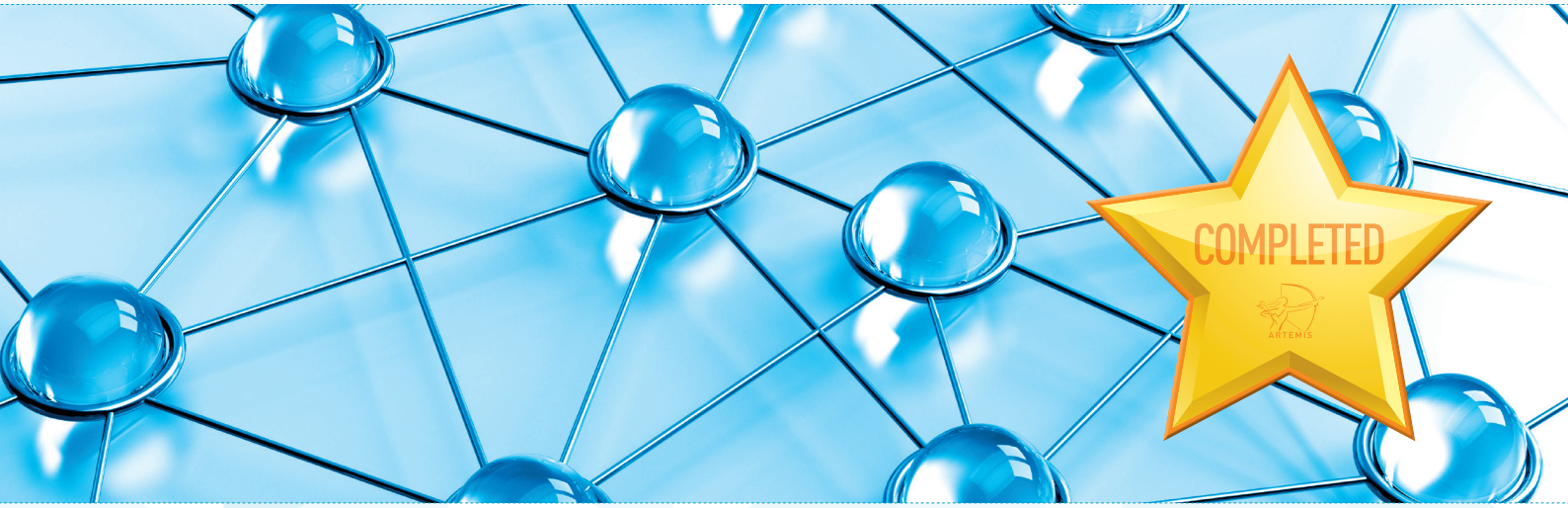
ARTEMIS Call 2010 Project
269374

IoE

Internet of Energy for Electric Mobility



EXECUTIVE *summary*

The Internet of Energy for Electric Mobility (IoE) objective is to develop hardware, software and middleware for seamless, secure connectivity and interoperability by connecting the Internet with the energy grids. The application of the IoE will be the infrastructure for electric mobility. The underlying architecture is of distributed Embedded Systems, combining power electronics, integrated circuits, sensors, processing units, storage technologies, algorithms and software.

CONTRIBUTION *to SRA*

The IoE addresses seamless connectivity and middleware by achieving the interoperability of Internet applications for Electric Vehicles (EVs) and Smart Homes with the Energy Grid, with the focus on Electric Mobility infrastructure, and the communication between them.

The IoE contributes to reference design and architectures by addressing architectural and functional dependability thus ensuring secure, reliable and timely system services and the design, development and deployment of ubiquitous electronics and software systems. These systems will be interoperable, cost effective, powerful and safe. The IoE proposes innovative solutions for interfacing the Internet with the power grid with applications for electric mobility, helping to make transport more sustainable, efficient, clean, safe and seamless.

MARKET INNOVATION *& impact*

The IoE will impact the future electricity grid by using data communication to transport electricity more efficiently, reliably and affordably as well as future Internet by using the electricity grid to facilitate and accelerate communication amongst the various energy nodes and domains.

Overall, the grid will shift from a centralised, producer controlled network to a distributed, consumer interactive, environmentally responsive model, enabling bi-directional power/energy transport and greater consumer participation thanks to a capillary of information distribution and economic benefits for energy production. It will incorporate significant levels of energy storage and generation that will remedy disparities between peak supply and demand.

RELEVANCE & CONTRIBUTIONS *call 2008/call 2009/ call 2010 objectives*

- Common, multi-domain architecture based on standards for interoperability in smart environments combing the Internet and the power network/grid.
- Smart metering miniaturised embedded systems that store detailed data on energy usage and data information exchange as a communication gateway with peripheral devices.
- Communication networks operating in parallel with the electricity grid to distribute data throughout all elements of the new intelligent grid. This network is connected through the Future Internet and Internet of Things enabling seamless and secure ES interactions and cooperation over heterogeneous communication infrastructures.
- Advanced utility sensors and control systems deployed throughout the infrastructure that will improve the system's resilience.
- Application software and embedded software to control the communication process to present, interpret, analyse and react to the enormous amount of data that will consequently permeate the system. This will be supported by a middleware to enable the seamless connectivity between the different domains of power grids, power plants, EVs and smart buildings.

- Security and privacy structures (i.e. to counter malicious intrusive attacks, maintain the confidentiality of sensitive data and protect personal identification).
- Business models and energy services to accommodate the requirements of all stakeholders (including multi-domain SMEs and corporations, research institutes and public authorities) willing to enter the innovative market of electric mobility applications.
- Smart energy-efficient dynamic and self-reconfigurable topologies for the aggregation of the nodes of the Internet of Energy (EVs, distributed renewable energy generation, distributed storage) addressing sustainable mobility and Urban Life.

R&D INNOVATION *and technical excellence*

- Smart grid power network modelling, emulation and simulation for Internet of Energy integration: IoE network modelling will increase the number of participants for whom precise and detailed information and accurate state estimation and prediction are available.
- Communication ES architectures, protocols, modules and circuits: progress beyond the state-of-the-art addresses the development of standardised, embedded solutions that host facilities to communicate with various actors in electric mobility, and to facilitate secure identification and transaction processing.
- Power modules and network devices: the IoE's step beyond the state of the art will be the integration of ICT features with hardware control functions (µC's, FPGAs). Interweaving functions that currently use separate sets of chips will enable a cost-effective, reliable data information exchange between ICT and electric energy domain.
- Bidirectional on-board charging and rapid charging station systems: the IoE addresses the development of a cost-effective and energy-efficient bi-directional power flow controller capable of rapid charging and intelligent control of the exchange of energy between distributed storage, renewable energy sources and the grid.
- Power storage architectures and communication modules for integration on the Internet of Energy electric mobility applications: the IoE addresses a range of power storage modules with a selection of geometries to suit various expected operational locations using different chemistry and super capacitor technologies, optimised for effective operation for all usage and charging scenarios.
- Renewable energy integration and infrastructure for Internet of Energy electric mobility applications targeting the combination of controlled multiple systems and the monitoring of new data as well as the integration of remote monitoring with navigation systems for novel green mobility services.
- Security, privacy, dependability and safety for Internet of Energy applications: an overall architecture is proposed to ensure that correct operation safeguards the system against system failure or misuse. The project will provide guidelines for the implementation of security, privacy and dependability in IoE "by design". For a selected number of cases in the project the security guidelines will be validated using models and simulations.
- Remote meter reading or outage detection: a novel smart meter system with multiple interfaces that provides communication between a data concentrator and a consumer's electricity meter (i.e. PLC systems), direct communication between the meter and the central system using a broadband internet connection, connection between the meter and a local terminal with wireless functionality, communication between the central meter and secondary meters or multi-utility meters for gas, water or heat and communication between the meter and a Home Area Network, enabling advanced demand response and load shedding.

PROJECT *partners*

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START
May 2011

DURATION
42 months

TOTAL INVESTMENT
€44.3 M

PARTICIPATING ORGANISATIONS
38

NUMBER OF COUNTRIES
10