ELECTRIC ROADS AROUND THE WORLD

Håkan Sundelin
Senior Researcher, PhD
VIKTORIA SWEDISH ICT

- Non-profit research institute
- Owned by industry and Swedish government
- Around 70 persons and growing
- Approximately half PhD’s or higher degree
- Five application areas
  - **Electromobility**, Cooperative Systems, Sustainable Business, **Sustainable Transport**, Digitalization strategy
ELECTRIC ROAD SYSTEM
A SYSTEM-OF-SYSTEMS

Vehicle system
Transportation System
Power Transfer system
Energy system
Safety and control System
Payment system
DIFFERENT SOLUTIONS

Conductive, overhead line

Conductive, rail

Inductive, wireless
DIFFERENT CHALLENGES
(SUMMARY OF OPINIONS)

- No in-road installation
  - High efficiency
- Multimodal
  - High efficiency
- No visual pollution

- Visual pollution
- Safety
  - In-road installation
- Expensive infrastructure
  - In-road installation
DYNAMIC POWER TRANSFER

Commercial actors
BOMBARDIER

MANHEIM, Germany
80m test track
Research project Slide-in

Concept:
Inductive (10cm, 183kW, 89%, +/- 10cm)
HÄLLERED, Sweden
400m test track
Research project Slide-in

Concept:
Conductive (120kW, 93.3%, +/- 50 cm)
ELWAYS

ARLANDA, Sweden
350m existing test track
2km public demo (Q3 2017)

Concept:
Conductive
OLEV TECHNOLOGY

GUMI, South Korea
Bus in operation (144m, 2 vehicles)
Research originates from KAIST
Concept:
Inductive (27cm, 20-200kW, 74-83%, +/- 20cm)
DYNAMIC POWER TRANSFER, COMMERCIAL ACTORS

Inductive
- Bombardier
- OLEV
- IPT Technology (Conductix Wampfler)
- Qualcomm (Halo IPT)
- WAVE

Conductive
- Alstom
- Siemens
- Elways
- El-on-road
DYNAMIC POWER TRANSFER

Research
FABRIC

Feasibility analysis and development of on-road charging solutions for future electric vehicles

Italy

TORINO, Italy
260m test track under development
Testing planned to start Q2 2016
SAET (Inova lab) and POLITO, FIAT
Concept:
Inductive (25cm, 20-100kW, 70-80%, +/- 50cm?)

France

SATORY, France
100m test track under development
Qualcomm (Halo IPT), Renault
Concept:
Inductive (12.5-17.5cm, 20-40kW, 80%, +/- 20cm)
MALAGA, Spain
100 m dynamic with 8 coils (80cm)
12.5m between each coil
Test starting in Q1 2016
Part of ”Smart City Malaga” led by Endesa

Concept:
Inductive (15-25cm, 50kW, 85%, +/- 30%)

Gulliver U520, 5.3 m
Self-guided control

Static/Static on route inductive charging
100 m Dynamic inductive charging
Static/Static on route inductive charging

Gulliver U520, 5.3 m
Self-guided control
WAVE is a spinoff from USU

LOGAN, UTAH, USA
Demo 20-passenger bus, 2016 Q2
New research facility (2-3 M$)
Concept:
Inductive (25-35cm, 25-40kW, 90%, +/- 20cm)
FEASIBILITY STUDY OF INDUCTIVE ERS

GOAL
"To identify a dynamic Wireless Power Transfer system that sits beneath the motorway surface that will provide a continuous power transfer to the electric vehicle, whether it is a car, LGV/HGV or coach whilst moving on the strategic road network."
DYNAMIC POWER TRANSFER, RESEARCH

FABRIC
Highways England
UTAH STATE UNIVERSITY
Project Victoria (ENDESA)
Project SLIDE-IN Inductive /Conductive
KAIST
INTIS
NREL
Project ELinGO (SINTEF)
A TECHNOLOGY GAINING MOMENTUM

Federal Ministry for the Environment

Highways Agency

Statens vegvesen

TRAFIKVERKET

Project Victoria

endesa

NREL

South Coast AQMD

KAIST OLEV

fabric

Swedish ICT

VIKTORIA
EXPECTED STATE THE ART - 2017

Extent of use

Component test  System test  Public road test  Closed System  Open System

ElonRoad  SAET  Qualcomm  Utah State University  Bombardier  Alstom  Victoria  Elways  Highways England  Siemens  OLEV

Commercial operation
ERS – CLOSED SYSTEM
ERS – CLOSED SYSTEM

- Vehicle system
- Transportation system
- Power transfer system
- Energy system
- Safety and control system
- Payment system
ERS – OPEN SYSTEM

- Vehicle system
- Transportation system
- Power transfer system
- Energy system
- Safety and control system
- Payment system
MOST LIKELY APPLICATIONS OF OPEN SYSTEMS

• Metropolitan deployment for busses
• International freight corridors
• Long-haul national freight corridors
• Short-haul freight corridors

Reference: FABRIC
CHALLENGES AHEAD

Extent of use

Component test  System test  Public road test  Closed System  Open System

ElonRoad  SAET  Qualcomm  Utah State University  Bombardier  Alstom  Victoria  Elways  Highways England  Siemens  OLEV

Commercial operation
CHALLENGES AHEAD

- System integration of subsystems
  - Test and demonstration of closed system
- Interoperability and validation of interfaces
  - Commercial pilot of limited open system
Håkan Sundelin
Senior Researcher, PhD, Electromobility

Viktoria Swedish ICT AB

📞 +46 730 278 493
✉️ hakan.sundelin@viktoria.se
WWW.VIKTORIA.SE