how challenges are handled and success factors of EFV implementation
3. FREVUE’s state of the art study

Approach

- EU projects on electromobility, city logistics, freight electric vehicles
- National, regional, municipal initiatives
- Private sector initiatives

Observations from the state of art review

Identification of case studies for deeper analysis

Conclusions on main challenges and success factors from the freight EVs implementation in city logistics and lessons to be learned from and for demonstrators
3. FREVUE’s state of the art study

**Approach**

- Focus on the deployment of freight electric vehicles in city logistics and related services

<table>
<thead>
<tr>
<th>Initiator/funding source</th>
<th>Projects/Companies</th>
</tr>
</thead>
<tbody>
<tr>
<td>EU</td>
<td>EEO, EVUE, ELCIDIS, FIDEUS, ENCLOSE, Smartfusion, EFRUD, DemoEV, SUGAR, Straighstol, Bestfact I and II, TURBLOG, CIVITAS, ELTIS, CO2NeuTrAI, Staart, Green eMotion, CVP/Cleen Fleets, C-Liege, Green Post</td>
</tr>
<tr>
<td>National, regional, municipal</td>
<td>EVD Post, MOVELE (ES), Source for London (UK), Luccaport (IT), Going electric (EU), Electric Mobility Pilot Regions (GE), MOBI.E (PT), E-Laad (the NL)</td>
</tr>
<tr>
<td>Private sector</td>
<td>France (Carrefour, La Poste, Deret); The Netherlands (CityShopper, Binnenstadservice, UPS, 020 stadsdistributie, Cargohopper); Germany (UPS); Spain (Leche Pascual, Eroski, Correos, Seur); UK (TNT, DHL, Seymour Green, Tesco); Italy (Eco-Logis), Norway (Posten Norge)</td>
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</tbody>
</table>

**Issues and challenges on:**
- Technical performance
- Economics
- Operational performance
- Environmental performance and wider systemic impact
- Social and attitudinal impacts
- Local policy and governance structures
3. FREVUE’s state of the art study

Technical performance

- **Range**
  - The range promised by the manufacturer is not reached; new(er) vehicles have higher real range
  - Whether the range is a limiting factor depends
  - Failing batteries (and limited or late) support
  - Equipment availability issues

- **Charging**
  - Relatively long charging time
  - Necessity to adapt charging infrastructure for fleet needs
  - The availability of public charging points is seen as a confidence boosting measure

- **Rapid improvement in technology** - new vehicles and batteries are available in near future. Reason to wait (at the moment) to buy.
3. FREVUE’s state of the art study

Technical performance

- Limited availability and types of vehicles on the market
- Dealing with limited availability and types of vehicles on the market: converting conventional vehicles

Before... ... and after conversion.
3. FREVUE’s state of the art study

*Technical performance*

<table>
<thead>
<tr>
<th>Feeder</th>
<th>Collection and Delivery under 100 km per day</th>
<th>Collection and Delivery over 100 km per day</th>
<th>Backup</th>
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</thead>
<tbody>
<tr>
<td>Walker or tricycle</td>
<td>Green</td>
<td>Green</td>
<td></td>
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<tr>
<td>Electrically assisted tricycle</td>
<td>Green</td>
<td>Green</td>
<td></td>
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<tr>
<td>Electric</td>
<td>Green</td>
<td>Yellow</td>
<td></td>
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<tr>
<td>Range extended electric or hybrid</td>
<td>Green</td>
<td>Green</td>
<td></td>
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<tr>
<td>Biomethane</td>
<td>Yellow</td>
<td>Green</td>
<td></td>
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<tr>
<td>Biodiesel</td>
<td>Yellow</td>
<td>Yellow</td>
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<tr>
<td>Natural gas (CNG, LNG)</td>
<td>Yellow</td>
<td>Yellow</td>
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<tr>
<td>Hydrogen</td>
<td>Yellow</td>
<td>Yellow</td>
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<tr>
<td>Propane (LPG)</td>
<td>Yellow</td>
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*Key:*
- Green: Good sustainability, feasibility, payback balance
- Yellow: Poor sustainability, feasibility, payback balance

Source: UPS EMEA Alternative Technology Roadmap
3. FREVUE’s state of the art study

Economics

› Costs
  - High procurement costs
  - High cost of battery
  - Lower maintenance and fuel costs
  - Downtimes (due to malfunction)

› Benefits
  - Lower operating and (regular) maintenance costs which results in more working hours, better service quality and lower total lifetime usage costs
  - If regulative environment supports the introduction of EV’s, the benefits from EV’s implementation are higher

› Lack of knowledge on what really determines the EV’s residual value

› Innovative battery leasing schemes
3. FREVUE’s state of the art study

**Economics**

- In the short and medium term EV cost are high. EVs become more competitive in a long term. Wider uptake of EVs is difficult due to non viable business case in short term.

![Image of EV comparison](image_url)

Lee et al, 2013
3. FREVUE’s state of the art study

**Economics**

![Graph showing vehicle ownership cost over time, with lines indicating cost of electric vehicles and incumbent costs, and notes on solutions to high ownership cost and limitations.]

- **Cost of electric vehicles** is high due to CAPEX, range limitations, and charge time.
- **Solutions to high ownership cost**:
  - EV-centric logistic solutions
  - Leasing models
  - Improved EV technology
  - EV supportive policy (e.g., extended delivery hours, fiscal incentives)

- **Cost of incumbent** increased through additional taxation, congestion charging, valuing air pollution, etc.

- **Time**
3. FREVUE’s state of the art study

**TCO electric vehicles**

Source: VUB, MOBI, Macharis and Lebeau, 2013
3. FREVUE’s state of the art study
Operational performance

- Higher operational efficiency
  - Larger time windows allow more efficiency in operations
  - More efficient routes can be achieved as vehicle can drive inside environmental zones
  - Free parking, use bus lanes

- Loading capacity
  - Limited loading capacity

- Logistics concepts need to be adapted for the usage of EVs

3. FREVUE’s state of the art study

Operational performance

› Maintenance
  - Manufacturing companies do not provide fast maintenance services and vehicles can be out of order for a couple of months

› Charging points
  - Home-charging (in company-charging) is most often used
  - Downtime of vehicles is too long
  - For vehicles on the fixed routes, home charging may be sufficient; for vehicles on variable distance routes it is necessary to consider complimentary charging methods (complimentary fast charge or battery swap technologies)
3. FREVUE’s state of the art study 

Environmental performance

- Good environmental performance and improved air quality:
  - Posten Norge, Norway: savings of 1.4 – 2.1 ton CO₂ per vehicle per year by using EVs instead of fossil fuel vehicle
  - Bristol CC, UK: Freight consolidation scheme in combination with two 9 tonnes EVs brought saving of 380,000 lorry/km, resulting in 102 tonnes CO₂ reduction and 3.300 kgs NOx, 100 kg PM 10’s reduction
  - Tesco, UK: operate 15 Modec EVs and each EV saves between 13 – 15 tonnes of CO₂ each year
  - Deret, France: 38 times less of CO₂ emission per truck for the EV compared to truck of the same capacity
3. FREVUE’s state of the art study
Social and attitudinal impact

- **Noise**
  - No noise from vehicles, but from (un)loading equipment and drivers behaviour

- **Drivers acceptance**
  - Drivers are very happy with vehicles having an acute turning range, which is very helpful in city’s streets
  - Vehicles are very quite
  - Some time is needed to get used to, therefore training with vehicle is necessary
  - No long-term problems with range anxiety
  - Ambivalence in drivers’ attitude

- **General acceptance**
  - Very positive general acceptance from public, vehicles attract a lot of interest

- **Contributed to the positive image of transport operator and shipper**

- **Uncertain safety level**
Government policy supporting EVs or policies to limit ICE usage are a key factor of success.

The most common government support measures are:
- Purchase subsidies
- Exemption from purchase taxes (e.g. VAT on purchase)
- No charges on toll roads
- Free access on bus lanes
- Free municipal parking

Political support, procurement demands, public opinion and awareness also among private companies and surrounding municipalities are factors of success of demonstrators.
3. FREVUE’s state of the art study

Policy and governance

<table>
<thead>
<tr>
<th>Promoting EV</th>
<th>Restricting CV</th>
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<tbody>
<tr>
<td>- Purchase subsidy</td>
<td>- Higher parking charges</td>
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<tr>
<td>- Exemption from vehicle registration taxes</td>
<td>- Higher taxes</td>
</tr>
<tr>
<td>- Discount on toll and parking fees</td>
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<table>
<thead>
<tr>
<th>Financial</th>
<th>Non-financial</th>
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<tbody>
<tr>
<td>- Preferential parking spaces</td>
<td>- Low emissions zones</td>
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<tr>
<td>- Access to restricted highways or bus lanes</td>
<td>- Time windows</td>
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<tr>
<td>- Facilitating charging infrastructure</td>
<td></td>
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<tr>
<td>- Sharing practical information</td>
<td></td>
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<tr>
<td>- Carbon footprint related recognitions</td>
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3. FREVUE’s state of the art study

Main observations

• Biggest majority of documents available are on the implementation of the private electric vehicles; the scope and the number of the projects/initiatives focused on freight is limited, but slowly growing

• Only few sources are available presenting real evaluation results; majority are focused on the pre-trial or only context description information

Challenges with implementation of the freight EVs during the first trials differ from today’s challenges

- Then: high procurement costs, limited product diversity, little or no after sale support, long waiting time for spare parts, overruns in delivery dates, small range and low speed, necessity to develop more reliable and better performing batteries, EFVs were limited in power and payload

- Now: Scepticism, waiting for further technology development and viable business case

Use of EVs for city logistics still has to gain benefits from practical demonstrations in order to be recognized, notably by fleet managers.
3. FREVUE’s state of the art study

Main observations

What is needed for acceleration of uptake of EFVs?

› Adaptation of logistics concept enables EFV use in urban logistics

› Local governmental support to accelerate EFV introduction

› Companies that want to be sustainable
4. Concluding remarks

1. Many uncertainties about EFVs and (therefore) many risks

2. Mismatch EFV characteristics and current logistics operations and concept

3. High initial investment costs

4. Equipment availability issues, service issues, and limited availability of EFVs in the market

5. Positive image for carrier / transporter
Thanks for your attention

Questions?

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