November 2014
Special Issue

e-DASH a Success Story

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MAIN PROJECT RESULTS

This special edition of the e-DASH project newsletter has the purpose to describe the main results of the project presented on the final Dissemination Event that e-DASH hosted October 23rd 2014 in Wolfsburg. After a welcome address of Mr. Boukerche (EU-Commission) and a keynote speech about e-Mobility at VW by Mr. Poschmann (VW), e-DASH partners presented the project motivation and the main technical results as well as a set of demonstrators.

The project e-DASH (Electricity Demand and Supply Harmonization for EVs) targeted the design, development and validation of an innovative charging solution for fleets of Fully Electric Vehicles (FEVs) enabling sustainable FEV grid integration in the context of sometimes contradicting requirements like individual driver requests, availability of renewable energies, energy demand as well as low-voltage grid capacity. The presentation of the main project results were focused on the following topics:

- e-DASH added value to e-Mobility,
- Status quo of Energy Market and Challenges for e-Mobility,
- Vehicle to Grid Interfaces and Standardisation,
- The Telemetry enabled Electric Vehicle Fleet as a Smart Energy Consumer,
- Energy Brokerage for E-Mobility Fleets

DEMONSTRATORS

Besides the presentation of the main project results a set of demonstrators could be visited representing the key subsystems of the e-DASH solution to show the crucial e-DASH components „in action“ even for different brands:

- Broker Operation
- OEM Backend Operation
- Vehicle to Grid Front-End
  - Implementation of ISO/IEC 15118 in Electric Vehicles
  - Discharging of Electric Vehicle
  - Smart Charging HMI
- Vehicle to Grid Communication Standards
  - Compliant Integration of Electric Vehicles into Smart Grids
  - High Level Charging using ISO/IEC 15118

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Newsletter Topics

- Project Motivation and key Project Results
- e-DASH Added Value to the community .
- Project Demonstrators

e-DASH Concept

The project e-DASH (Electricity Demand and Supply Harmonization for EVs) targeted the design, development and validation of an innovative charging solution for fleets of Fully Electric Vehicles (FEVs) enabling sustainable FEV grid integration in the context of sometimes contradicting requirements like individual driver requests, availability of renewable energies, energy demand as well as low-voltage grid capacity. The project's approach involves a fleet manager (OEM) who interacts via the e-Mobility Broker with grid stakeholders, i.e. Balancing Responsible Parties (BRPs), and provides innovative best effort grid services through a controlled smart charging of his FEV fleet. In order to do so, the flexibility of the fleet's charging profile is offered through a brokering instance to respective grid stakeholders, who identify their favourable demand load profile within the fleet's nominated flexibility. Based on the grid stakeholder's request, the fleet manager decomposes the requested demand profile from an aggregated fleet level to individual FEV charging schedules respecting decentralized local grid constraints. This new form of integrating FEVs in the energy network requires the development of intelligent hybrid charging concepts, in the sense of partly centralized vs. decentralized charging control. Such distributed control requires algorithms reducing the need for near real-time information exchange between all stakeholders to a minimum. This allows all participating stakeholders in the OEM and utility domains to create a new and currently unused potential within their value chains. The e-DASH project develops and validates this new approach, always considering and building upon existing as well as currently developing standards in the e-Mobility

"The project's approach is bringing together the FEV Market Potentials as Smart Consumer and the Energy Market Potentials."

Charging flexibility as business value

The flexible energy consumption and provision contributes to balancing of energy production and consumption in the grid

FEV Potential as Smart Device

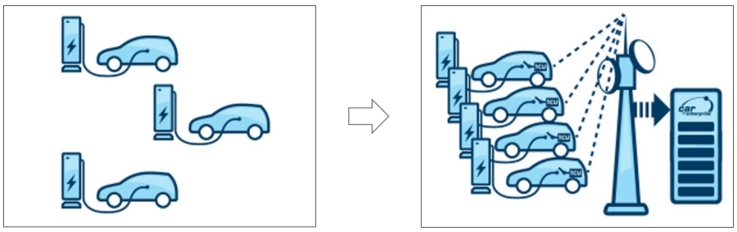
Generally FEVs can be considered as distributed energy resources (DERs) which will facilitate a flexible energy consumption (smart consumer). Required basic metering and control facilities are already available in the FEVs. By this means, FEVs will enable:

⇒ Flexible control of the charging/discharging process

⇒ Precise forecast of energy demand or supply capacity for fleets

As a consequence, the ***flexible energy consumption and provision contributes to balancing of energy production and consumption in the grid***.

Key to raise this FEV potential is to make the step from individual FEVs with low relevance and uncontrolled charging behaviour to smart consumer fleets representing a controlled, reliable, predictable and significant energy consumer.

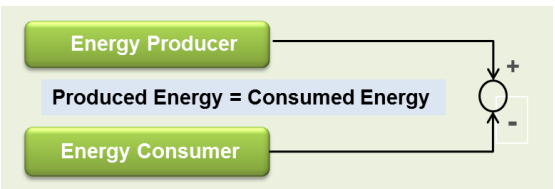


Basic Energy Market Mechanisms

In reference to the balancing of the energy production and consumption in the grid, the need for smart devices enabling a flexible energy consumption/provision is of high and increasing importance to:

⇒ compensate volatility of energy production (e.g. due to increased share of renewable energy)

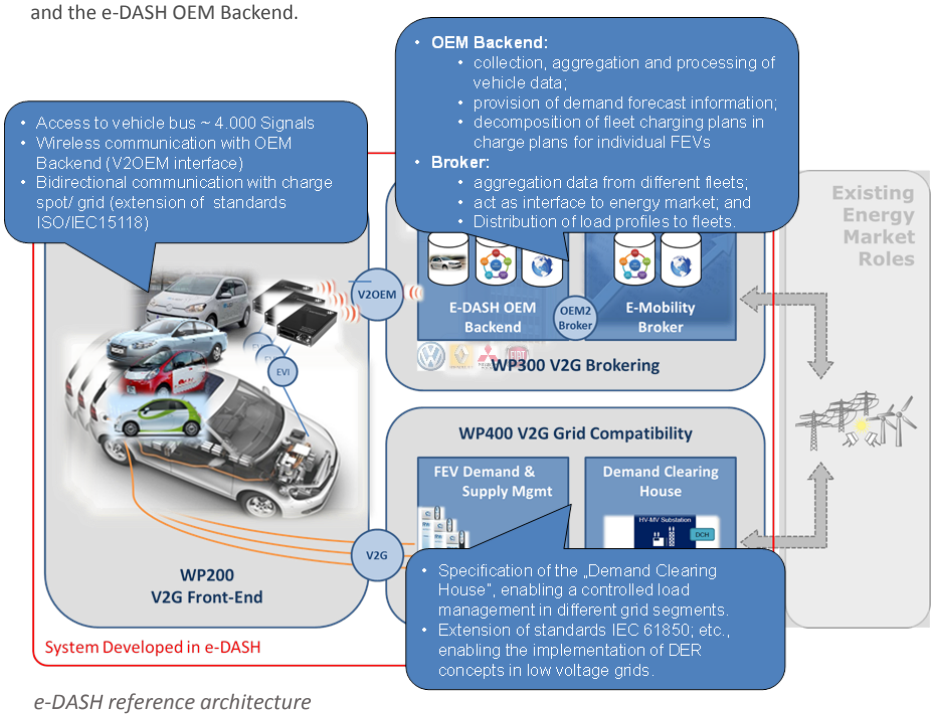
⇒ smooth energy demand peak loads (reducing energy grid investment)



Energy Balancing principle

Key to achieve this objective is a tailored charging/discharging process for individual FEV, according to their needs and constraints.

The project developed and tested innovative concepts and communication solutions to enable a harmonised control of the charging process of full electrical vehicles (FEV), in context to the energy demand, network load, driver requests and availability of renewable energies. This new form of integrating FEVs into the energy grid required the development of intelligent energy demand forecast and charging concepts, requiring a coordinated information exchange between the FEV, the electricity grid and the e-DASH OEM Backend.



e-DASH reference architecture

Vehicle to Grid Interfaces and Standardisation

⇒ ISO/IEC 15118 by Proof-of-Concept Implementation of EVCCs and SECCs

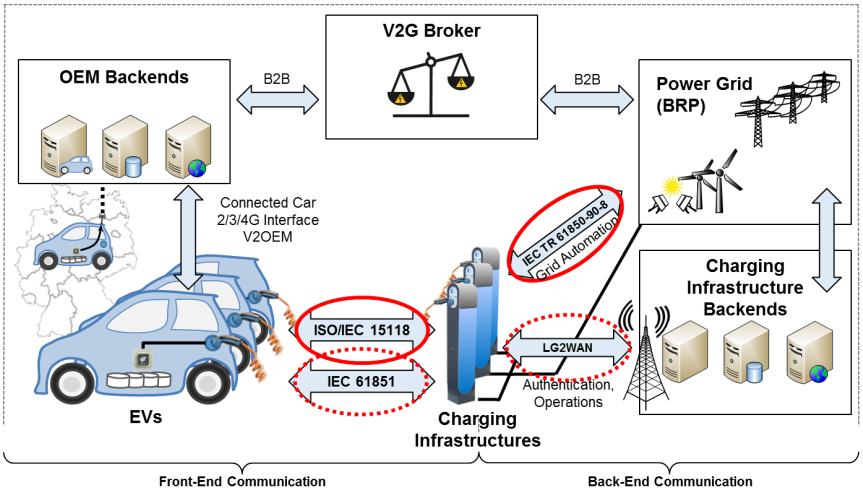
* Real-World Validation of the Standardized Specifications
* First Proposal on Reverse Charging Support (incl. Power Electronics & Functional Safety Analysis)

⇒ Harmonization between ISO/IEC 15118 and other Standardization Initiatives (e.g. Smart Energy Profile 2.0)

⇒ Main Authors of Technical Report on E-Mobility Object Model (Published as Techn. Report IEC 61850-90-8, included in CD for IEC 61850-7-420 Ed. 2)

⇒ Contributions to IEC 62913-2-4 Electric Transportation Domain in order to provide 1st attempt of top down approach of Electric Transportation in the Smart Grid

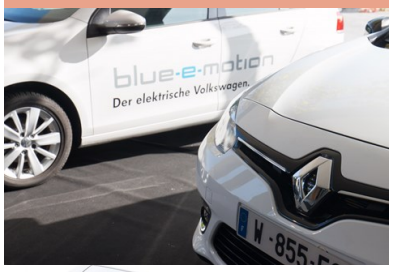
⇒ e-DASH Project proofed for the first time that ISO/IEC 15118 may be associated with OEM-



Standardization Aspects addressed in e-DASH Scenarios

The OEM Backend is the key module enabling energy demand harmonization

ISO/IEC 15118 by Proof-of-Concept Implementation of EVCCs and SECCs

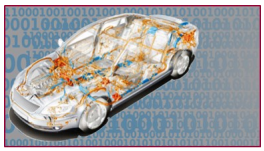


Beyond e-DASH

- Modules and components of the e-DASH OEM Backend solution will be applied in future commercial services.
- Reuse of developed OEM Backend technologies in the scope of future RTD project (e.g. Big Data in automotive industry).
- Fleet management platform will be investigated toward mobile sensors networks management system.
- Drive the discussion on the introduction of the e-DASH approach into the OEMs as part of the global OEM e-mobility business strategy.
- Concept of Demand Clearing House will be realized in a test bed.

The Telemetry enabled Electric Vehicle Fleet as a Smart Energy Consumer

The key enabling technology to realise such kind of innovative concepts are based on new telemetry concepts and solutions, ensuring the information transfer with vehicles, independent from their position or connectivity to the grid.



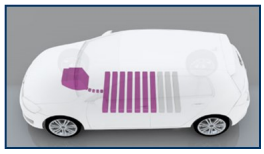
⇒ Access to vehicle CAN bus with ~ 4.000 signals

⇒ Gathering of service specific signals

⇒ Resampling and data storage

⇒ Signing and compression of telemetric data

⇒ Secure Transmission of data using wireless communication between FEV and OEM Backend (V2OEM interface)



⇒ Provisioning of FEV specific charge plans according to defined fleet load profile

⇒ Continuous monitoring of the charging process

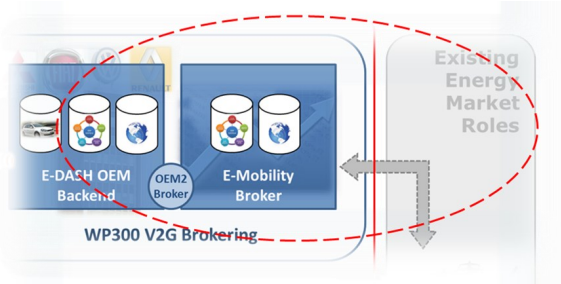
Energy Brokerage for E-Mobility Fleets

The Energy Brokerage represents the e-DASH interface to the Energy Market. Therefore, the e-DASH e-Mobility Broker offers the charging flexibility of smart consumer fleets to the energy market actors (BRPs). The main objectives of the E-Mobility Broker are to:

⇒ negotiate energy requirements vs. energy offered,

⇒ aggregate fleet forecasts into BRP specific flexible energy demands

⇒ Decompose BRP load profiles into fleet specific BRP load profiles



e-DASH added value to mobility

At the end of 3 years of project it can be stated that e-DASH contributed an added value to mobility. The main challenges with which the project had to deal with, represent on the one hand that FEVs are an additional class of energy consumer which will boost already existing load peaks, and on the other hand the volatility in energy production due to increasing percentage of renewable energy. To overcome these challenges of a flexible energy consumption and provisioning there is an urgent need for a Smart Energy Consumer behaviour.

Having these challenges in mind e-DASH aimed to bring together the FEV potential as Smart Consumer and the Energy Market. This could be achieved by offering a Flexible Energy Consumption/ Provisioning to compensate for volatility of energy production (e.g. wind energy etc.), to leverage energy demand peak loads and make a tailored charging/discharging process for individual FEV needs and constraints.

The key e-DASH added value to e-Mobility are:

⇒ Telemetry enabled Electric Vehicles acting as a smart Energy Consumer/Provider

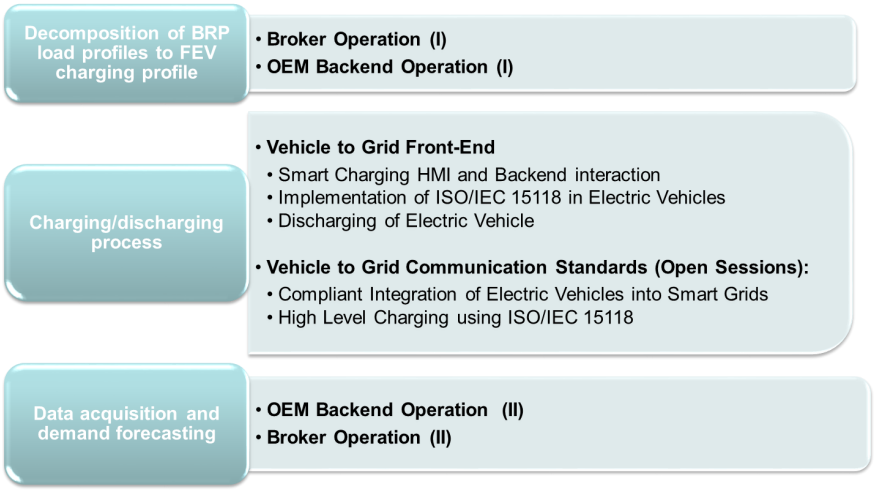
⇒ Innovative charging solution for fleets of Electric Vehicles

⇒ Sustainable Electric Vehicles grid integration by using intelligent charging concepts

⇒ Brokering of flexible fleet demand profiles to grid stakeholders

Demonstrators

The demonstrators were presented in a form and sequence as to show the whole data and energy flow that e-DASH project covers. The following figure illustrates the complete storyline and below the individual demonstrators presented during the event are described.



e-Mobility Broker

The demonstration of the Energy Mobility Broker (EMB) was realized by ATOS and focused on all processes performed by the EMB, covering the complete cycle of the brokering management. The first part of the demonstration addressed the decomposition of the Global load profile, received from the Balance Responsible Parties, into Fleet Load profiles. These Fleet Load profiles are sent to each OEM fleets. The second part of the demonstration presented the demand forecasting phase where the e-Mobility Broker receives the OEM fleet energy demands (on a day-ahead basis), aggregates energy demands once the reception process is closed, and finally negotiates with the Balance Responsible Party the received Global Load profile. Furthermore the E-Mobility Broker performs basic statistical reports of its activities.

OEM Backend operation

The first part of the of the e-DASH OEM Backend demonstration focused on the Decomposition of Fleet load Profiles received from the e-Mobility Broker into the individual FEV charging profiles and the charging of the FEV in reference to the individual charge plan. The second part of the demonstration addressed the process of collection, aggregation and processing of vehicle data as well as the provision of the demand forecast information to the E-Mobility Broker. Both functionalities (forecast & decomposition) was realized by CEA .

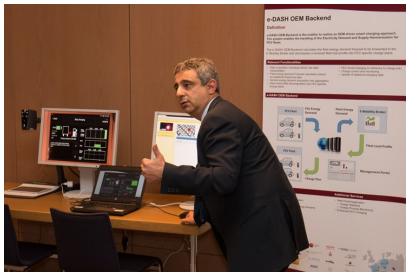
Furthermore, this demonstration covered the data from one mixed fleet consisting of FEVs from VW and Renault, operating in a VW e-DASH OEM Backend implementation.

Implementation of ISO/IEC 15118 in Electric Vehicles

The demonstration of the ISO/IEC 15118 implementation, with the Renault vehicle and charge spot, has shown an implementation of AC-based smart charging via ISO/IEC 15118 compliant Vehicle-to-Grid communication interface and use of Power line Communications over Control Pilot Line inside the vehicle and charge spot.

Discharging of Electric Vehicle

The demonstration of Discharging of an Electric Vehicle in a Renault vehicle has shown the discharging of an Electric Vehicle with a newly proposed and extended version of ISO/IEC 15118.



Smart Charging HMI

The purpose of the CRF prototype was to provide a proof of concept of the smart charging process control based on e-DASH specifications. The FEV infrastructure is based on the commercial infotainment unit Blue&Me that acquires and sends the real-time data to the HMI via Bluetooth connection. The HMI is an Android app running on a commercial tablet which operates both as additional on board display and as charging process controller. The e-DASH CRF Backend acquires the telemetry data and charging control messages of the FEV and manages the connection with the e-Mobility Broker.

Compliant Integration of EVs into smart Grids

This demonstration, showcased by Broadbit and TuD, has shown a system for testing the standards-compliance of a V2G implementation on either the EV or EVSE side. The demonstrated test system is adhering to the conformance testing specifications currently developed at the ISO/IEC, and shall ensure the future interoperability between any Electric Vehicle and EVSE brand.

Low Level Charging using ISO/IEC 15118

The demonstrator, made by CEA, emulates Electric Vehicles with a stack of Li-Ion cells, charger controller, a simplified Battery Management System, a communication controller and the charge spot by an MMI:

- The pilot wire and IEC/ISO 61851 requirements are emulated by a serial communication link.
- IEC/ISO 15118_3 is supported by both the communication controller and the MMI representing the charge spot.

The demonstration has shown a nominal charging process an interactive action between operators that creates occurrence of defaults at the level of Li-Ion cells or charger but also at the level of the charge spot (simulated by MMI action).

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