The feasibility of Dynamic Wireless Power Transfer on highways

Denis Naberezhnykh – Head of ULEV and ITS Technology
ITS World Congress Bordeaux, 8th October 2015
Our Vision

To be the world leader in creating the future of transport and mobility, using evidence-based solutions and innovative thinking

Fast facts

- One of the largest independent transport centres in the world
- International reputation for first class consultancy, research excellence and project delivery
- A team of over 400 highly qualified transport specialists

Clients in 145 Countries

Over 800 Projects delivered in 2014

Over 4,000 TRL Reports available to download

TRL Software sold in over 60 Countries and 250 cities world-wide
Trends in road vehicle electrification

- No revolution in on-board battery storage
- EV range will double by 2020 (as will battery capacity)
- Novel, more flexible vehicle usage and ownership leading to higher vehicle utilisation

Batteries unlikely to provide range comparable with ICE vehicles in the near future

Range anxiety could be replaced with “charging anxiety”

Increased demand in opportunistic charging
Plug-in charging has its place
How scalable is plug-in charging?

Vehicle traffic by road type (UK)

- 98% of all roads by length
  - Average daily flow: 3,000 vehicles
- 2% of all roads by length
  - Average daily flow: 54,000 vehicles

DfT Road Traffic Statistics 2015, Table TRA4115

ITS World Congress Bordeaux
What is Wireless Power Transfer (WPT)?

Position 1
Vehicle detection & recharging system in stand-by

Position 2
Vehicle is charging by passing over the recharging pad and receiving transmitted power

Position 3
Transmitted power depends upon:
- Speed
- Power unit
- Track length

Source: SAET

ITS World Congress Bordeaux
**FABRIC**

**EC Call**

| GC.SST.2013-1. Feasibility analysis and technological development of on-road charging for long term electric vehicle range extension |
|---|---|---|---|
| **Type of action** | **Project budget** | **EU Funding** | **Project Start** |
| Research & Innovation | € 9 m | € 6.5 m | January 1st, 2014 |

**Partners**

ICCS, CRF, SCANIA, VOLVO, VeDeCom (Renault), SAET, ERTICO, AMET, ATA, CEA, CIRCE, ENIDE, FKA, IREN, KTH, MECT, POLITO, QIE, SaNeF, TRL, TNO, TECNO, UNIGE-DITEN

**Activities & Status**

- Three wireless charging solutions are being developed
  - VEDECOM in France using QUALCOMM static charging pads
  - POLITO in Italy
  - SAET in Italy

---

![Image of electric vehicle charging](image-url)
Background

- Highways England published a research programme in 2014
- Prepare the SRN for future EV take up and facilitate their adoption
- Contribute to reducing GHG emissions and air pollution
- Focus is on identifying a wireless power transfer solution that could be installed under the road surface
Feasibility study:
Powering electric vehicles on England’s major roads

http://www.highways.gov.uk/knowledge/publications/1902/

ITS World Congress Bordeaux
Press release

Off road trials for “electric highways” technology

From: Highways England and Andrew Jones MP
First published: 11 August 2015
Part of: Road network and traffic

Off road trials of the technology needed to power electric and hybrid vehicles on England’s major roads are due to take place later this year.

The trials are the first of their kind and will test how the technology would work safely and effectively on the country’s motorways and major A roads, allowing drivers of ultra-low emission vehicles to travel long distances without needing to stop and charge the car’s battery.

The trials follow the completion of the feasibility study commissioned by Highways England into ‘dynamic wireless power transfer’ technologies.
Project team led by TRL
Feasibility study results

- Does the technology already exist?

  **Power:** 140kW to 200kW
  **Efficiency:** 80%-90%
  **Air gap:** Up to 30cm

Images: Scania
Feasibility study results

Power: Up to 200kW
Efficiency: 75%
Air gap: Up to 27cm

Images: DW OLEV and KAIST
ITS World Congress Bordeaux
Feasibility study results

- How much will it cost?

<table>
<thead>
<tr>
<th></th>
<th>Construction, operation and electricity costs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NPV (over 20 years, from 2010)</strong></td>
<td>£17M per km</td>
</tr>
<tr>
<td>Installation and grid connection</td>
<td>£3.9M per km</td>
</tr>
<tr>
<td>Operation</td>
<td>£1.2M per km</td>
</tr>
<tr>
<td>Electricity cost</td>
<td>£12M per km</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Environmental benefit (20 yrs)</th>
<th>% reduction</th>
<th>Monetised saving</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO₂</td>
<td>45%</td>
<td>~£2M per km</td>
</tr>
<tr>
<td>NOₓ and PM</td>
<td>35% and 40%</td>
<td>Between £100k to £1M per km</td>
</tr>
</tbody>
</table>
Could this be the future?
Thank you

Denis Naberezhnykh
Head of ULEV and ITS Technology
Tel: 01344770689
Email: dnaberezhnykh@trl.co.uk
Feasibility study results

- Can it be installed in the road?

DW OLEV / KAIST DWPT system

Modieslab – Netherlands
Feasibility study results

- Can the system be connected to the electric grid?