Optimizing Grid to Vehicle electric energy system with new technologies

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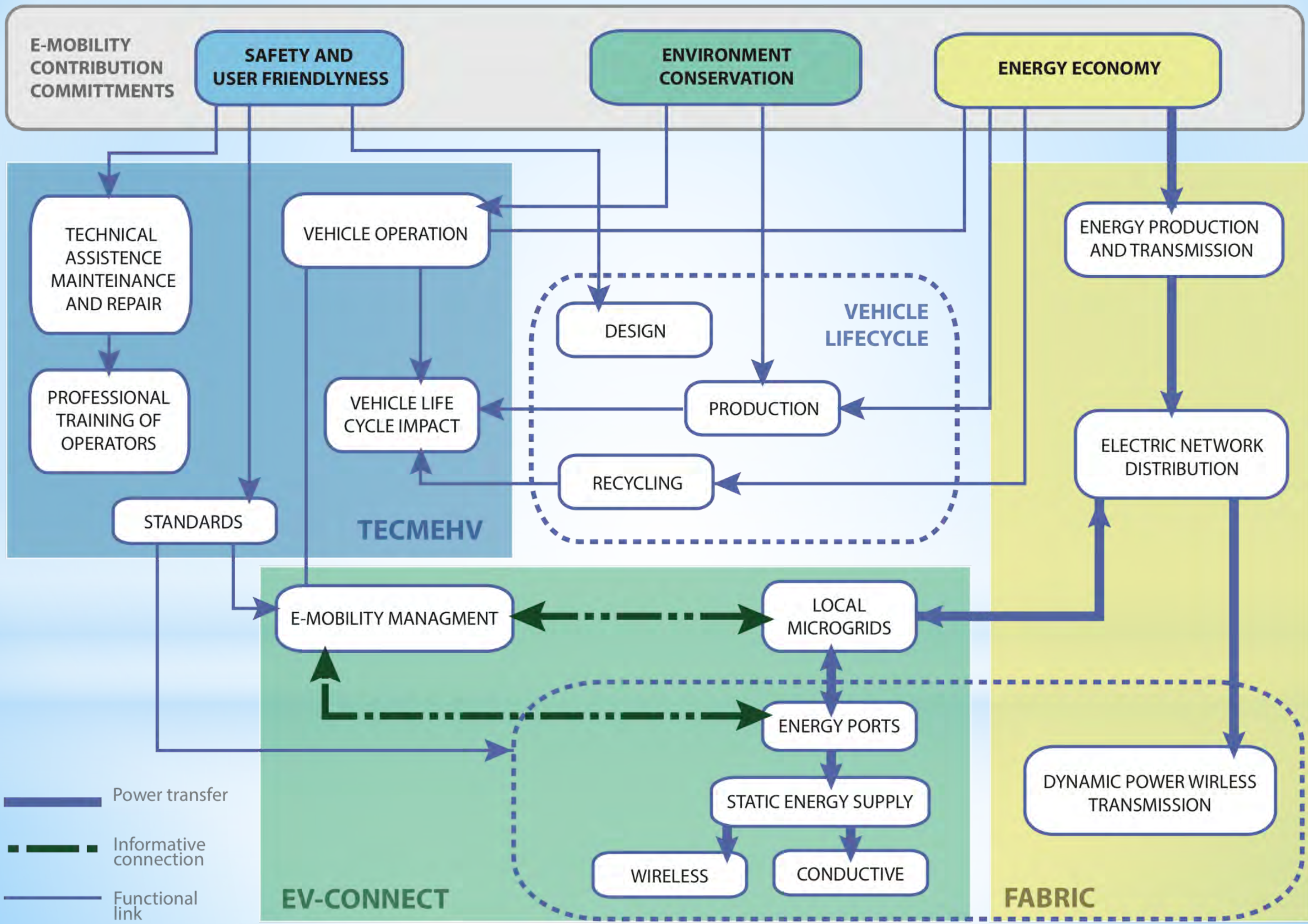
ICCPE 2015

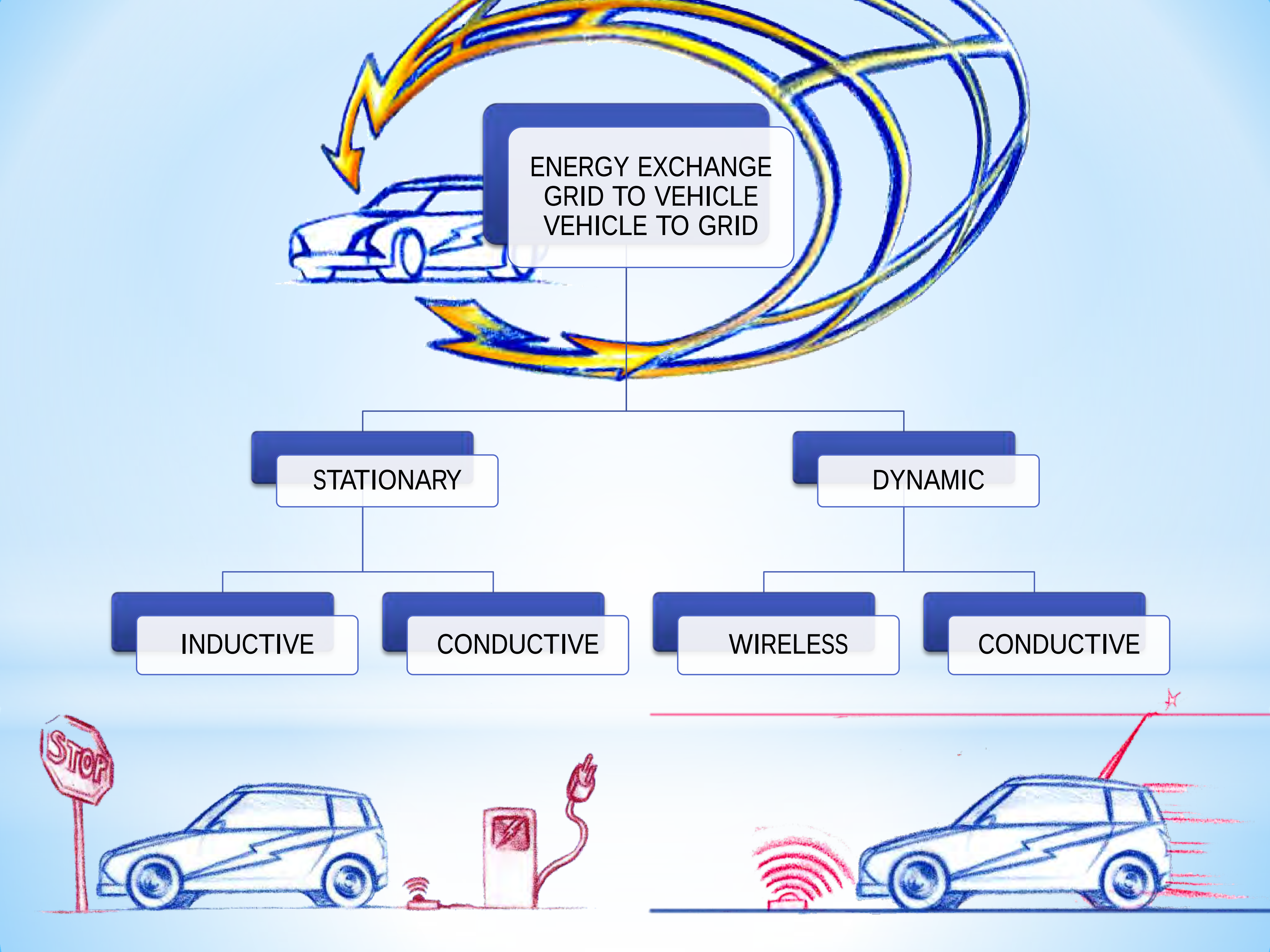
Taormina, 16 – 18 June, 2015

Content

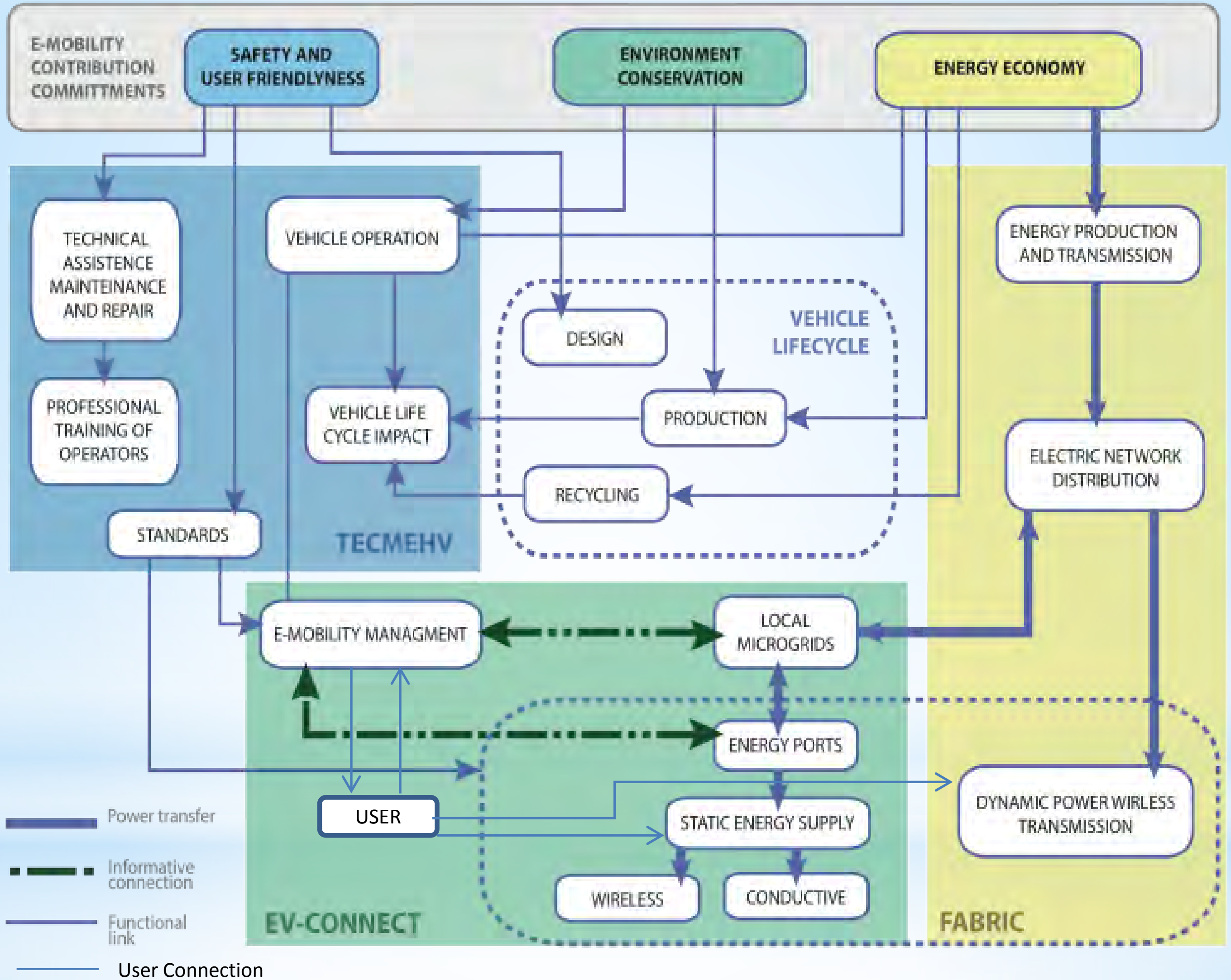
- The impact of electric mobility on the social issueselectric vehicle impact to energy and mobility
- Service and integration with electric network
- Vehicle–grid interaction
- Interactive system User – Grid
- Static charging systems
- Dynamic charging
- Standards for Vehicle – Infrastructure interaction
- Conclusion

Impact of externally chargeable electric vehicles on energy and mobility




ENERGY EXCHANGE
GRID TO VEHICLE
VEHICLE TO GRID
STATIONARY
DYNAMIC
INDUCTIVE
CONDUCTIVE
WIRELESS
CONDUCTIVE
STOP

Human Interaction in Electric Vehicle operation

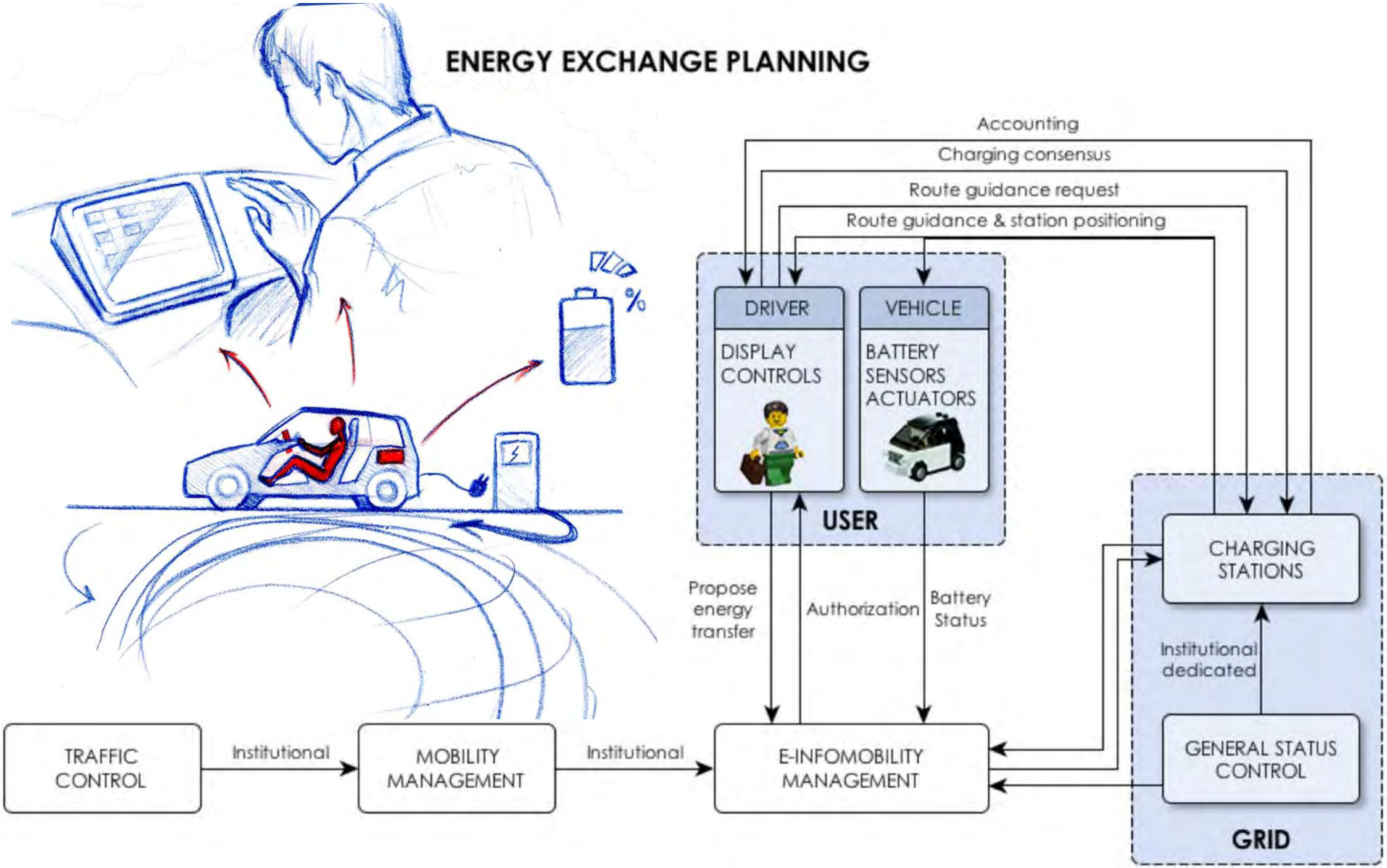


Grid to Vehicle Power Transfer

Cooperative Functions

Route guidance to energy supply station
Assisted driving approach

Lateral &
Longitudinal control


ENERGY EXCHANGE PLANNING
Accounting
Charging consensus
Route guidance request
Route guidance & station positioning
DRIVER
DISPLAY
CONTROLS
VEHICLE
BATTERY
SENSORS
ACTUATORS
USER
CHARGING
STATIONS
Propose
energy
transfer
Authorization
Battery
Status
Institutional
dedicated
GENERAL STATUS
CONTROL
GRID
TRAFFIC
CONTROL
Institutional
MOBILITY
MANAGEMENT
Institutional
E-INFOMOBILITY
MANAGEMENT

Vehicle – Infrastructure System Development Road Map

Strategical location of the energy supply points and ICT network
A study of the European Project EV-CONNECT for the addressing actions

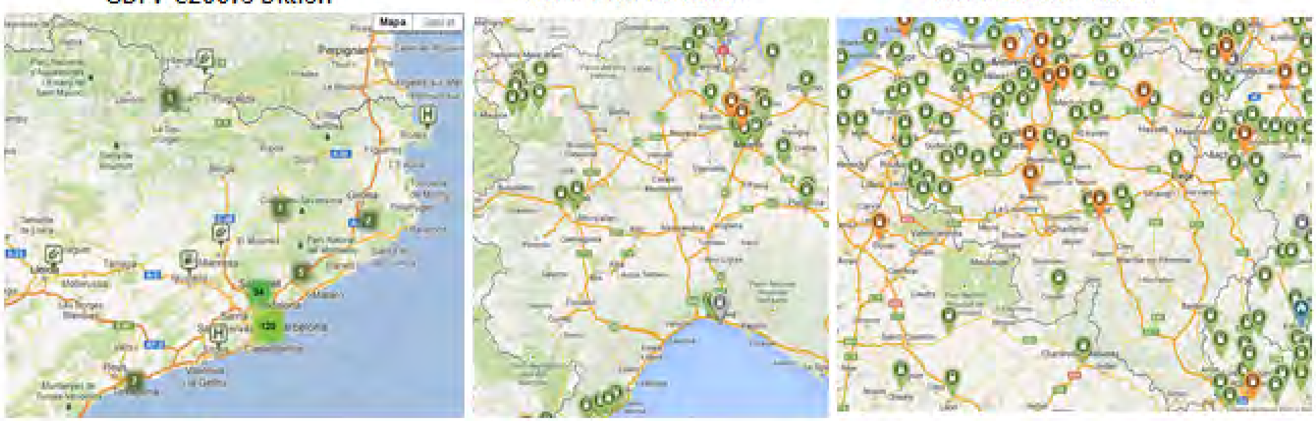
Roadmap focus

Focused on 3 different regions... The geographic scope will then be extended

Catalonia
Area: 32,106.5 km²
Census: 7,539,618
GDP: €200.3 billion

Piedmont
Area: 25,402 km²
Census: 4,646,251
GDP: €127.0 billion

Belgium
Area: 32,106.5 km²
Census: 11,099,554
GDP: €353.6 billion



Catalonia Piedmont Belgium

EV CONNECT roadmap

EUROPEAN COMMISSION
Enterprise and Industry

www.ev-connect.eu

Interface technology: Inductive Energy Transfer

Inductive coupler
(Hughes Power Control System)

The European Mandates for Interaction Vehicle - Infrastructure

Mandate 246 EU/EFTA to CEN, CENELEC, for coordination of Standards and actions for an Infrastructural System to assure the safe charging of the electric vehicles in the EU Member States, with the interoperability of plugs and vehicles.

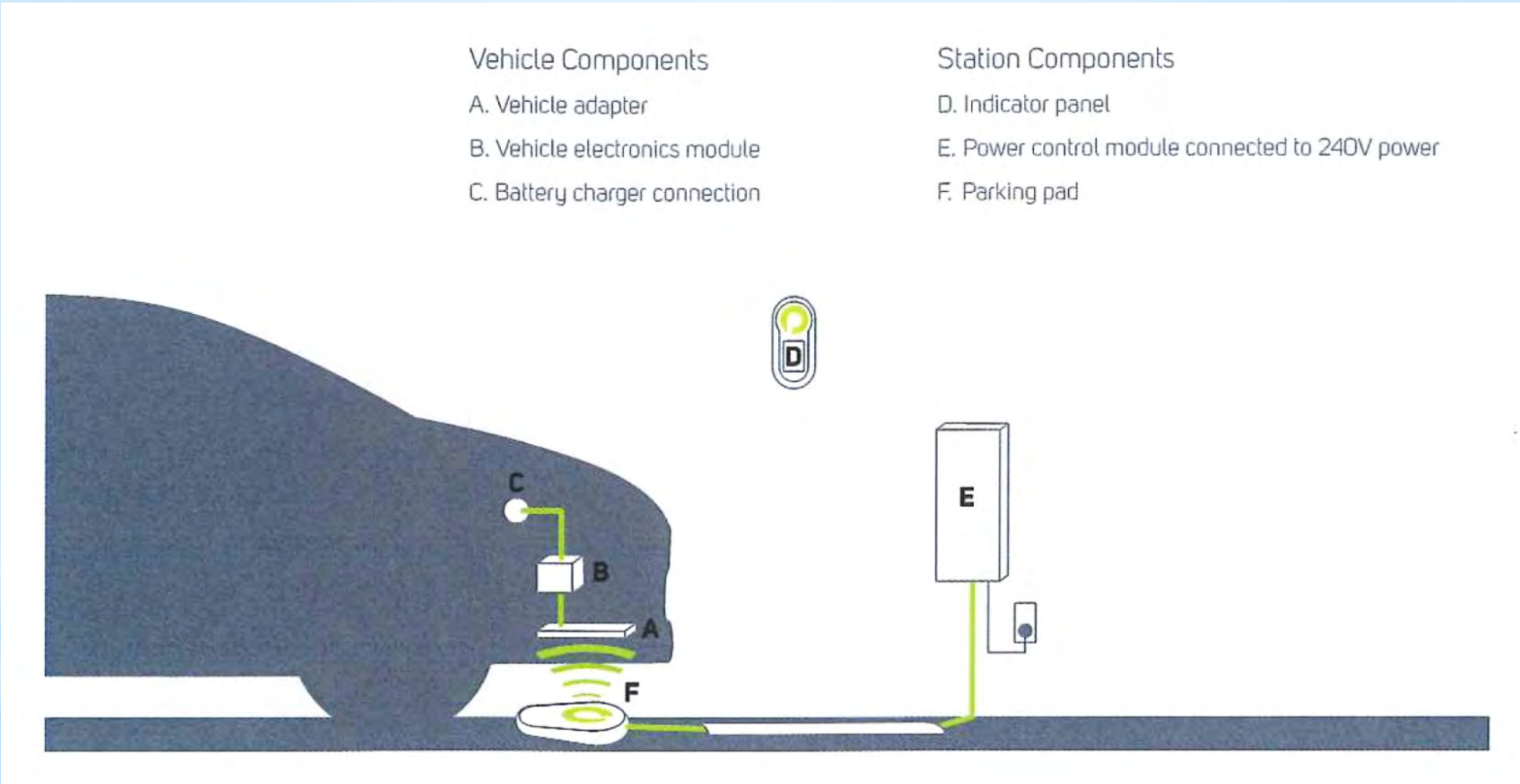
Mandate 490 EC to CEN, CENELEC and ETSI for the standardization of Smart grid functionalities, aiming at the definition of:

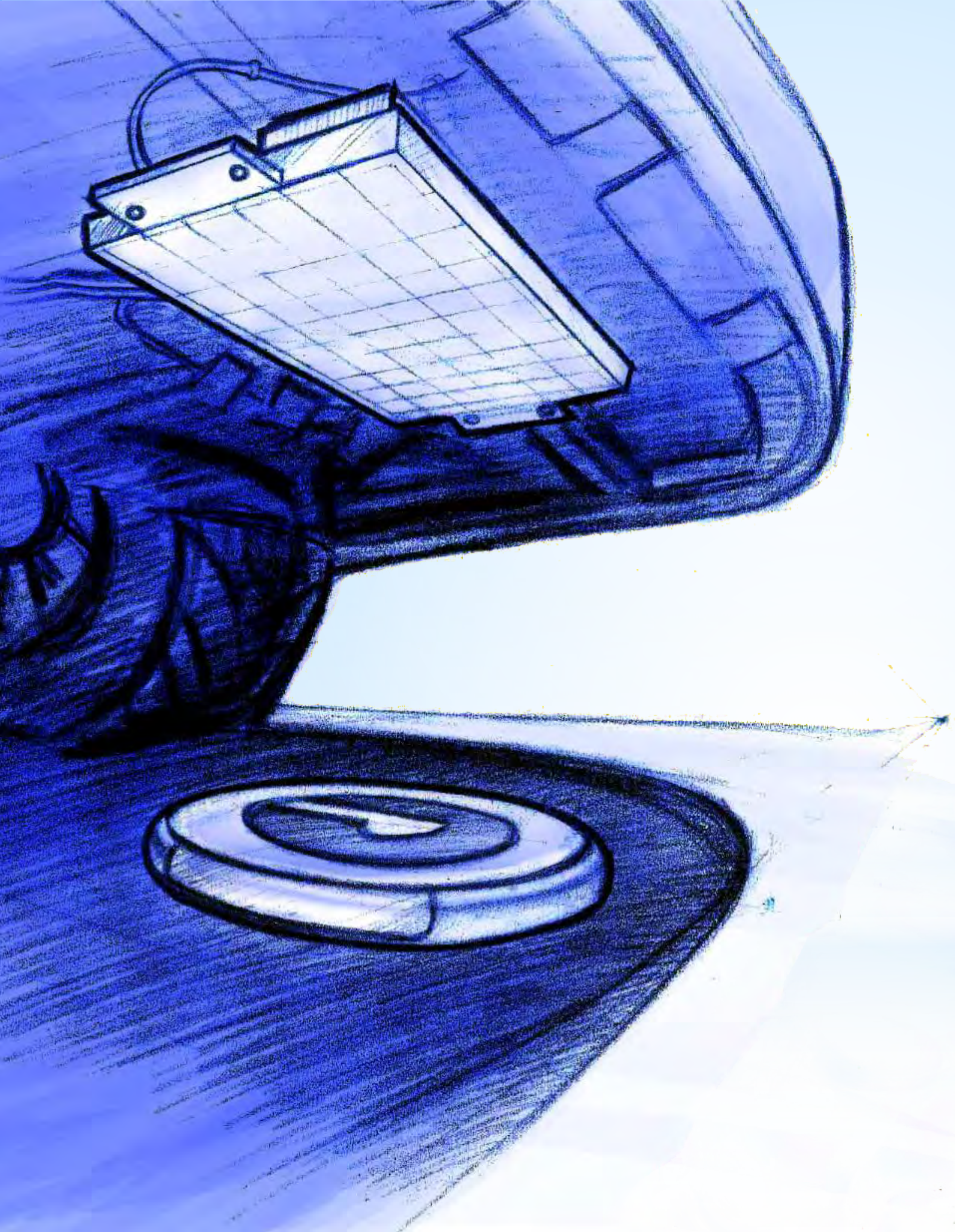
•A technical reference architecture ,which will reprsent the functional information data flows between the main domains and integrate many systems subsystems architectures.

•A set of consistent standards, which will support the information exchange (communication protocols and data models) and integration of all users into the electric system operation.

Studies of Handout Inductive charging system with frontal docking at the Vrije Universiteit Brussel

Wireless static energy transfer

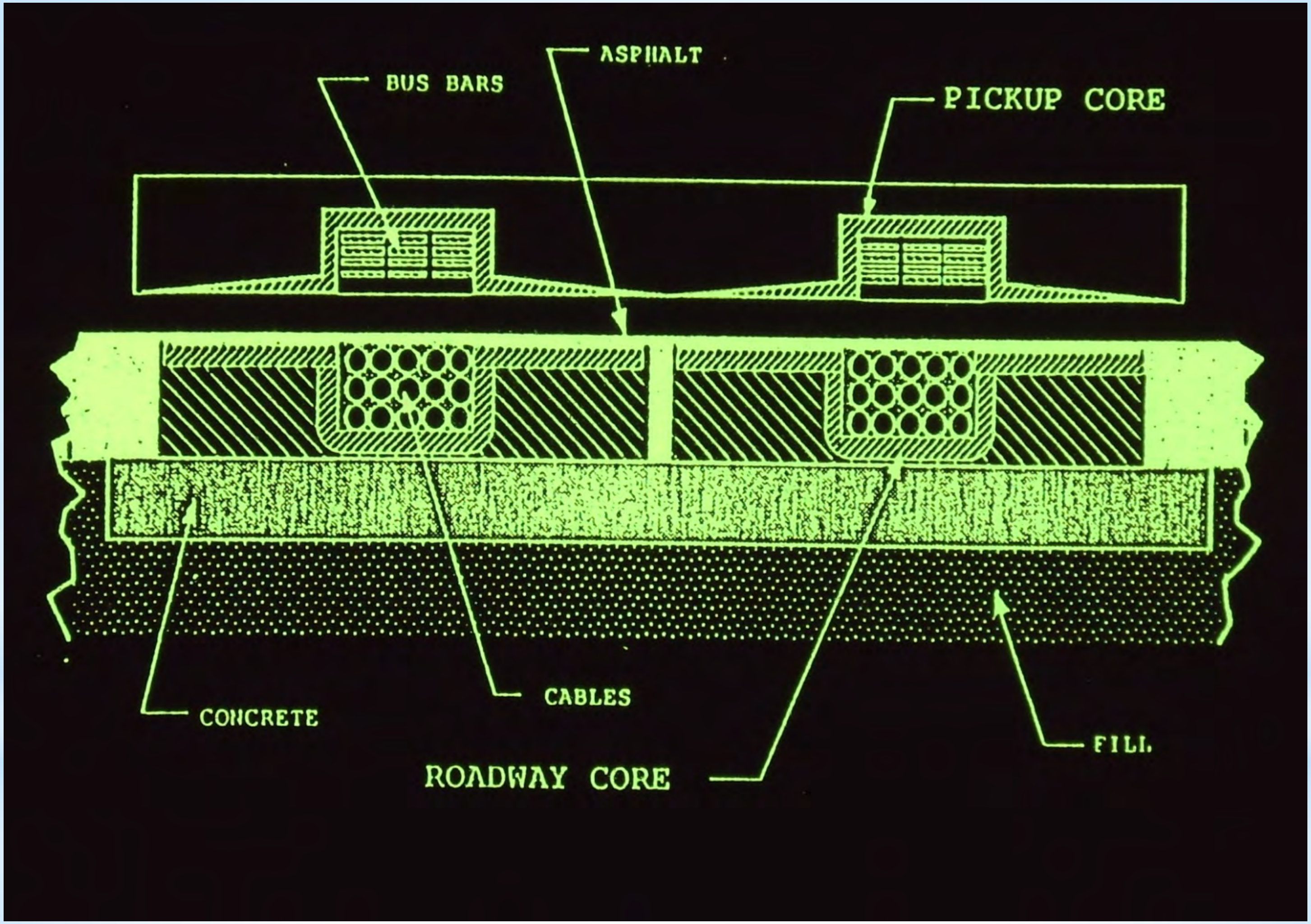




Energy transducer parts on board and on ground of wireless charging system

Dynamic energy transfer system concept

Lawrence Livermore Laboratory studies in years '80

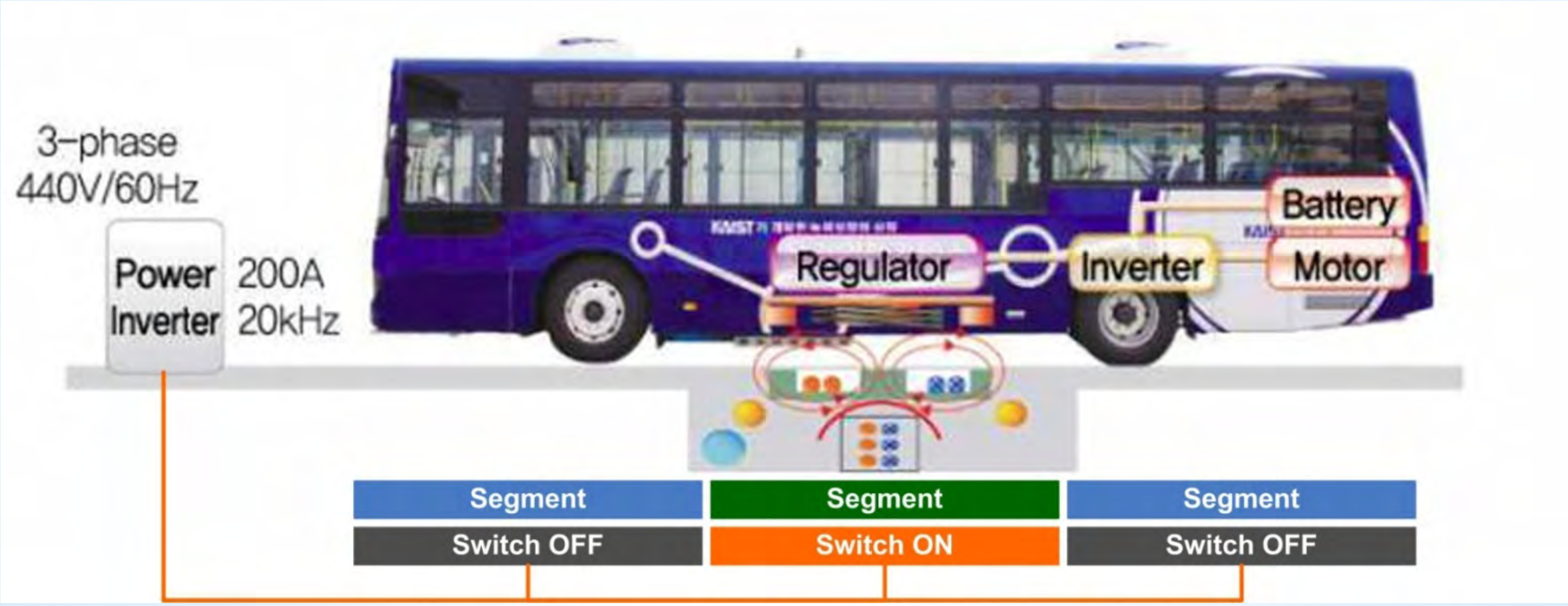


Brassboard for study of wiring structure and air gap

Lawrence Livermore Laboratory studies in years ‘80

Dynamic wireless energy transfer application

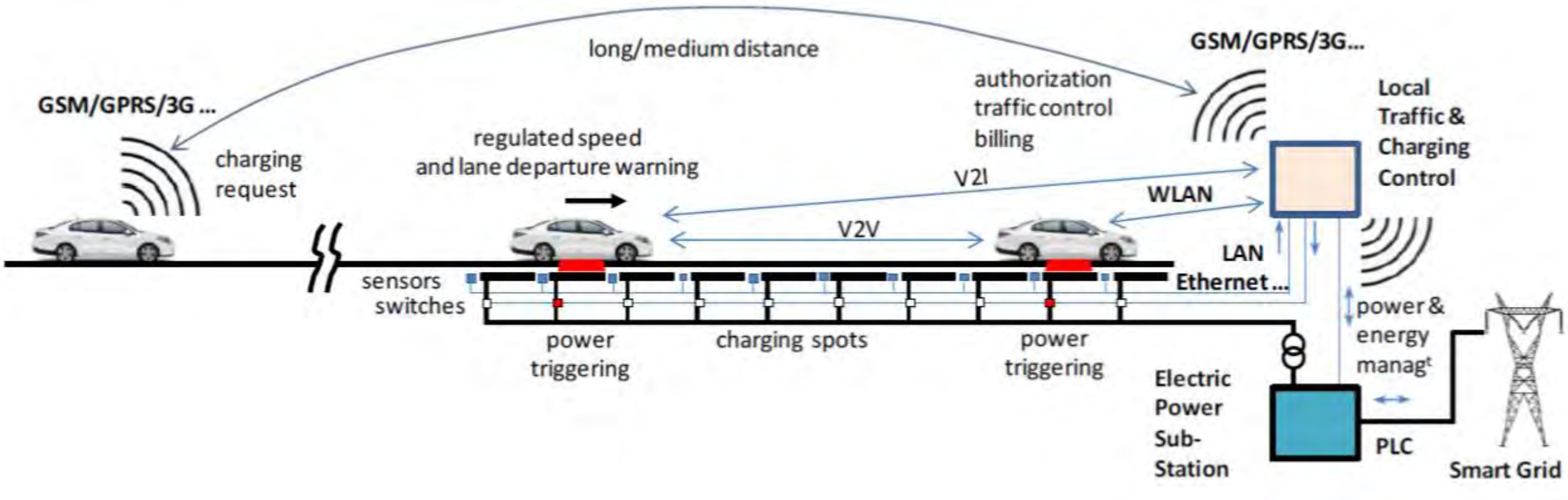
an example to bus application



(Source: OLEV)

The energy is transferred through resonant cicuits from segments of the inductive line activated during the transit of the vehicle

The European Project FABRIC



Dynamic Wireless Power Transfer Concept

The European Project FABRIC

Motivation & Objectives

Study, development and test on the ultimate solution to supply energy to electric vehicles in any operational situation, including dynamic wireless, paving the way to a sustainable general diffusion of the Electric Mobility

Expected achievements:

* Road and grid infrastructure adaptations to support dynamic EV charging
* Development of prototypes for static, stationary and dynamic wireless charging
* Study of the Electromagnetic safety aspects
* Contribution to the development of the relevant Standards

Feasibility study for the large scale deployment of dynamic charging solutions and economic sustainability study.

Project FABRIC deployment

Application to various types of vehicles:

* Passenger cars,
* Light weight duty vehicles,
* Heavy vehicles,
* Busses

Technology approaches

Two families of solutions:

- Installation of coils under the road surfaces (in variable coil lengths, frequencies, materials and performance) up to more than 20 meter length
- Installation of several charging coils concentrated, embedded along the line in the road surface, resulting in high frequency coupling/decoupling impulsive charging
- Integration in three FABRIC test sites in Italy, France and Sweden

FABRIC solutions benefits

- Facilitate the use of smaller and cheaper storage systems
- Increase Electric Vehicle range
- Reduce immobilization (unavailability) due to charging
- User comfort
- No visual pollution
- Integration in the system Vehicle to Grid with various vehicle operational modes: Static, Stationary, Dynamic

FABRIC Consortium

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Institute of Communication
& Computer Systems
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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

ICCS, CRF, ERTICO ITS Europe, TRL, KTH Royal Institute of Technology, VOLVO, SCANIA, Institut VeDeCoM

TNO, circe, QiEnergy, iren energia, fka, TECNOSITAF, enide

Politecnico di Torino, DITEN, saet group, sanef, cea, AVIA, AMET, MECT

Supported by: EUCAR, ERTICO ITS Europe

FABRIC

Standards ISO, IEC, SAE, UL on wireless charging (source VDA)

ISO 19363 (scheduled for 10-2016) Electrically propelled road vehicles – Magnetic field Power Transfer – Interoperability and Safety requirements

IEC 61980 Electric vehicle wireless power transfer (WPT) systems

- Part 1: General requirements
- Part 2: Specific requirements for communication EV and infrastructure
- Part 3: Specific requirements for the magnetic field power transfer systems

ISO/IEC 15118 (scheduled for 10-2016) Road vehicle to grid communication interface

- Part 6: General information and use-case definition for wireless communication
- Part 7: Network and application protocol requirements for wireless communication
- Part 8: Physical layer and data link layer requirements for wireless communication

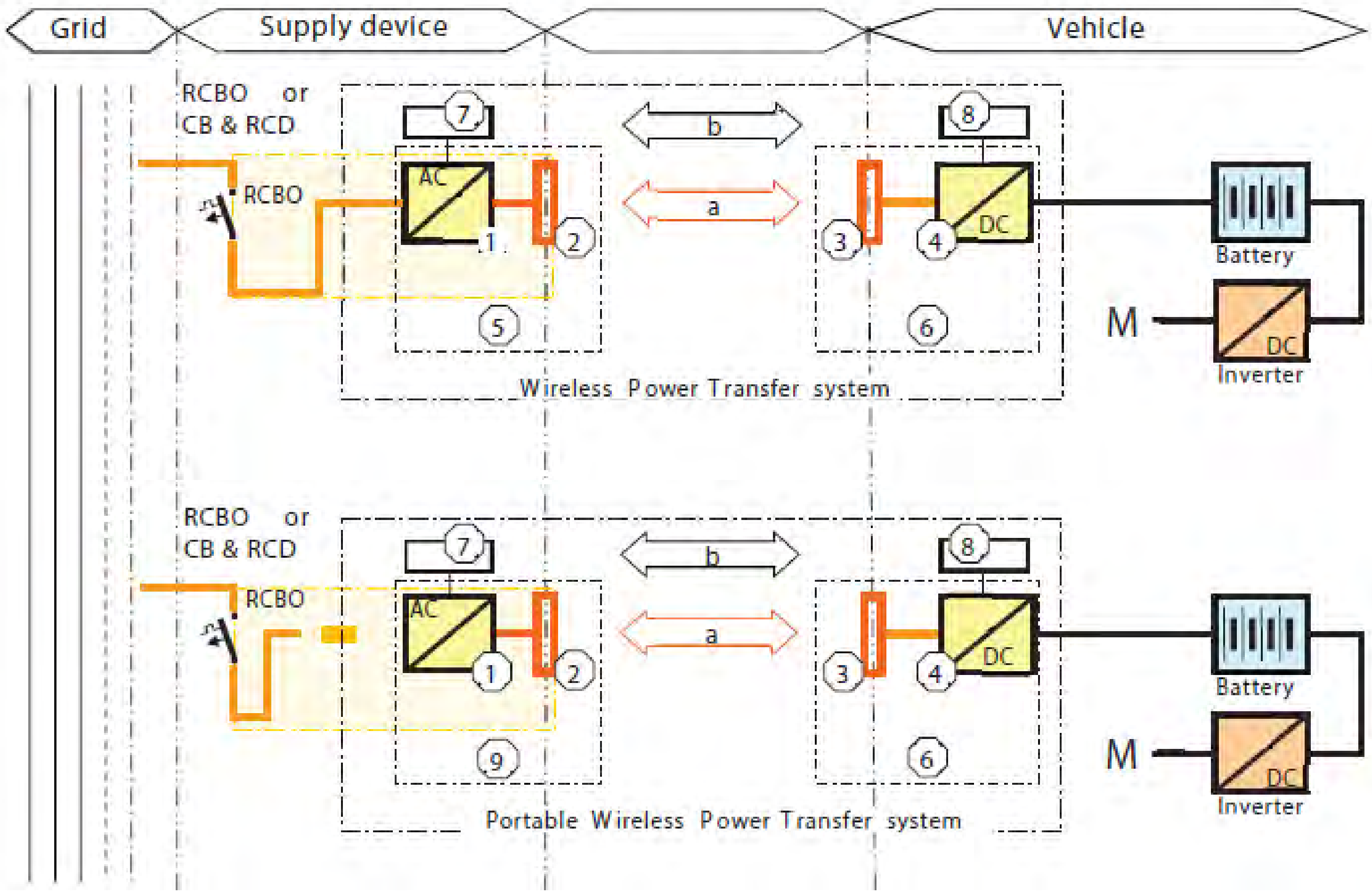
SAE J2954 Wireless Charging of Electric and Plug-in Hybrid Vehicles (Guideline scheduled for 06/2014)

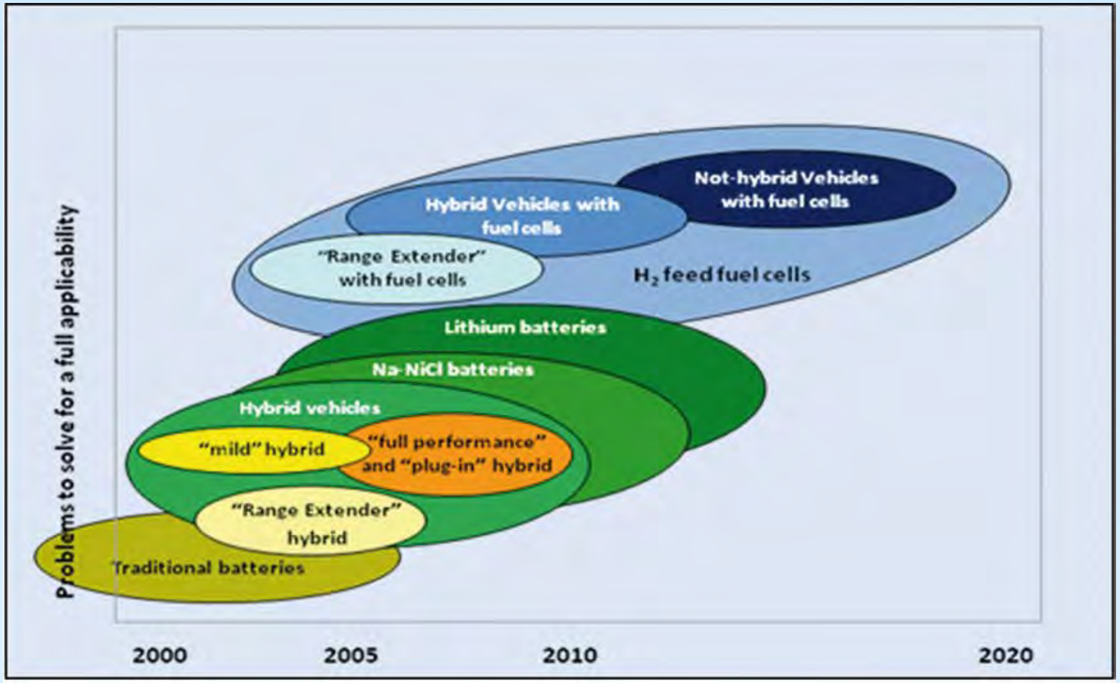
SAE J2836/6 J2847/6 J2931/6 Communication for inductive charging (Guideline scheduled for 06/2014)

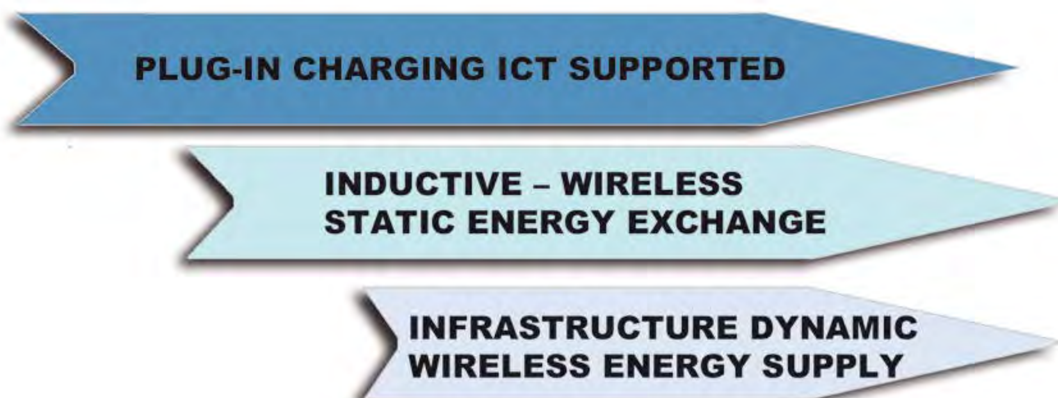
SAE J1773 Electric Vehicle Inductively Coupled Charging (published as recommended practice)

UL 2750 Wireless EV charging

General scheme of WPT between primary and secondary element (infrastructure and vehicle)

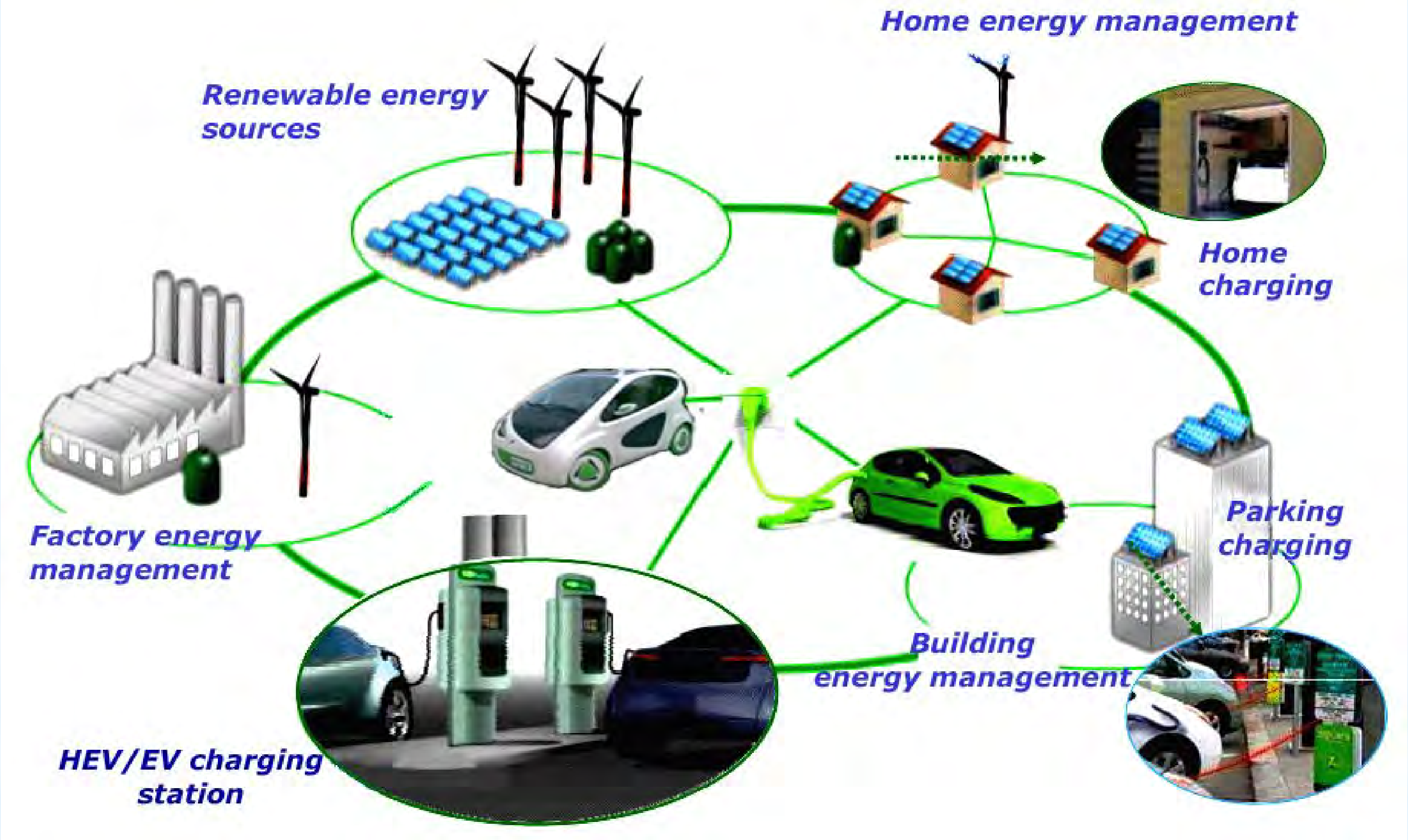






Infrastructure and supportive network

A future energy integrated system scenario



The electric vehicles can be key protagonists in the eco sustainable transport system

Conclusions

•The electric and rechargeable hybrid vehicles introduction in the mobility system can contribute to the rational management of the primary energy sources and of the electric energy distribution in the general utilization system.

•The on board rechargeable energy storage of the electric vehicles can offer and be used as a contribution for leveling of the electric load of the grid, with appropriate management of the interaction vehicle – grid.

•The management of the interaction User - Vehicle – Infrastructure has to be effectively supported by an Information and Communication Technology network.

•The technical solutions defined by the project FABRIC can open the way for a wider global design of the system Vehicle-Electric Network through the user friendly Wireless Power Transfer technology, in the different operational situations, Static, Stationary and Dynamic of the various category of vehicles.

•The Electric Vehicle can be a key protagonist in the eco sustainable transport system.

THANK YOU FOR YOUR ATTENTION

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