Session highlights/1

- **“Feasibility analysis and development of on-road charging solutions for future electric vehicles”,** Short overview of the FABRIC project’s objectives, techical activities and expected results.
  Angelos Amditis, ICCS, Greece

- ***“Impact of dynamic EV wireless charging on the grid”:*** Simulation environment for assess the impact of dynamic wireless charging on the grid, evaluate energy storage requirements for demand smoothing and explore the possibility of integrating solar energy into the dynamic wireless charging infrastructure.
  Paolo Guglielmi, Politechnico di Torino, Italy

- **“Towards new infrastructure materials for on-the- road charging”: s**tudy of potential materials, construction and maintenance aims to give developers more awareness of the necessity and potential cross-coupling benefits from interdisciplinary collaboration, by taking the road infrastructure research into the concept development of E-Roads.
  Feng Chen, KTH, Sweden

- “***Standardisation framework on Wireless Power Transfer systems***”: Overview of standardisation activities in the field of inductive charging for electric vehicles.
  Giampiero Brusaglino, ATA, Italy

Session highlights/2

- ***"Operational requirements for dynamic wireless power transfer systems for electric vehicles"*:** Provisional outputs from FABRIC project on road operator and power distribution system operator requiremenets.
  Theodoros Theodoropoulos, ICCS, Greece
- ***"Electromobility: a market readiness study - Preliminary findings"***: Current electromobility status and preliminary results of a market readiness survey for charging systems that was conducted within FABRIC IP.
  Yannis Damousis, ICCS, Greece

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

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

TS3.7 Towards wireless dynamic charging: Challenges and Prospects

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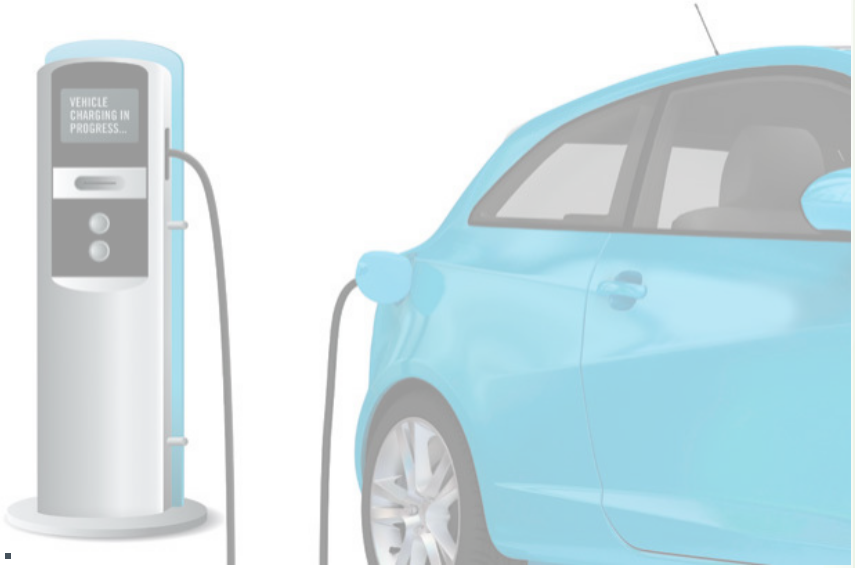
Contents

1. Roadblocks for large scale electromobility adoption;
2. ITS solutions facilitating electromobility;
3. Charging technology trends – why go wireless?
4. The FABRIC project concept and solutions;

Roadblocks for large scale electromobility adoption

EVs as percentage of the whole fleet:

- France 0.83%
- US 0.62% (96000 sold in 2013)
- Japan 0.59%
- Germany 0.25% (7400 sold in 2013)



Current penetration of EVs very small.

Reasons:

- Weight and size of batteries.
- Cost of battery manufacturing.
- EV price premium over conventional vehicles.
- Small or non-existent charging infrastructure network.
- Long duration of charging.
- Plugging the EV in is not a user friendly experience.

Solutions:

- ITS
- Novel charging technologies

ITS solutions facilitating electromobility

- Accurate range estimation allows for “range anxiety” reduction and efficient trip planning.
- Cooperative ITS allow for robust traveling via re-routing, e-call, infrastructure pre-booking (charging stations, parking spots…).
- ITS functions such as automatic identification, authorization and accounting improve user convenience.
- Accurate and dependable charging infrastructure POI and maps combined with pre-booking and dynamic trip planning potentially allow the use of smaller batteries.
- ITS facilitate the implementation of new charging technologies (e.g. dynamic charging).

Charging technology trends – why go wireless?

Present → Future

Plug-in static		Conductive dynamic		Inductive dynamic	
Cons	Pros	Cons	Pros	Cons	Pros
User discomfort	Mature technology	Visual pollution	Easy installation	Expensive infrastructure	Smaller batteries
Long charging duration		Expensive pantograph systems	Smaller batteries		Cheaper EVs
Large and expensive batteries			Extended range		Extended range
Expensive EVs			Comfort		Comfort
Vehicle must be parked			Increased mobility		Increased mobility
					No visual pollution

The FABRIC project: Facts

Coordinator

Angelos Amditis,
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Duration	48 Months
DG / Unit	Research and Innovation
Budget	9 M€
Funding	6.5 M€

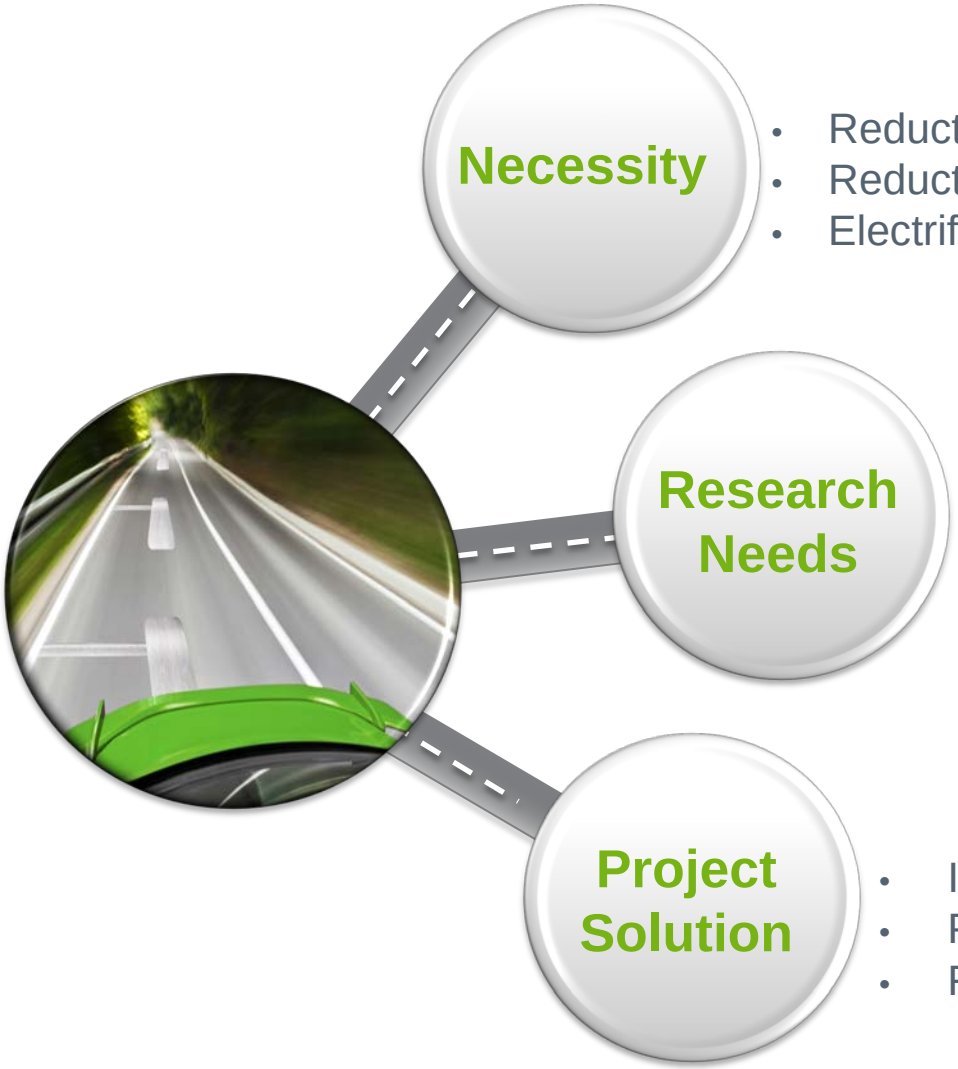
This project has received funding from the EU's FP7 for research, technological development & demonstration under GA no 605405

Consortium

Supported by:

www.fabric-project.eu

Project motivation



- Reduction of greenhouse air pollutants.
- Reduction of fossil fuel usage in transport.
- Electrification of transport.

- Longer EV range.
- Wireless dynamic EV charging feasibility analysis.
- A priori lifecycle impact & feasibility assessment of large scale electromobility deployment.

- Infrastructure adaptation.
- Prototypes testing.
- Feasibility studies.

Vision

Large-scale adoption of pure **Electric Vehicles (EVs)** in future transportation systems through **Advanced on-road charging solutions** to improve:

- driving range and battery lifetime; energy efficiency and price of the Full Electric Vehicles (FEV), given the need for a smaller battery.

Objectives

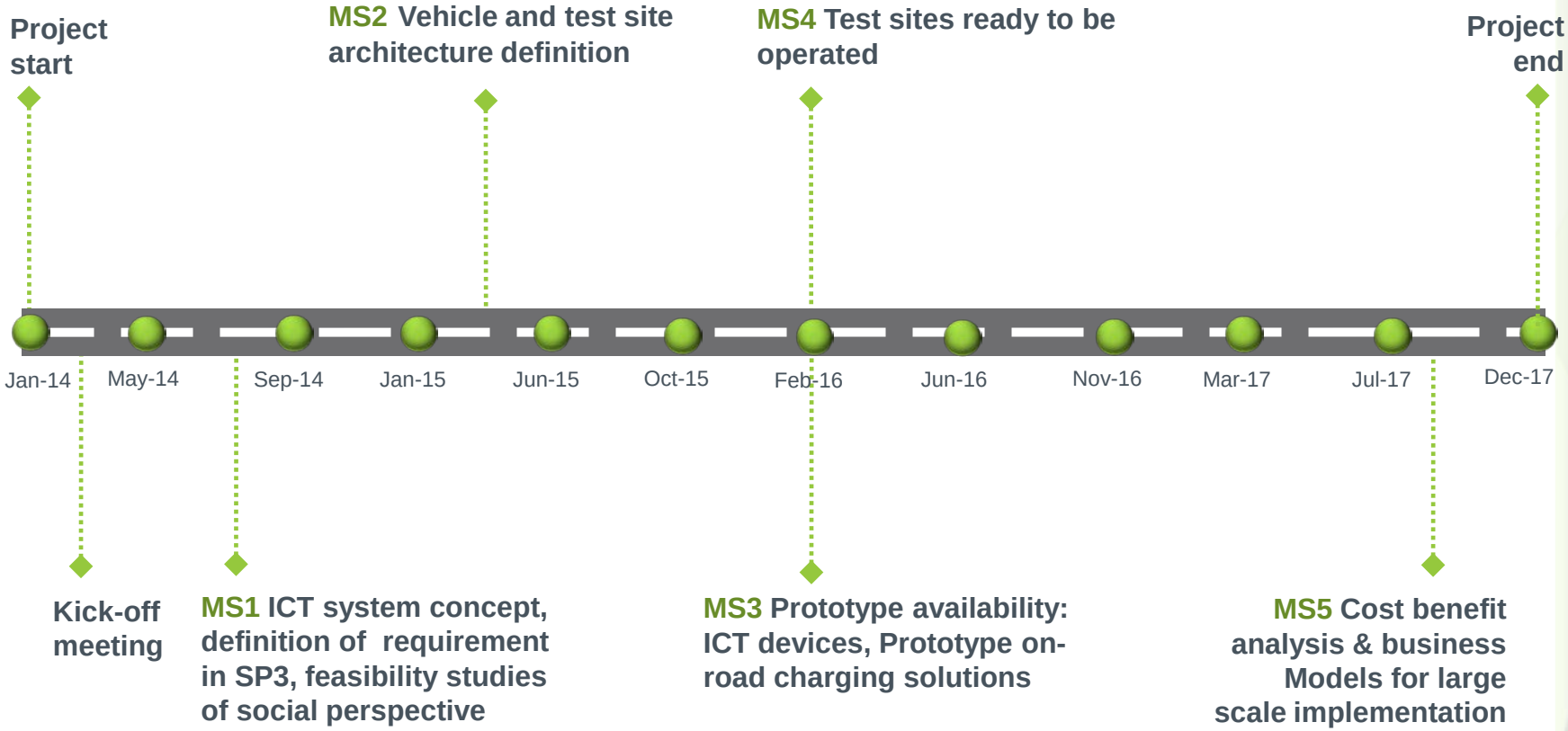
The project's specific technological objectives are to:

Development & evaluation of advanced ICT & wireless EV charging solutions at test sites in Italy, France and Sweden;

Specifications for integration with road & grid infrastructures and guidelines for authorities and policy makers;

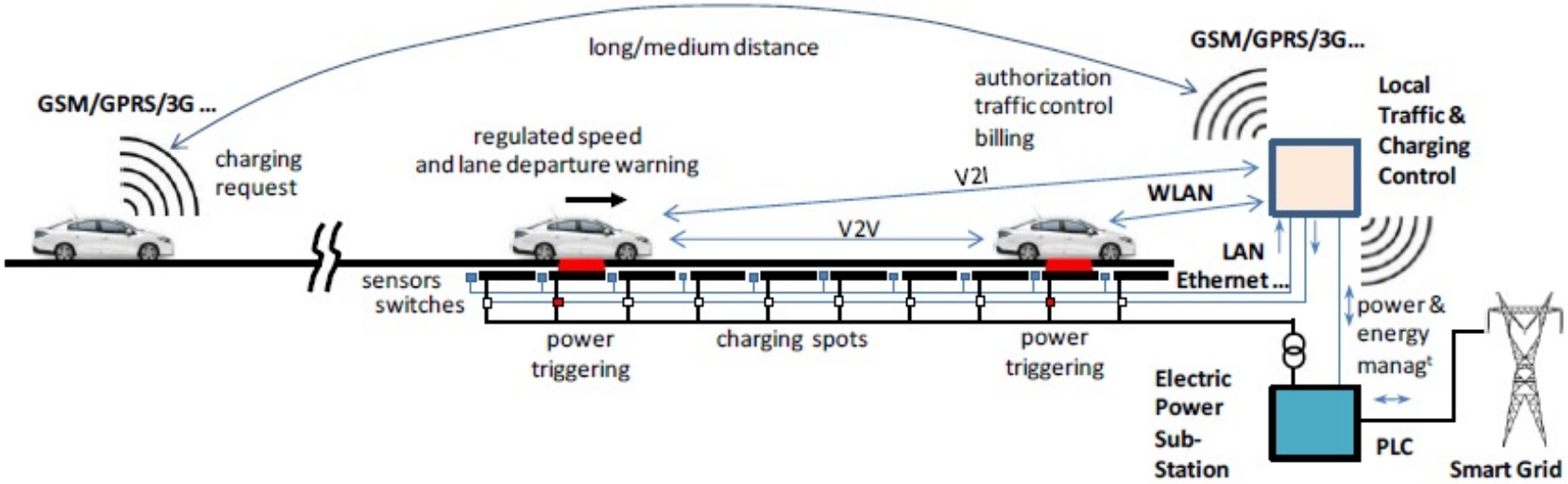
Long-term socioeconomic impact & feasibility studies for large-scale electromobility implementation;

Timeline and Milestones

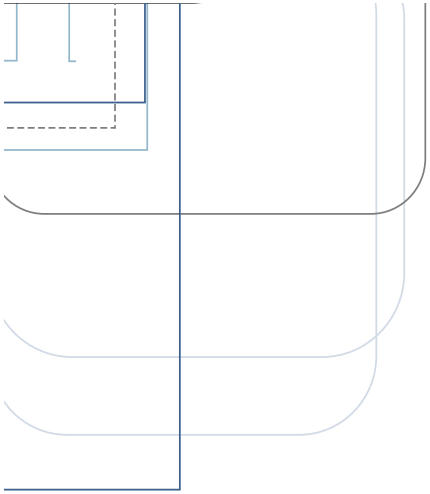


Concept

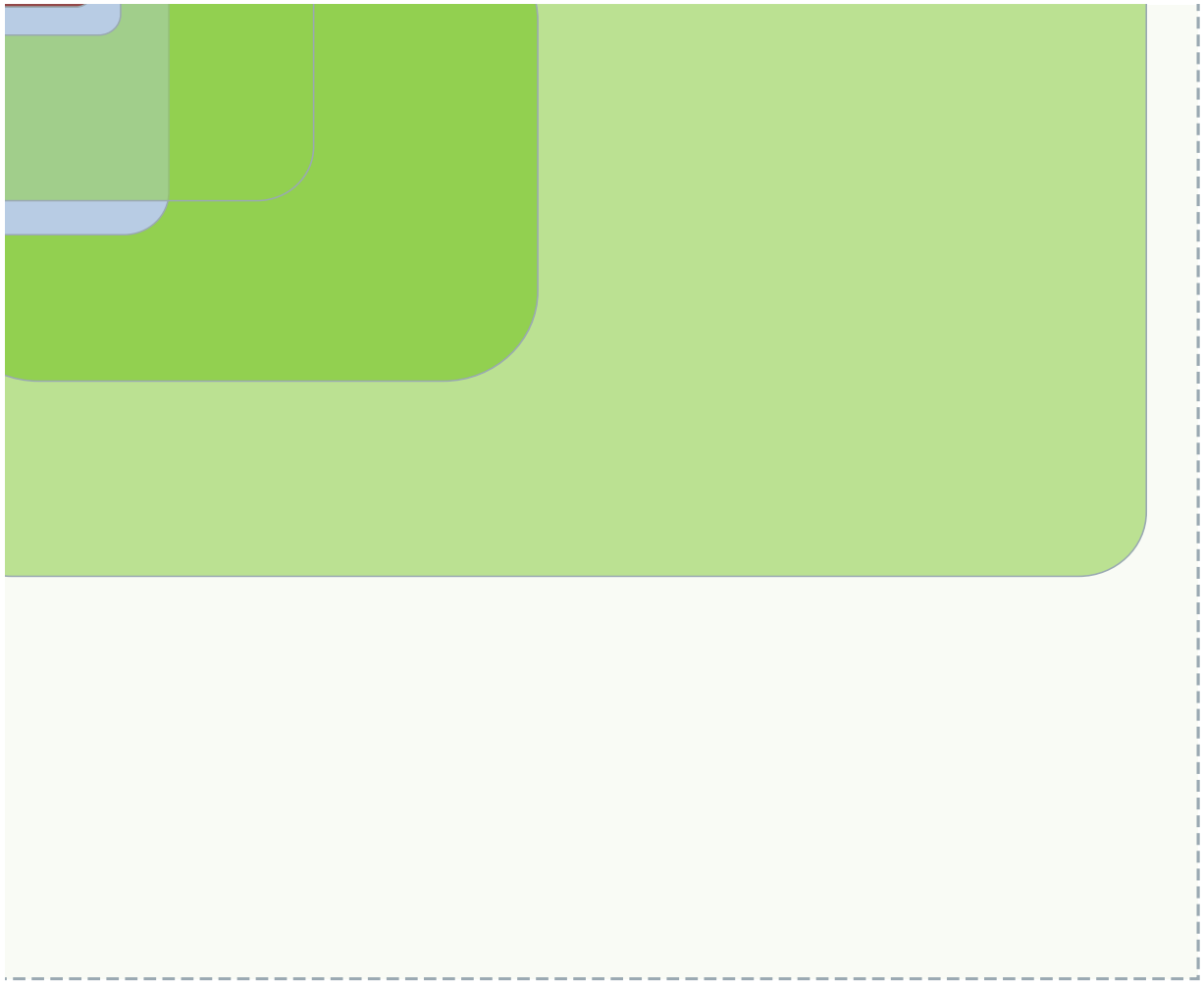
Assessment of wireless charging solution technological feasibility and market readiness at both component and system levels.



FABRIC preliminary ICT architecture



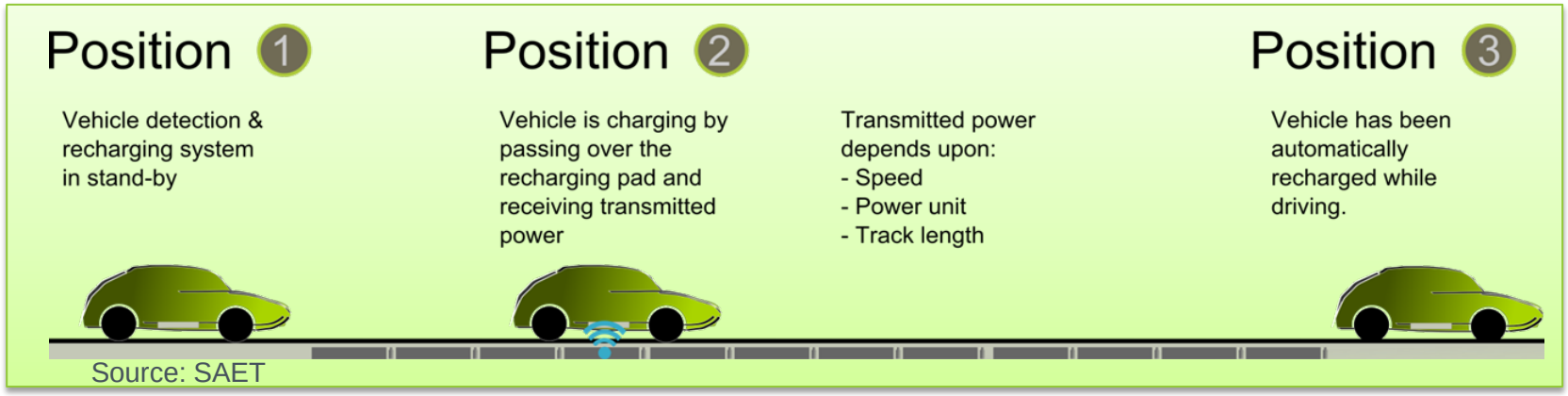
FABRIC preliminary ICT architecture - OBU



FABRIC preliminary ICT architecture-cnt.

Pilot activities: Italy

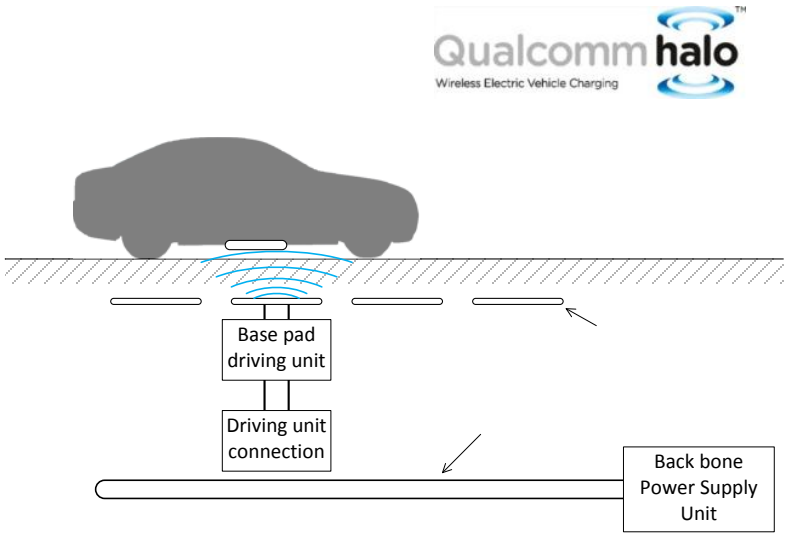
- Development of dynamic charging prototype no1 – Italy (POLITO, CRF)
  - 200m test track, 20m long coils, 20kW
- Development of dynamic charging prototype no2 – Italy (SAET)
- 50m, 10-150kHz load-resonant power frequency



Source: SAET

Pilot activities: France

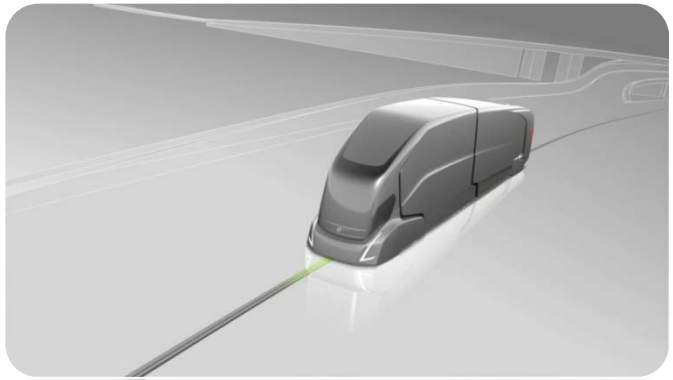
- Development of dynamic charging prototype no3 – France (QUALCOMM, VEDECOM)
  - 100m test track, QUALCOMM charging pads in series, 85kHz, >20kW



QUALCOMM solution @ Satory test site

Pilot activities: Sweden

- Volvo test site in Hällered;
- Test track for conductive electrical road tests (DC 750V).
- Test track is 435m long, electrified part of the track is 275m.



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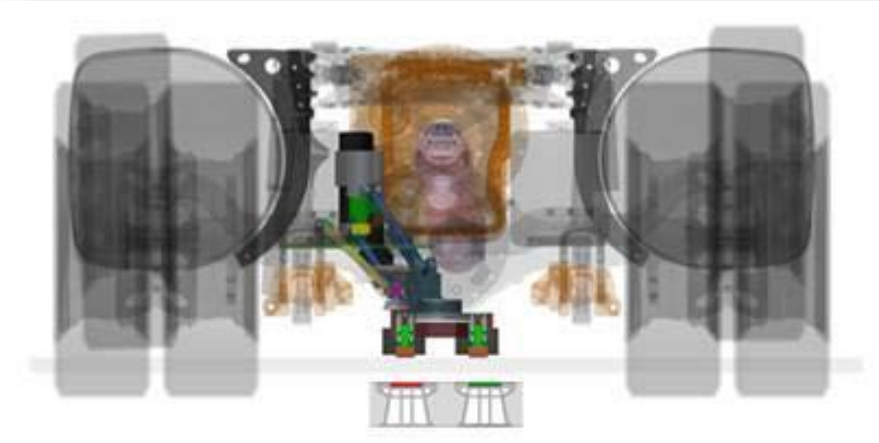


Focus on technology: Vehicle

SAFETY

Must Meet Standards

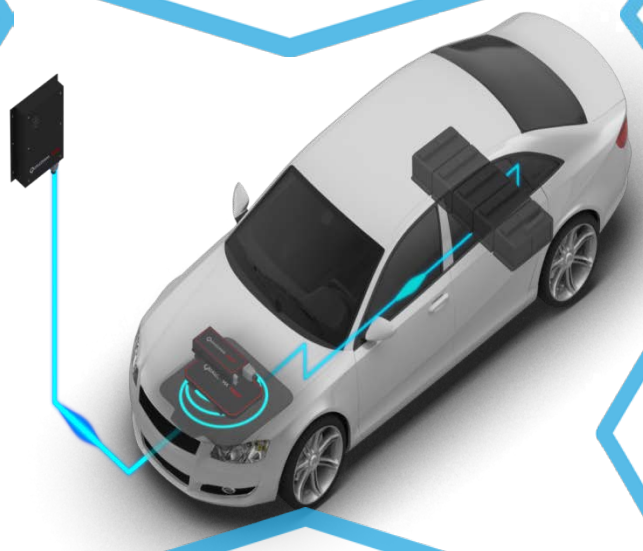
- Foreign Object Detection
- Living Object Protection

SYSTEM DESIGN

- Standards
- Efficiency
- Cost

ON BOARD SYSTEM

- Charging management
- Authorization, authentication
- HMI



COEXISTENCE

Must Not Interfere With Other Systems

- On Vehicle
- Implantable Medical Devices, etc.

EASE OF USE

Tolerant to Misalignment

- Without the need for expensive & slow automatic parking or alignment technology;
- While still being compliant to regulatory framework;

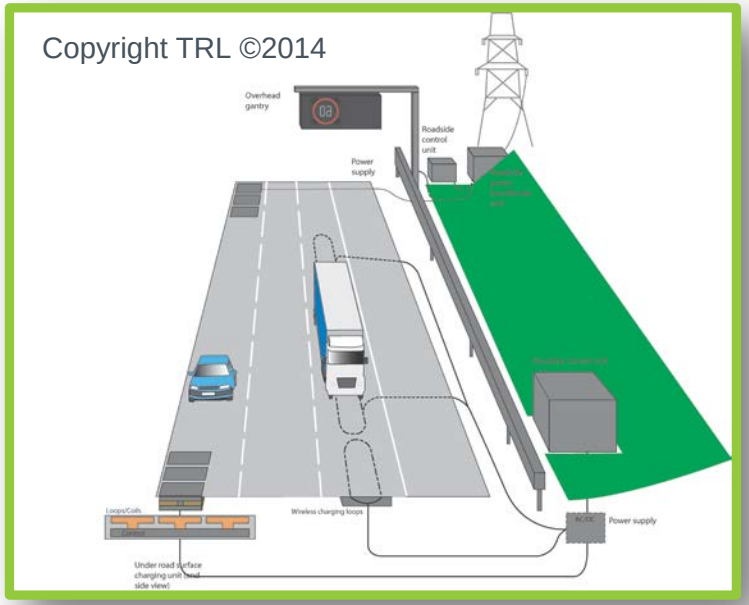
GRID INTERFACE

- Efficiency
- Interoperability
- Compatibility

Source: QUALCOMM

Focus on technology: Infrastructure

- Road infrastructure adaptation for electrification;
- Electric grid integration;
- ICT technologies for:
  - Navigation, alignment;
  - Authentication, authorization;
  - Charging management, billing.



Source: KAIST

Expected outcome 1/2

- **ICT solutions**
  - Prototypes of on-board, off-board units for driver assistance, charging management, billing.
- **Charging solutions**
  - Assessment of various technologies and integration in an integrated wireless charging environment.
- **Road infrastructure**
  - Guidelines for installation and maintenance of e-roads.
- **Grid infrastructure**
  - Analysis of current infrastructure and guidelines for wireless charging schemes.
- **Prototype vehicles**

Expected outcome 2/2

- **Global assessment**;
- **Cost-benefit analysis and business models** of large-scale deployment of on-road charging;
- **Environmental life-cycle assessment** & scenario **analyses** for achieving environmental targets;
- **Contribution to standards**;
- **Feasibility study** on societal perspectives towards on road charging

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

Thank you!

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