STARTING SOON!!!
1st ELIPTIC webinar:

Optimised braking energy recovery in electric public transport systems

29 April 2016, 10.00 to 11.30 AM CEST
Who is present

Moderator:
Wolfgang Backhaus, Rupprecht Consult GmbH
Project Manager of the Horizon 2020 ELIPTIC project

Presenter:
Daniela Carbone & Veronica Usai, ASSTRA
Introduction Pillar B - objectives and use cases

Ricardo Barrero, STIB Brussels
Optimised braking energy recovery in metro & light rail systems

Mikolaj Bartlomiejczyk, PKT Gdynia
Optimised braking energy recovery in trolleybus systems
## Agenda

<table>
<thead>
<tr>
<th>Time</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>10:00 - 10:15</td>
<td>Welcome message and brief introduction to ELIPTIC, Wolfgang Backhaus, Ruprecht Consult</td>
</tr>
<tr>
<td>10:15 - 10:30</td>
<td>Introduction Pillar B &quot;Innovative energy storage systems to increase operational efficiency&quot; - objectives and use cases, Daniela Carbone and Veronica Usai, ASSTRA- Associazione Trasporti</td>
</tr>
<tr>
<td>10:30 - 10:50</td>
<td>Optimised braking energy recovery in metro and light rail systems - Ricardo Barrero, STIB Brussels</td>
</tr>
<tr>
<td>10:50 - 11:00</td>
<td>Question and answer - round I</td>
</tr>
<tr>
<td>11:00 - 11:20</td>
<td>Optimised braking energy recovery in trolleybus systems - Mikolaj Bartlomieczyn, PKT Gdynia</td>
</tr>
<tr>
<td>11:20 - 11:30</td>
<td>Question and answer - round II</td>
</tr>
<tr>
<td>11:30</td>
<td>End of webinar</td>
</tr>
</tbody>
</table>
ELIPTIC in a nutshell

- Research and Demonstration project in EU Program „Horizon 2020“ (Mobility for Growth 5.1)
- Funding primarily for research and promotion (only small share for hardware)
- 33 partner in 8 Countries
- Duration: 01.06.2015 – 30.05.2018
- Coordinator: Freie Hansestadt Bremen
- Budget: 5,9 Million Euro (100% funding)
ELIPTIC – project objectives

Safe integration of electric vehicles into existing electric PT infrastructure:

- (re)charging ebuses “en route” (e.g. trolleybus operated on tram infrastructure) or on the spot (battery buses/ hybrids charged from trolleybus, tram, metro network);
- upgrading trolleybus networks with battery buses or trolley hybrids (diesel bus substitution);
- upgrading and/or regenerating electric public transport systems (flywheel, reversible substations)

Multi-purpose use of electric public transport infrastructure:

- safe (re)charging of non-public transport vehicles (pedelecs, electric cars/ taxis, utility trucks);
- analyse the potential of existing electric public transport infrastructure to become a backbone for smart electromobility
Three research and innovation pillars

A. E-buses
Safe integration into existing electric PT infrastructure

B. Energy efficient electric PT system

C. Multi-purpose use of electric PT infrastructure
## The ELIPTIC use cases

<table>
<thead>
<tr>
<th>Partner city</th>
<th>Thematic pillar</th>
<th>Safe integration of ebuses using existing electric public transport infrastructure</th>
<th>Innovative energy storage systems to increase operational efficiency</th>
<th>(C) Multi-purpose use of electric public transport infrastructure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bremen (DE)</td>
<td>A.1: Operation-optimized system of opportunity charging at bus depots</td>
<td></td>
<td></td>
<td>C.1: From uniqueness to system: Extension of existing multimodal mobility hub station</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>C.2: Use of metro sub-station for (re)charging TFL fleet vehicles (e-cars &amp; e-vans) and zero-emission capable taxis</td>
</tr>
<tr>
<td>Brussels (BE)</td>
<td>A.2: Opportunity (re)charging of ebuses and/or plug-in hybrid buses (using metro infrastructure)</td>
<td></td>
<td></td>
<td>C.3: Use of metro/tram infrastructure for recharging e-cars (municipal fleet and private e-cars)</td>
</tr>
<tr>
<td>Barcelona (ES)</td>
<td>A.3: Progressive electrification of hybrid bus network, using existing tram and metro infrastructure</td>
<td>B.2: Optimised braking energy recovery in light rail network</td>
<td></td>
<td>C.4: Use of tram network sub-station for (re)charging e-vehicles</td>
</tr>
<tr>
<td>Warsaw (PL)</td>
<td>A.5: Use of /tram infrastructure for recharging e-buses</td>
<td></td>
<td></td>
<td>C.5: Fast-charging stations for e-cars powered from the tram network</td>
</tr>
<tr>
<td>Leipzig (DE)</td>
<td>A.6: Opportunity (re)charging of ebuses (using tram infrastructure)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oberhausen (DE)</td>
<td>A.7: Opportunity (re)charging of ebuses (tram catenaries and sub-stations)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gdynia (PL)</td>
<td>A.9: Opportunity (re)charging of ebuses connecting Tri-city agglomeration based on trolleybus infrastructure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eberswalde (DE)</td>
<td>A.10: Replacing of diesel bus lines by extending trolleybus network with trolley-hybrids</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Szeged (HU)</td>
<td>A.11: Replacing diesel bus lines by extending trolleybus network with trolley-hybrids (incl. demo of automatic (de)wiring)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lanciano (IT)</td>
<td>A.12: Replacing diesel bus lines by extending trolleybus network with trolley-hybrids</td>
<td>B.4: Light rail (tram) operation for rural rail track</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Table 2: ELIPTIC use cases

- **Feasibility study / technological concept**
  - A.1: Operation-optimized system of opportunity charging at bus depots
  - A.2: Opportunity (re)charging of ebuses and/or plug-in hybrid buses (using metro infrastructure)
  - A.3: Progressive electrification of hybrid bus network, using existing tram and metro infrastructure
  - A.4: Opportunity fast (re)charging and slow overnight charging of electric buses based on metro infrastructure
  - A.5: Use of /tram infrastructure for recharging e-buses
  - A.6: Opportunity (re)charging of ebuses (using tram infrastructure)
  - A.7: Opportunity (re)charging of ebuses (tram catenaries and sub-stations)
  - A.9: Opportunity (re)charging of ebuses connecting Tri-city agglomeration based on trolleybus infrastructure
  - A.10: Replacing of diesel bus lines by extending trolleybus network with trolley-hybrids
  - A.11: Replacing diesel bus lines by extending trolleybus network with trolley-hybrids (incl. demo of automatic (de)wiring)
  - A.12: Replacing diesel bus lines by extending trolleybus network with trolley-hybrids

- **Demonstration in operational environment**
  - B.1: Recuperation of braking energy from trams: Refurbishment of a flywheel energy storage system
  - B.2: Optimised braking energy recovery in light rail network
  - B.4: Light rail (tram) operation for rural rail track

- **Multi-purpose use of electric public transport infrastructure**
  - C.1: From uniqueness to system: Extension of existing multimodal mobility hub station
  - C.2: Use of metro sub-station for (re)charging TFL fleet vehicles (e-cars & e-vans) and zero-emission capable taxis
  - C.3: Use of metro/tram infrastructure for recharging e-cars (municipal fleet and private e-cars)
  - C.4: Use of tram network sub-station for (re)charging e-vehicles
  - C.5: Fast-charging stations for e-cars powered from the tram network
  - C.7: Multipurpose use of infrastructure for (re)charging trolley-hybrids & e-vehicles
The concept/idea

Source: Müller-Hellmann
Potential of using existing public transport infrastructure

- Trolleybuses as "backbone" of transport chains
- Micro-Mobility & Vehicle-Sharing to complete start & end mile

Source: Spath, IAO, 2011
Thematic pillar C: Multi-purpose use of electric public transport infrastructure

Use case London (TfL)

- A feasibility study will investigate the potential for using the London Underground (LU) power network for charging electric cars & commercial vehicles, such as TfL’s own vehicles kept at common locations.

- This study will complement the Mayor’s proposals for newly-licensed taxis from 2018 to be zero-emissions capable. TfL is investigating how a charging network could support this and where possible network locations with sufficient capacity could exist.
## Passenger car vs. Bus (18m)

<table>
<thead>
<tr>
<th>Feature</th>
<th>Passenger car</th>
<th>Bus (18m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily usage</td>
<td>&lt; 1 hour</td>
<td>12 - 16 hours</td>
</tr>
<tr>
<td>Engine size</td>
<td>Small (- medium)</td>
<td>big</td>
</tr>
<tr>
<td>Fuel</td>
<td>50 - 60% Diesel</td>
<td>95 – 98 % Diesel</td>
</tr>
<tr>
<td>local pollutants</td>
<td>Diesel: PM$_{10}$ + NO$_2$</td>
<td>Diesel: PM$_{10}$ + NO$_2$</td>
</tr>
<tr>
<td>Annual fuel consumption</td>
<td>500 l gasoline/Diesel</td>
<td>40,000 l Diesel</td>
</tr>
<tr>
<td>CO$_2$ emission p.a.</td>
<td>~ 1,2 to</td>
<td>~ 100 to</td>
</tr>
<tr>
<td>Total impact</td>
<td></td>
<td>Equals to app. 100 electric passenger cars</td>
</tr>
</tbody>
</table>

Diesel: PM$_{10}$ + NO$_2$

**CO$_2$ emission p.a.**

~ 1,2 to

Total impact

Equals to app. 100 electric passenger cars
Thank you for your attention!

http://www.eliptic-project.eu/

Contact:
Wolfgang Backhaus
Rupprecht Consult GmbH
w.backhaus@rupprecht-consult.eu
+49 221 60 60 55 19