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7th Framework Programme

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PowerUp Project Presentation

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LIST OF ABBREVIATIONS

ABBREVIATION	DESCRIPTION
FEV	Fully Electric Vehicle
V2G	Vehicle-to-Grid communications interface

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REVISION CHART AND HISTORY LOG

REV	DATE	REASON
0.1	2011-07-10	Draft in presentation format
0.2	2011-07-26	Formatting in deliverable document format
1.0	2011-07-27	Editorial changes and re-formatting of figures

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EXECUTIVE SUMMARY

This deliverable describes the objectives, concepts, and expected outcomes of the PowerUp research project. The project consortium is also introduced.

PowerUp is a STREP project which has started on July 1st, 2011, and will conclude on June 30, 2013.

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INTRODUCTION

The expected introduction of fully electric vehicles puts a significant additional demand on electricity production plants and distribution grids. This major change on the electricity demand side occurs at nearly the same time as an expected shift from stable to partly variable supply input, caused by the extension of renewable production capacities. It is therefore essential for the viability of these developments that the electricity production and demand sides become better coordinated. The Vehicle-to-Grid (V2G) interface concept is an essential mechanism for such coordination.

Regarding the automotive aspects of electric vehicles, their limited driving range is one of the biggest deployment challenges. For mitigating this restriction, it is essential that owners should be able to recharge their electric vehicles not only at home, but also at their destination, namely at parking garages near their offices or near train/subway terminals. The Vehicle-to-Grid (V2G) interface concept is a mechanism for supporting this paradigm of nomadic electricity consumers. This new paradigm however raises questions about the architecture of measurement and billing components, as well as the involved value chains. A suitable design of the V2G interface shall support nomadic electricity consumption under any foreseen arrangement of the billing architecture or value chains.

For achieving the anticipated V2G-enabled benefits, the scope of PowerUp project is to develop and validate the V2G interface. PowerUp shall progress through a full development cycle of physical and link-layer V2G interface specification, protocol design for scheduling of recharging and for accounting control, prototype implementation, conformance testing, integrated field trials, and standardisation.

TECHNICAL APPROACH

V2G integration into smart-grid networks

Smart electric meters for automated meter-reading are the primary entry point into a smart-grid network. As a result of the EU directive on deploying smart electric meters throughout the EU by 2020, the integration of grid-side V2G adapter into smart electric meters solves the infrastructure-side deployment issue for the V2G interface. PowerUp will develop such V2G-ready electricity meters. Figure 1 illustrates the corresponding meshed smart-grid network after deployment of advanced automated electricity meters.

As an alternative approach, PowerUp will also aim to develop infrastructure side V2G adapters that can be installed at the local low-voltage transformer site. This solution shall enable the use V2G control interface in those regions, where the deployment of V2G-ready electricity meters is not feasible for some reason.

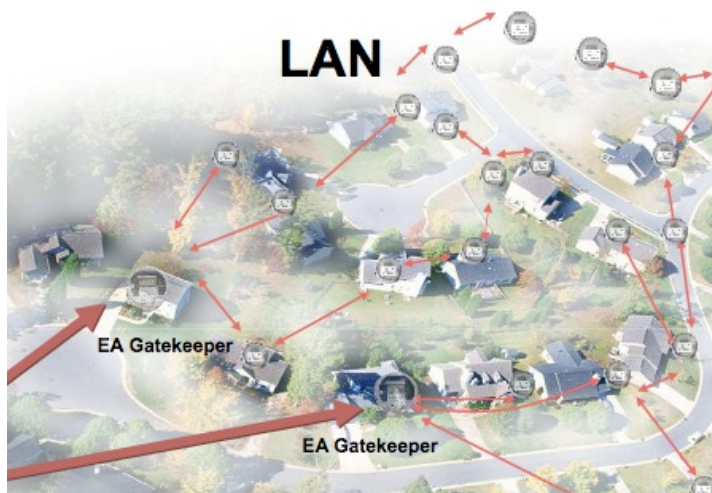


Figure 1: Illustration of automated electricity meters forming a meshed smart-grid network, providing infrastructure connectivity of the V2G interface

Robust grid operation and load balancing

Smart-Grid equipment enables flexibility between local and centralised load balancing; this architectural flexibility is illustrated in figure 2. FEV-specific load balancing algorithms will be researched and prototyped in PowerUp; these will take this new smart-grid flexibility into account.

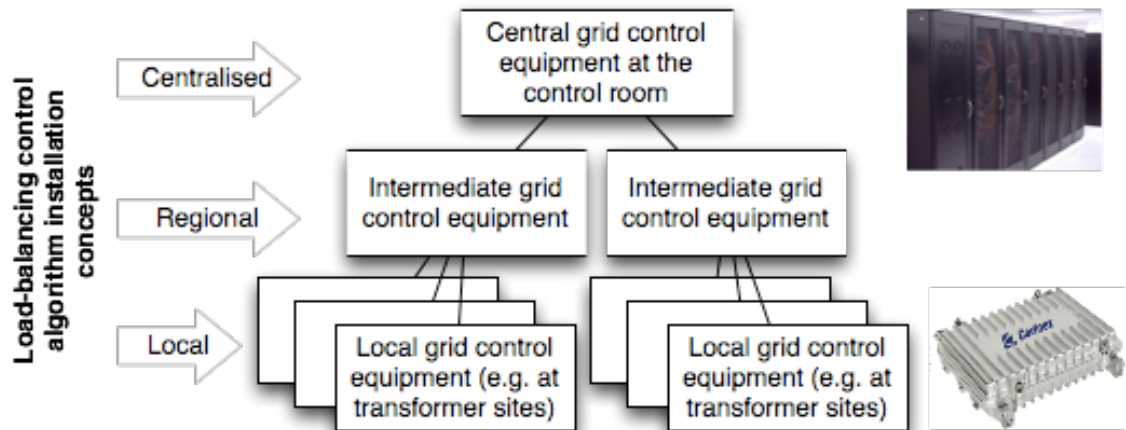


Figure 2: Smart-Grid flexibility between local and centralised load balancing

Support of nomadic electricity consumption

With the transition from traditional electric metering towards an architecture that supports e-Mobility, the number of involved actors grows and their interactions become more complex. This transition is illustrated in figure 3. It is not settled yet presently how the tasks of power measurement, billing, accounting, scheduling, customer identification, ... etc. are going to be shared among the involved actors.

The PowerUp project will map out the foreseen architectural arrangements, and will ensure that the specified V2G interface meets the requirements of nomadic electricity consumption under the anticipated main architecture scenarios. An advisory board will be set up for the validation of related PowerUp use cases and requirements; it will consist of representatives of stakeholders in figure 3.

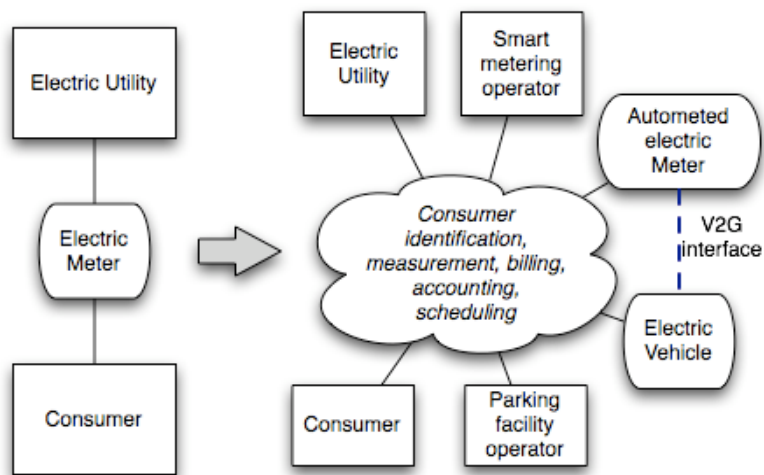


Figure 3: Smart-Grid flexibility between local and centralised load balancing

Support of destination planning

The PowerUp project will also address the essential V2G interface issues that arise within the route destination planning phase. Support of destination planning is important for system integrity, as drivers expect that the re-charging spot they are guided to will be functional, available, and meeting other possible driver preferences. Since the actual FEV-optimised travel-planning applications are out of PowerUp scope, the project will specify an open interface between an electric utility and ITS service providers. Through

this interface ITS service providers may poll real-time status and schedule information of the FEV re-charging spots. This data may be then broadcast to personal navigators or vehicles' embedded systems. Figure 4 illustrates this architecture and information flow.

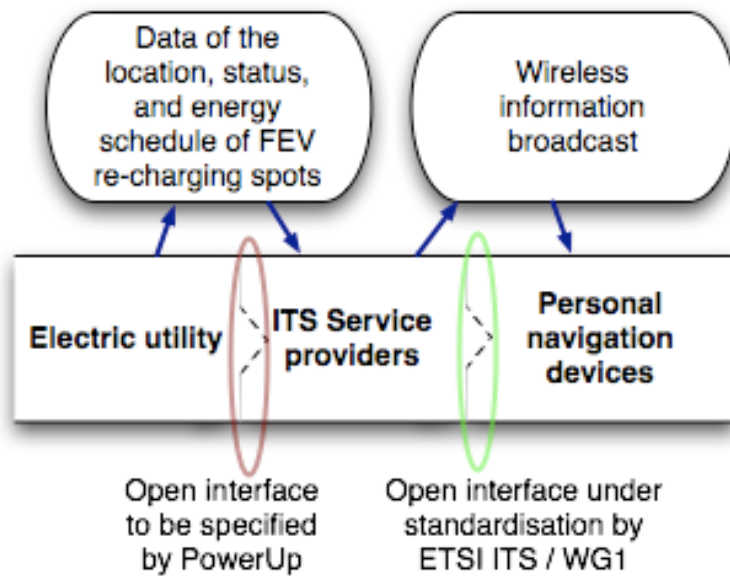


Figure 4: Support of destination planning

Conformance and Interoperability Testing

Multi-vendor compatibility is crucial for the success of V2G technology, so that the recharging of any fully electric vehicle brand could be controlled by any electric network in the EU. As figure 5 illustrates, conformance testing of implementations' compliance to a common V2G standard is an important task for achieving general compatibility. Because of the large number of possible interaction types between various vendors, namely the multiple of automotive-side and grid-side implementations, such conformance testing requires careful and thorough methodology.

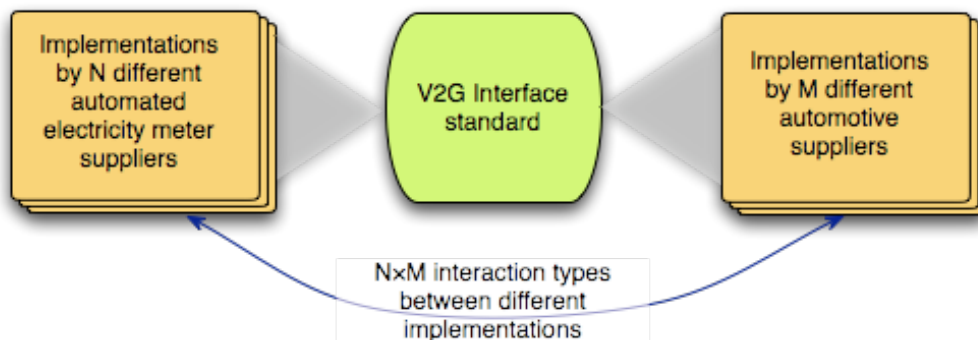


Figure 5: Illustration of multiplying number of interacting implementations

For ensuring that follow-up deployments are compliant to V2G standards, the project will develop a detailed conformance and interoperability test specifications through which future implementations of the V2G interface could be tested for compliance. The institutional framework for administering such interoperability testing events will be also established at ETSI.

PROTOTYPE DEVELOPMENT

PowerUp shall focus its prototyping activities on delivering:

- Automotive V2G adapters
- V2G adapters integrated into the Automated Electricity Meters
- V2G-ready Smart-Grid infrastructure components

Interface standards between all involved components will be enhanced as needed for meeting identified V2G requirements.

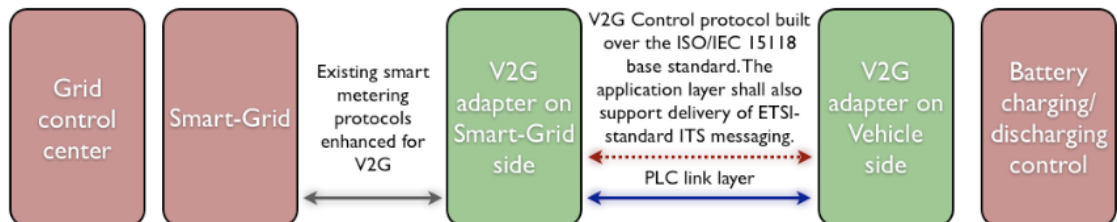


Figure 6: Illustration of prototyped V2G adapters

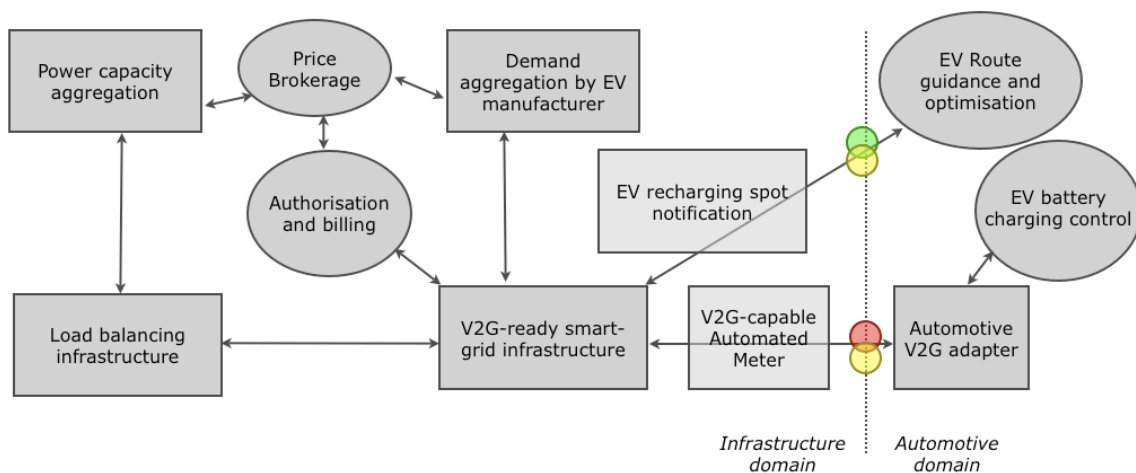
Prototypes of these components will be field trialed in an end-to-end chain.

EXPECTED POWERUP RESULTS

PowerUp aims to provide the automotive and electric utility communities with the following results:

- Specification of the V2G interface; a self-contained 'consensus' specification of the V2G protocol stack. These specifications will follow the ISO/IEC 15118 draft standards to the extent that is considered practical for the first implementation, and may be complemented as needed for completeness. PowerUp consortium members shall contribute the project specification results for standardisation.
- Specification of a V2G specific load balancing algorithm for the smart-grid
- Automotive V2G adapters for EV integration and V2G ready electricity meter prototypes. These components may be used by EV related follow-up field trials.
- End-to-end demonstration of the V2G system; this may also serve as a model for follow-up field trials
- V2G interoperability testing capability; relevant for compatibility of follow-up multivendor products

PowerUp will contribute its results to the following highlighted standardisation activities:



Ongoing standards development:

- ISO/IEC 15118
- ETSI ITS committee

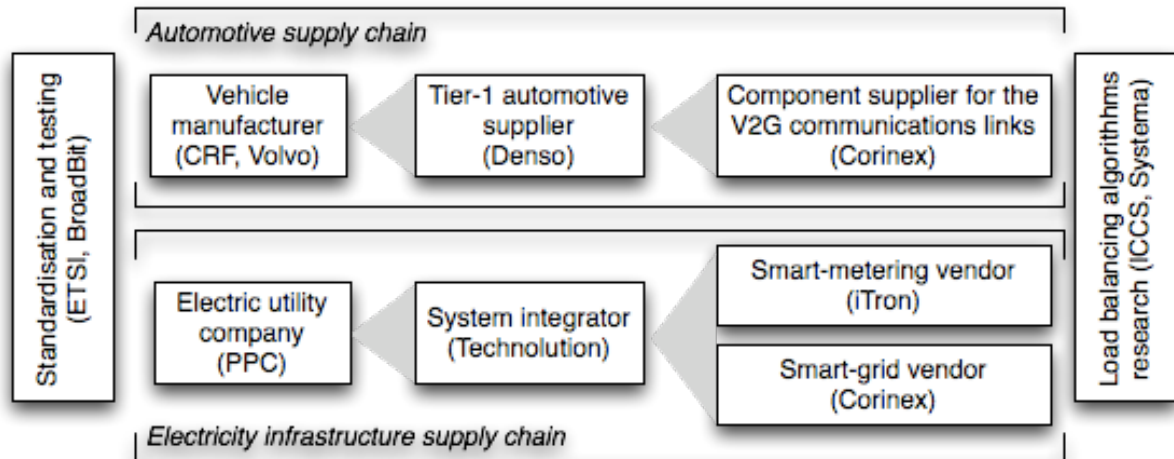
Planned development of conformance and interoperability testing standards:

- ETSI ITS committee

Figure 7: PowerUp related standardisation activities

POWERUP CONSORTIUM

PowerUp consortium represents the full supplier value chain in both automotive and electricity grid domains:



FURTHER INFORMATION

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