



INERTIA-Vision...

INERTIA will introduce the Internet of Things/Services principles to the Distribution Grid Control and Demand Side Management Operations.

INERTIA at a Glance

| | |
|-------------|------------------------------|
| CONSORTIUM: | 10 PARTNERS FROM 5 COUNTRIES |
| START: | OCTOBER 2012 |
| DURATION: | 3 YEARS |
| PROGRAMME: | FP7-ICT-2011-7, |
| OBJECTIVE : | 6.1: ICT SMART ENERGY GRIDS |
| BUDGET: | € 5,34 M. |



INERTIA will develop an overlay network for efficient grid control, running on top of the existing energy grid and incorporating high level distributed intelligence within autonomous and semantically enhanced Prosumer Nodes. This way, it will address the apparent *"structural inertia"* of the Distribution Grid by introducing more active elements coupled with the necessary control and distributed coordination mechanisms and Demand Side Management Operations.



The INERTIA Challenges

Structural inertia of Distribution Grids

INERTIA will deliver the efficient real-time coordination of Distribution Grids by rendering Demand and Supply components into active flexible grid nodes. Distributed Energy Resources (DER) will form dynamic clusters which will essentially comprise self-organized networks of intelligent and autonomous active nodes, efficiently distributing global and local intelligence.

Real-Time Monitoring & Control of Distributed Energy Resources (DER)

INERTIA will develop an Integrated Management Framework for monitoring, balancing and eventually crediting electricity production and consumption. In this way it will maximize the response capacity of the vast commercial small & medium size prosumer nodes, presenting incentives and delivering strong benefits for prosumers, aggregators and power system operators through their automated active participation in the energy market.

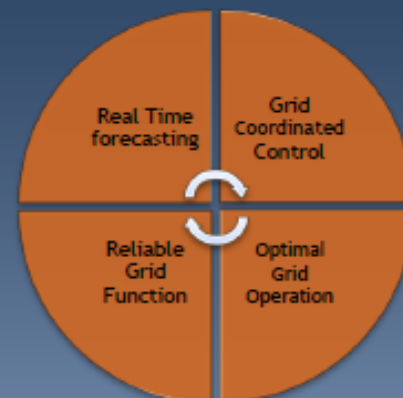
Efficient Control Framework for Aggregators

The INERTIA hybrid control framework will optimally combine characteristics from both direct and indirect load control strategies and further extend the participation of various types of local generation and demand loads under a single integrated framework. A complete toolset for DSO's and Aggregators will be delivered, for real-time monitoring and control of aggregated prosumer node clusters, under specific event and control optimization strategies.

Non-Intrusive Control of Individual Consumers

The human factor will be an indispensable part of INERTIA. The INERTIA Automated Consumer Profiling mechanism will dynamically extract Individual and Group Profiles through various ambient and non-intrusive user interfaces. Buildings will continuously adapt to occupant's behavior and preferences and act on behalf of their occupants when interacting with the Smart Grid towards more energy efficient and sustainable operations.

Benefits for Energy Suppliers and DSOs




Real-Time & Short/Mid-Term DER Flexibility Analysis, Forecasting & Utilization

INERTIA will allow Aggregators to accurately perform real-time, short/mid-term Load flexibility forecasting based on various contextual parameters and utilize DER load flexibility in the most reliable, profitable and services oriented manner. DER Clusters flexibility will be analyzed against specific situations and market needs (whole sale market, reserve market) allowing the Aggregator to optimize its position in the Energy Market.

Coordinated Control And Market Active Participation of Small DER

The dynamic aggregation of DER, will lower the market entry barrier for DER loads and provide efficient ways of defining valuable shared-profit services. The INERTIA Aggregator will be able to perform real-time optimal local control strategies based on multi dimensional parameters of DER portfolio, thus discovering ways for small DER to group into clusters of high Capacity Credit and provide highly reliable services to the distribution grid (ancillary services) and individual clients (demand & cost reduction, scheduling and optimization).








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INERTIA will develop an overlay network for efficient grid control, running on top of the existing energy grid and incorporating high levels of distributed intelligence within autonomous and semantically enhanced Prosumer Hubs. This way, it will address the present “*structural inertia*” of the Distribution Grid by introducing more active elements combined with the necessary control and distributed coordination mechanisms and Demand Side Management Operations.

The INERTIA Challenges

INERTIA “Internet of Things” Approach

INERTIA will introduce the Internet of Things approach towards the efficient real-time coordination of Distribution Grids and rendering Demand and Supply components into active flexible grid nodes. The “Internet of things” refers to a system where various objects and devices communicate with each other and thus a great challenge for ICT infrastructure is considered. The rapid advances in computational and communication part in energy systems, is paving the way towards highly sophisticated networked devices that will be able to carry out a variety of tasks by taking into full account dynamic and context specific information.

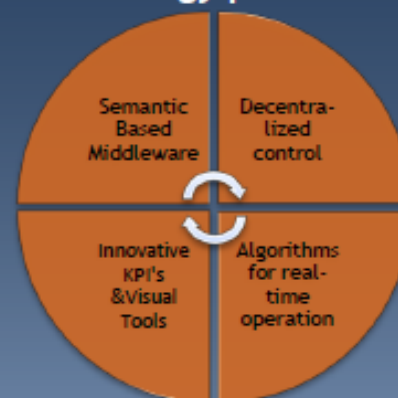
Real-Time Monitoring & Control of Distributed Energy Resources (DER) Loads

INERTIA will develop an Integrated Management Framework for monitoring, balancing and eventually crediting and billing electricity production and consumption. On this way, the INERTIA hybrid control framework will optimally combine characteristics from both direct and indirect load control strategies and different business scenarios, and thus increasing the need for novel and real-time execution algorithms and techniques in order to provide an immediate and accurate control tools.

Efficient Control Framework for Aggregators

A complete toolset for Distribution System Operators and Aggregators will be delivered, for real-time monitoring and control of aggregated node clusters, under specific event, time and location based global and local optimization strategies. This toolset will provide a combination of multi dimensional energy performance indicators and the additional visualization tools for a real time management of DER clusters. The fine definition of the indicative indicators increase a great challenge for the INERTIA project.

Benefits for ICT Community and Technology provides




Semantic Based Middleware

Different DER units and devices communicate each other and thus there is a need for a common environment. The total framework will build on existing HYDRA/ LinkSmart technology and assess its applicability in the INERTIA domain to provide a middleware that is able to integrate and process data coming from devices and sensors as well as meta-data information provided to/from other components like user profiling, occupancy detection and tracking. In addition, a thorough research on “ontologies in energy” will be delivered.

Decentralized approach for real time control

INERTIA will extend the latest developments in area of multi-agent system theory and their application to smart energy grid management. INERTIA will develop self-organized agent-based control and management solutions viable from both a demand and supply perspective. The INERTIA framework will allow for a clear separation of global and local intelligence and thus, global and local control actions will be performed on a real time basis on the building level, autonomously and automatically, in a multi agent environment.





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The INERTIA Challenges

- Lowering the Market Entry Barriers for Distributed Energy Resources (DER)

Introduction of a novel approach towards the efficient real-time coordination of DER. Various types of DER will be allowed to offer their capacity to the Aggregators in a streamlined and seamless manner. INERTIA will allow for the efficient utilization of prosumer capacity/flexibility (generation and consumption) within specific business scenarios and smart grid services.

- Maximization of Individual Prosumer Benefits

Delivery of innovative prosumer business models and tools which will ensure that grid operation will be performed in a decentralized and automated manner with the main goal of balancing consumer economic profits against personal/business preferences (Prosumer surplus). Identifying the parameters on which consumer surplus is sought, will lead to specific qualitative and quantitative performance metrics for of End Users market participation.

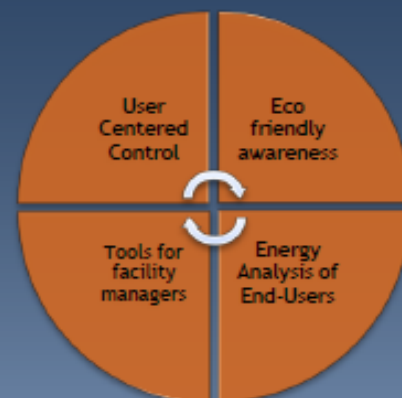
- Holistic Control and Sustainable Operations for Facility Managers and Energy Services Companies (ESCOs)

Facility management refers to an interdisciplinary field devoted to the coordination of space, infrastructure, people and organization. INERTIA will deliver new visualization tools for analyzing holistic performance (energy, operations and comfort), thus delivering integrated control optimization solutions for individual occupants, prosumers, facility managers and ESCOs.

- Pro-active Building Control

The majority of Demand Side Management capacity programmes require efficient and informed direct control through highly disruptive practices, mostly rejected by individual consumers for reasons of inefficiency, discomfort and lack of privacy. As a core challenge of INERTIA, buildings will pro-actively adapt to prosumer profiles (& preferences), minimizing end-user interaction while continuously and automatically optimizing local control strategies.

Benefits for prosumers and Facility Managers



Real time & Personalized (User-Centered) Building Control Optimization

INERTIA aims to provide a real-time *occupancy profiling* framework for tertiary and commercial buildings. Dynamic Occupant Profiles comprising robust models of individual and group behavior will result in more precise and context-aware load forecasting models thus allowing for reliable integrated building automation and control decisions.

INERTIA will promote Eco-friendly Consumer behavior

INERTIA will deliver Ambient User Interfaces in order to seamlessly collect data resulting from the occupant's interaction with typical building hub controls (e.g. light switches, HVAC panels, etc.) without actually requiring any explicit interaction by the building occupants. INERTIA Ambient User Interface will capture occupant preferences while at the same time promote eco-friendly sustainable behavior through optimized and personalized suggestions under specific performance goal settings.



Optimal Grid Coordination for DSO's & Aggregators

Global Operational & Technical parameters of the electricity grid will be seamlessly and continuously translated into real-time Local Control Strategies. INERTIA will offer fine grained control while at the same time ensure privacy and autonomy on the local level, fully respecting prosumer needs. INERTIA will promote the efficient integration of flexible demand with distributed generation within the smartgrid as the mean to tackle the problems resulting from the continuous and mass integration of distributed intermittent and non controllable renewable sources. INERTIA will propose viable Business Models for flexible service-oriented contracts distributing potential benefits to relevant stakeholders.

Reliable, Secure Grid Operations and reduced Operational Costs

The intermittency and variability of renewable generation can seriously impact quality of supply and security margins and consequently operational costs. Local network stresses continuously necessitate for costly upgrades towards increasing capacity and flexibility that will allow for the efficient integration of variable generation. INERTIA will deliver innovative strategies, directly contributing to lowering the need for investments in overall grid and generation capacity, thus leading to increased financial profits for the industry along with potential revenues for end prosumers under flexible shared-profit business and contractual models. INERTIA will establish a "system approach" in which distributed generators will not simply feed the network in a stand-alone and non-controlled mode, but instead they will be fully integrated into the network and coordinate their operation in order to exploit the full advantages of distributed generation.

The team



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HYPERTECH SA (GR)



PUBLIC POWER CORPORATION S.A. (GR)



ENEL.SI SRL (IT)

Key message to Energy Suppliers and Distribution System Operators (DSOs) based on the concept of minimizing grid structural inertia



INERTIA

Integrating
Active, Flexible and Responsive
Tertiary Prosumers into
a Smart Distribution Grid

We are social



INERTIA



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INERTIA



INERTIA Project

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