EUCAR Program Board
Sustainable Propulsion

FABRIC IP

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Project general information

Project full title:	Feasibility analysis and development of on-road charging solutions for future electric vehicles
Coordinator:	Dr. Angelos Amditis, ICCS
Project major partners:	23 partners (9 EU Countries) among them CRF, VOLVO, SCANIA, VEDECOM/RENAULT, ERTICO, TRL, KTH
Starting Date:	01/01/2014
Ending Date:	31/12/2017
Budget Total/Funding:	9 MEUR / 6.5 MEUR
Type of project:	IP

Motivation / objectives / milestones

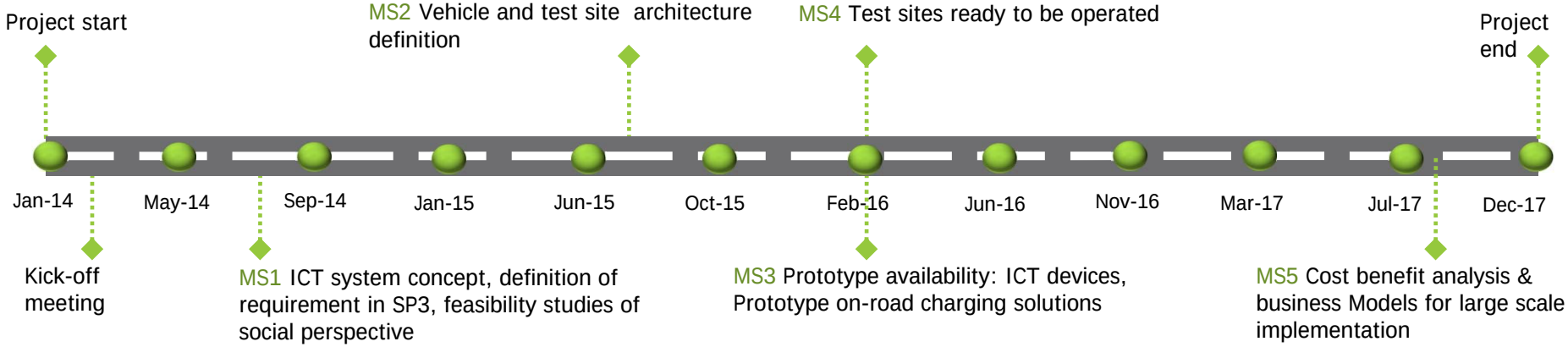
Motivation

- *Necessity: Decarbonization of transport, large scale deployment of electromobility, impact and investments assessment necessary.*
- *Research Needs: Longer EV range, feasibility studies on wireless dynamic EV charging.*
- *Project Solution: Feasibility studies, infrastructure adaptation guidelines, prototypes testing.*

Objectives

- *Development and testing of advanced ICT and charging solutions*
- *Sustainable integration with road and grid infrastructures specifications*
- *Long-term socioeconomic impact and feasibility studies for large scale electromobility implementation.*

Milestones plan

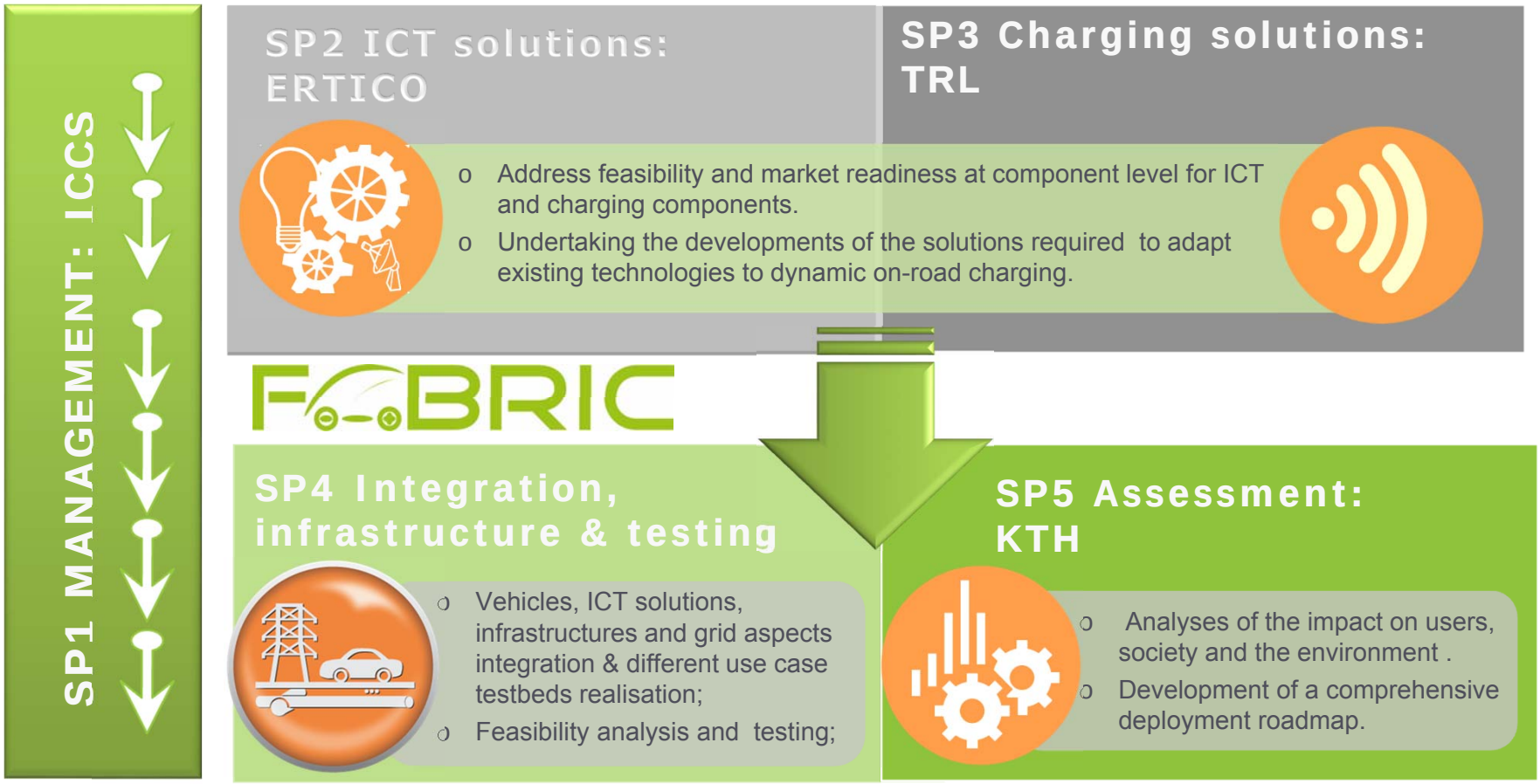


Status report on progress and deliverables

- *Currently on M10; On time*
- *No EC review yet*
- *Main results so far:*
  - *Technical benchmarking of charging solutions*
  - *Use cases*
  - *Definition of supported charging modes-towards universal definitions*
  - *Requirements (road authorities, vehicle manufacturers, DSOs, etc.)*
  - *Market readiness study*
- *Discussions with ecoFEV, liaison with UNPLUGGED, creation of "External Reference Group"*
- *Effort to establish technical cooperation with worldwide solution providers (KAIST, Witricity, USU WAVE, Oakridge National Lab, Bombardier, ALSTOM)*

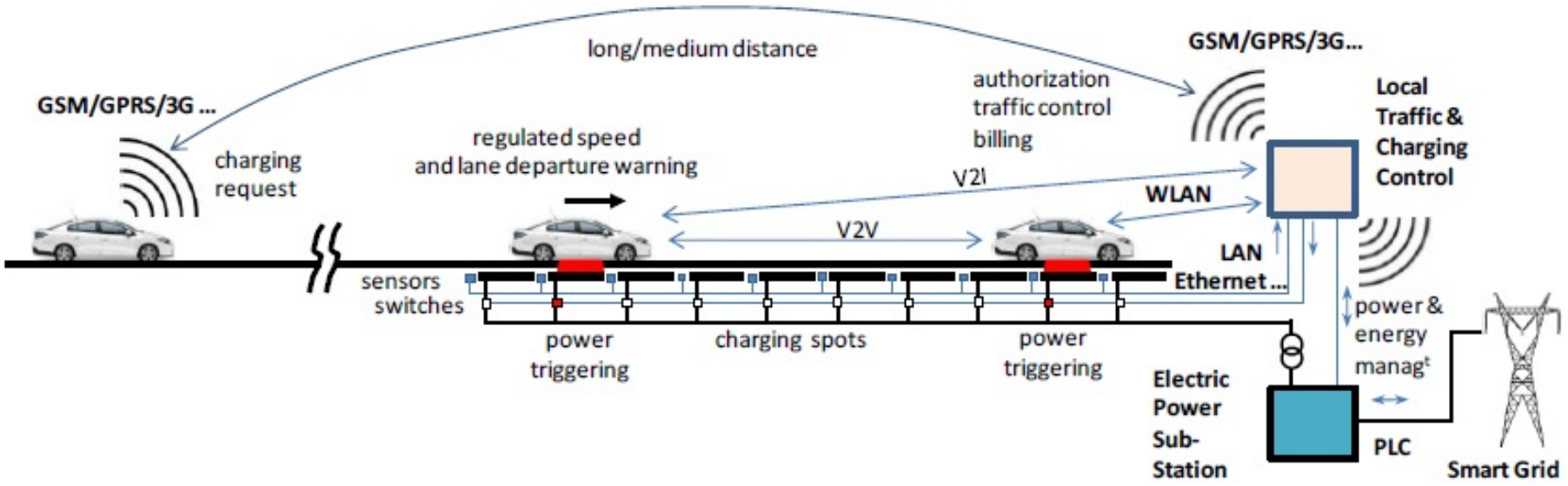
Main technical activities

- *FABRIC structure*



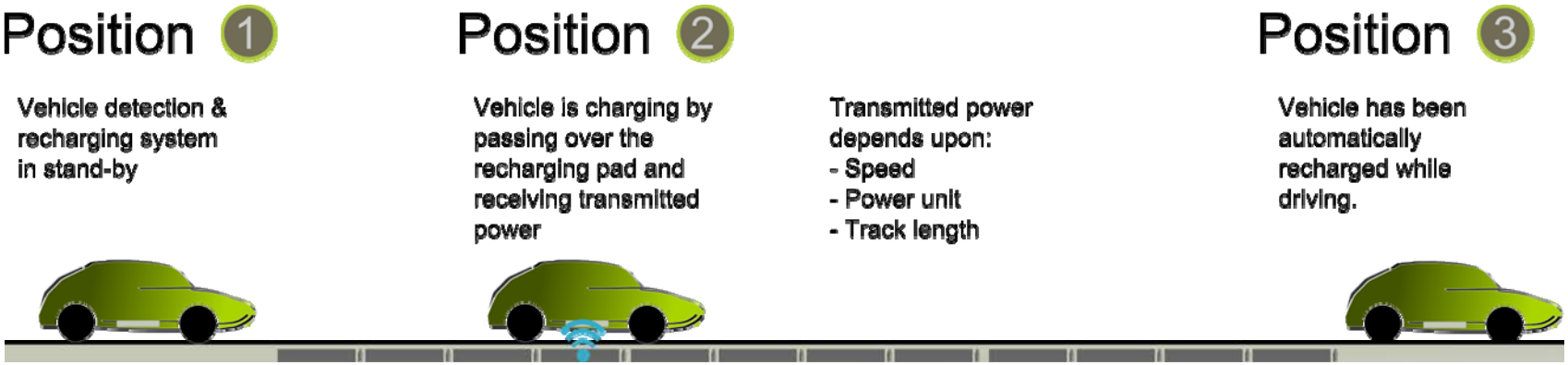
Main technical activities

- *Assessment of the technological feasibility and market readiness at component level for ICT and EV wireless charging components*



Main technical activities

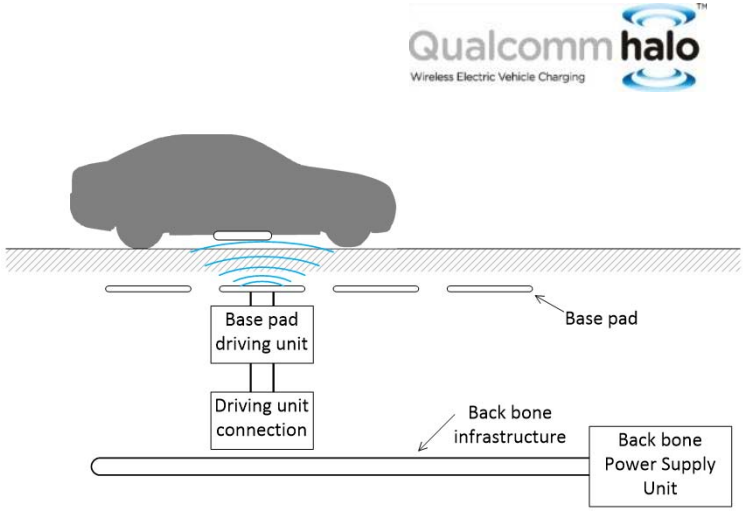
- *Development of dynamic charging prototype no1 – Italy (POLITO, CRF)*
  - *200m test track, 20m long coils, 20kW*
- *Development of dynamic charging prototype no2 – Italy (SAET)*
  - *50m, 10-150kHz load-resonant power frequency*



Source: SAET

Main technical activities

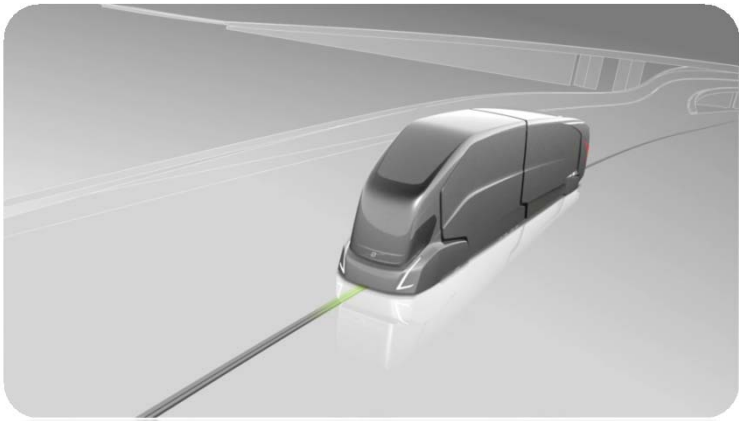
- *Development of dynamic charging prototype no3 – France (QUALCOMM, VEDE[IFSTTAR, RENAULT, PSA PEUGEOT CITROËN, IFP Energies nouvelles, ParisTech, INTEMPORA])*
  - *100m test track, QUALCOMM charging pads in series, 85kHz, >20kW*



QUALCOMM solution @ Satory test site

Main technical activities

- *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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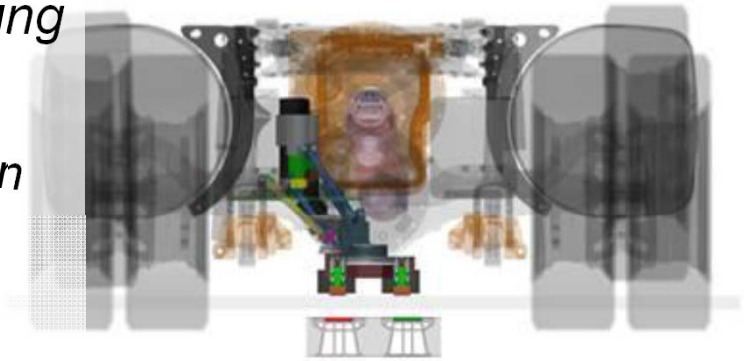
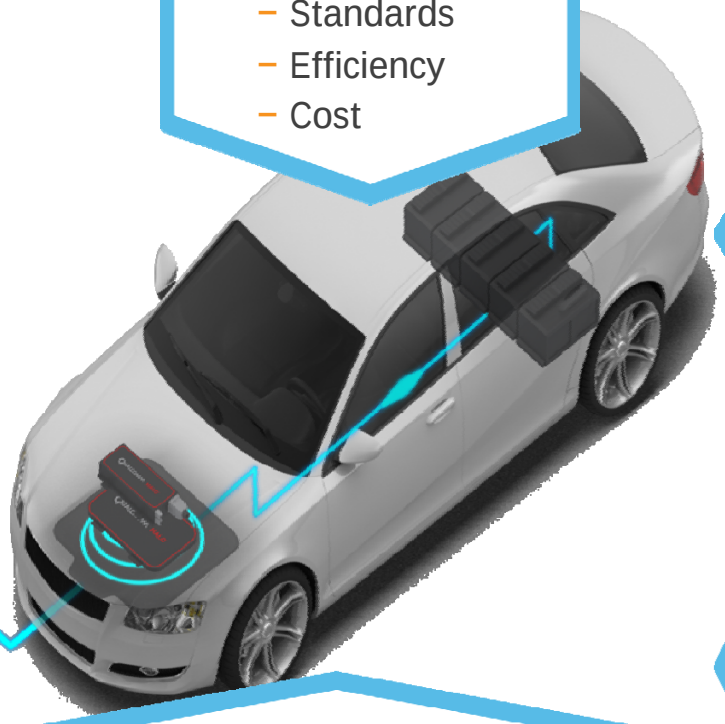
- *Technology evaluation results*
- *Demo of the track and system*
- *EM emissions measurements*
- *Conductive charging technology benchmarking*
- *Preliminary tests*
  - *expected power transfer efficiency verification*
  - *electro dynamic forces*
  - *electric circuit dynamics*
  - *overvoltage/under voltage dynamics*



Main technical activities

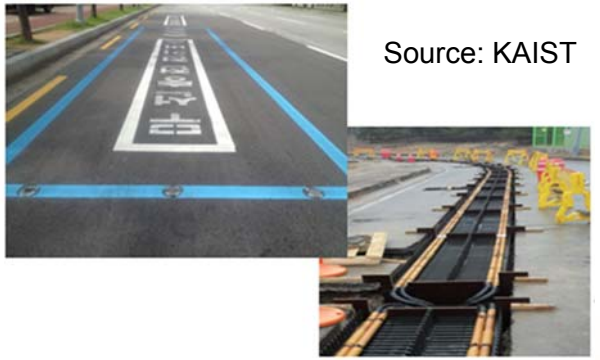
Source: QUALCOMM



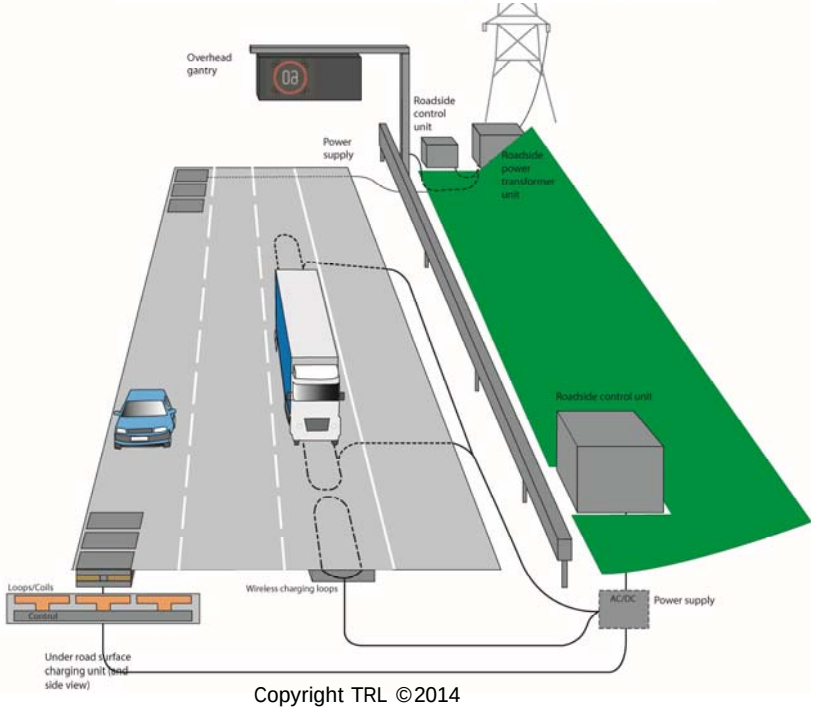
- SYSTEM DESIGN –
  - Standards
  - Efficiency
  - Cost
- SAFETY – Must Meet Standards
  - Foreign Object Detection
  - Living Object Protection
- PACKAGING – Volume and Weight
  - Flexible design for multiple vehicle configurations
- COEXISTENCE – Must Not Interfere With Other Systems
  - On Vehicle
  - Implantable Medical Devices, etc.
- EASE OF USE – Tolerant to Misalignment
  - Without the need for expensive and slow automatic parking or alignment technology
  - While still being compliant to regulatory framework
- COMPLIANCE – RF to Regulatory Framework
  - Varying vertical gaps and power transfers

Main technical activities

- *Road infrastructure adaptation to create “electric roads”*
- *Interfacing with the Grid and grid infrastructure adaptations at the test sites*
- *Thorough assessment framework*
  - System-level
  - Impact on Energy efficiency
  - Safety
  - Operation Management
  - Road Infrastructure
  - Vehicle technology



Source: KAIST



Next steps, future activities

- *Major activities (2015)*
  - *Architecture and specifications for wireless dynamic charging (ICT and in-vehicle)*
  - *Grid and road adaptations specifications and implementation*
  - *Feasibility study societal perspectives towards on-road charging*
- *Risks*
  - *Cooperation with external suppliers*
  - *Small funding for ICT tools*
- *Challenges*
  - *Short range V2I communication*
  - *load balancing in real time,*
  - *object detection*
  - *unobtrusive and efficient user interfacing*

Expected final results: exploitation and impact

- *Main benefits/final results*
  - *hands-on experience in developing on-road EV charging systems,*
  - *development prototype EVs with wireless stationary and dynamic charging capabilities,*
  - *study of the EM safety aspects,*
  - *experience in the connection with the grid and road infrastructures*
  - *feasibility study for the long term implementation of dynamic charging solutions*
- *How will these results be used?*
  - *industry/OEMs: manufacturing of future EVs, development of commercial wireless charging solutions*
  - *City/ grid planning authorities: adaptation of existing infrastructure (road, energy), guidelines for: i) large scale electromobility deployment , ii) development of future infrastructure*

Expected final results: exploitation and impact

- *Impact on future R&D and choice of technology paths*
  - *Feasibility study to provide answers ….(Feasible? Socially accepted? Implications? Sustainable? Cost-effective? Efficient? Optimum?)*
  - *Smooth integration with the grid (towards smart cities)*
- *Implications on technology choices*
  - *Revolutionalise charging of FEVs*
  - *Boost electromobility*

New research issues

- *Further research needs for H2020:*
  - *Dynamic wireless charging equipment*
  - *Standardization/interoperability (IEVC 2014)*
  - *Grid design*
  - *Connected EVs and seamless large-scale multicriteria energy management*
- *Still in R&D phase: TRL 4-5*
- *Support from EUCAR*
  - *Liaison activities with other groups and projects of EUCAR*
  - *Support in creating research and deployment roadmaps on wireless charging*

Overall comments and conclusions

- *Initiative of strategic importance for increased penetration of electromobility*
- *Strong connections with developers of similar worldwide prototypes*
- *Need for research and deployment roadmaps*

FABRIC should be seen as a first European effort to test wireless charging prototypes and to study the long term feasibility of such solutions

More research is needed