

EPRI Smart Grid Demonstration PREMIO: (Production Répartie, EnR et MDE, Intégrées et Optimisées)

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Objectives of the PREMIO demonstration

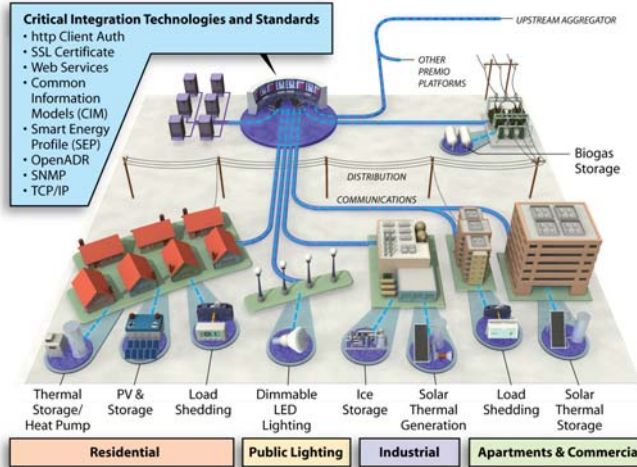
Objectives of the project

- To test a smart grid architecture developed with existing technologies (distributed resources at local scale) to reduce the load peak and improve energy efficiency.
- To identify weakness and strengths of the existing distributed resources and requirements when they are integrated in a smart grid architecture
- To learn lessons in the process of:
 - Developing technologies
 - Installing equipment
 - Assessing results
 - Recruiting customers and improving their acceptance

Objectives of the smart grid architecture

- To offer a service (one day-ahead or real time) of optimal load savings/generation to answers to the needs/requirements of an upstream operator based on the management of different implemented technologies on a specific zone

PREMIO's Architecture



- Critical Integration Technologies and Standards**
- http Client Auth
 - SSL Certificate
 - Web Services
 - Common Information Models (CIM)
 - Smart Energy Profile (SEP)
 - OpenADR
 - SNMP
 - TCP/IP

CU: Control Unit

UO: Upstream Operator

DR: Distributed Resources

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Technical functions of the architecture

Calculation of potential of load flexibilities for each technology: two ways

- At the DR level: Every technology has the capacity to calculate their potential of load flexibilities (generation or load shifting/shedding capacities + technical and customers limitations)
- At the CU level: Control Unit predict the potential of load flexibilities by dedicated learning algorithms for a set of technologies without internal capacity of calculation

Communication exchanges of main information

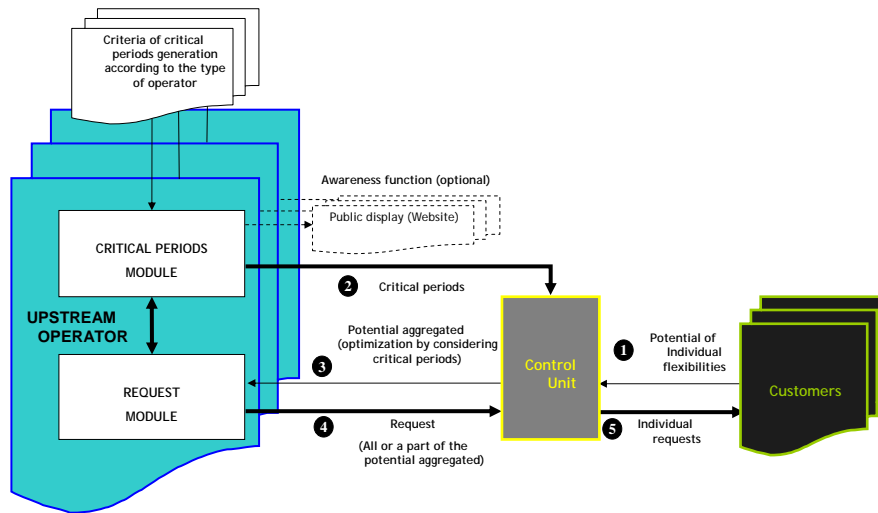
- UO sends the critical periods to the control unit (energy and/or environmental restrictions)
- CU collects the potential of individual load flexibilities
- CU aggregates in a optimized way the local hourly load flexibilities and transmits it to the upstream aggregator
- UO based on the aggregated load flexibilities, the upstream operator then sends a request to the control unit with a specific profile
- CU generates the individual request of load savings/generation by economical optimization
- CU dispatches the request to all the technologies (according to the specific characteristics) with a dedicated scheduling

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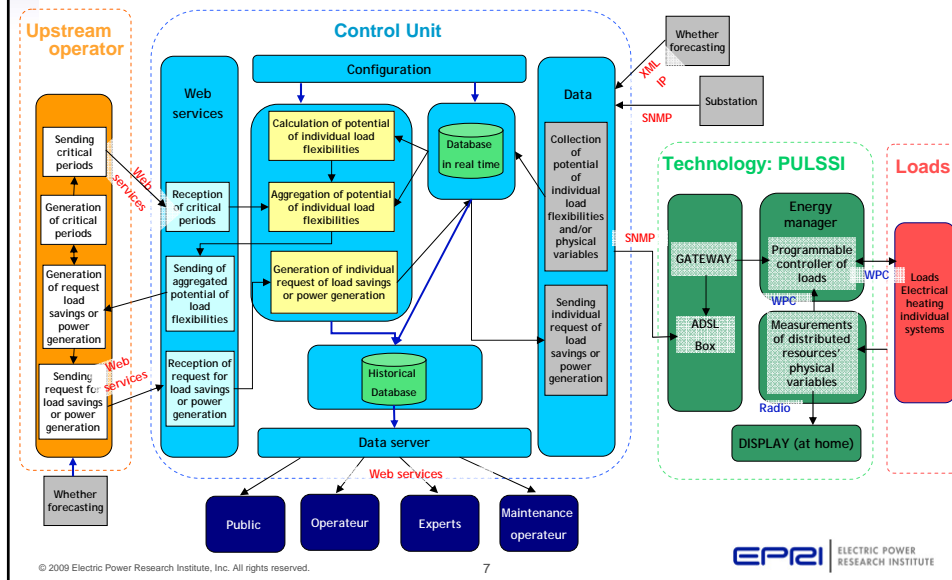
Overview of Information exchanges



Block Diagram

- Nine different types of technologies are installed at the customer side
- Each technology already existed and has been modified to be able to communicate with the control unit
- Some technologies have been modified in order to calculate their potential of load flexibilities
- These developments are not unified and there is not a single block diagram representing internal communications of the technologies

Block Diagram– Case WATTECO



Benefits of the project

Following benefits can be quantified in the framework of the project:

Improve systems economics	<ul style="list-style-type: none"> •Reduce peak demand (main objective) 	<ul style="list-style-type: none"> •Smart technologies remotely controlled by the control unit in critical periods •Local optimization: reduction of energy consumption or/and load shifted to off-peak periods
Improve power quality	<ul style="list-style-type: none"> •Improve local voltage 	<ul style="list-style-type: none"> •In the case of PV+ storage technology (MICROSCOPE). Automatic discharge of the battery when voltage is low.
Environmental	<ul style="list-style-type: none"> •Meet renewable resources •Reduce greenhouse gas emissions 	<ul style="list-style-type: none"> • PV panels, generation unit by using solar thermal storage
Electricity cost savings	<ul style="list-style-type: none"> •In some cases, lower energy consumption thanks to a local optimization •Reduce electricity bill 	<ul style="list-style-type: none"> •e.g. better control of heating systems •Higher electricity consumption in off-peak rate periods and lower consumption in peak periods

Benefits of the project

- Learned lesson related to:
 - Customer behavior
 - Customer acceptance
 - Recruitment process
 - Assessment methods
 - Assessment of load savings at the residential level
 - Assessment of greenhouse gas emissions reductions
 - Technologies
 - Protocols/standards
 - Requirements of improvement/evolution of technologies
 - Process of installation of technologies

Gaps / Challenges

- Scaling up of the platform – technical viability and cost-effectiveness :
 - Lack of standardized protocols of communication
 - Lack of low energy consumption technologies for load saving
 - Customer acceptance
 - Restriction of customers' freedom
 - Most of energy saving technologies are intrusive
 - Lack of knowledge of the customers' behavior to demand response actions at the residential level
 - Modeling of the potential of load flexibilities
 - Measurements
 - Calculation of the load savings
 - Difficulty to apply dedicated tariffs in demonstration projects in France
 - Lack of appropriated models and methods to calculate reduction of CO2 emissions

Zoom of WATTECO technologies

- Watteco presentation (company, Technology...)
- Watteco in PREMIO
 - Load shedding on pick alert
 - Energy monitoring, real time display
 - Energy efficiency scenarios
- Future Watteco trends of connected home.
 - Smart Plugs
 - Din rail mounting
 - DC solar panel monitoring and control
 - Communicating Thermostats
 - 802.15.4 with Zigbee on Wire or 6 LowPan on wire
 - IPV6

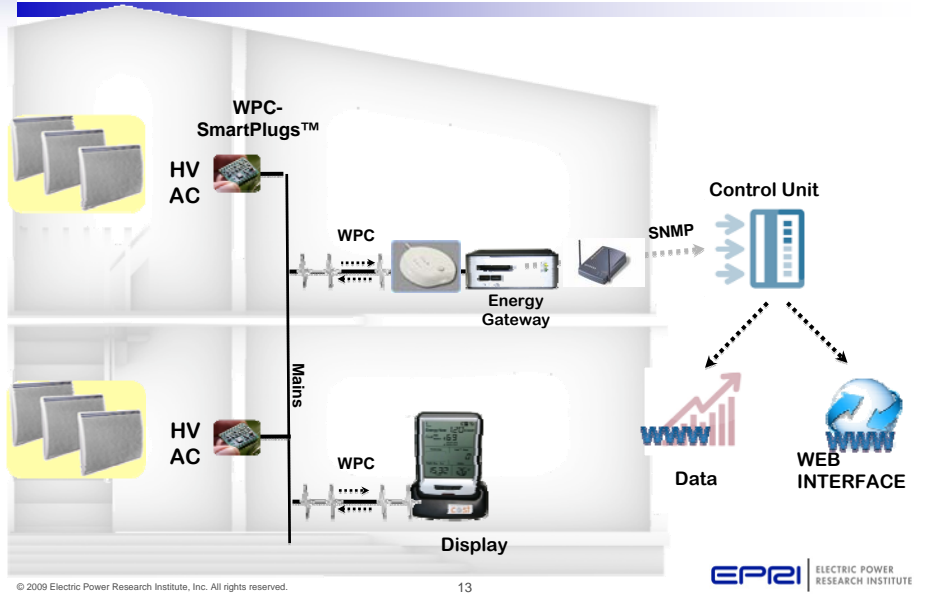
Watteco In PREMIO

- Watteco is a French company designing SOC for In-Home Low Rate, Low Power, Powerline communication for Smart Grid applications.
- Premio requirements was to use existing products. Pulssi, an existing proprietary low rate PLC technology, was available at that time and it was decided to use it. Pulssi allows local load & electric heater management through saving scenarios but cannot accept remote connections.
- To connect the Pulssi system to the Premio Control Unit it was then necessary to use a local gateway ensuring BroadBand connection and translation from SNMP order to Pulssi language.

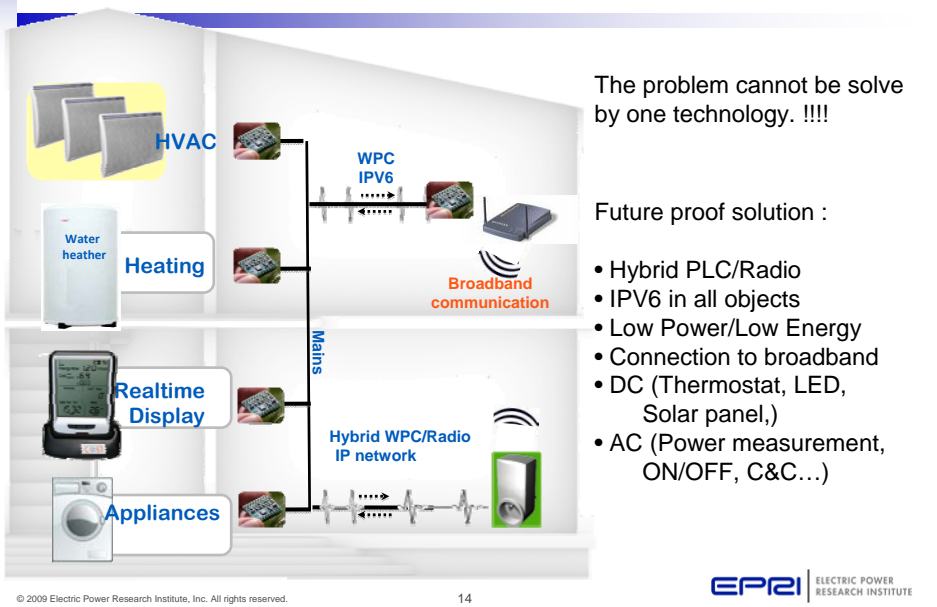


The solution was easy to develop and to setup but using a complex proprietary gateway could have some drawbacks in term of **cost, scalability, maintenance, and consumption.**

First application: load shedding in homes with a gateway

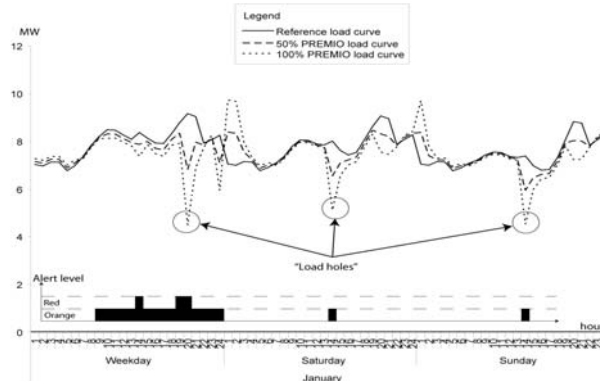


WATTECO IPV6: Empowering the future Smart Grid eco-system in home



Project Progress

- First study of the PREMIO platform's modeling and deployment
 - Bougnol P., Imbert P., Chartres S. Normand O., « Modélisation énergétique de la plateforme PREMIO, une architecture dédiée à la gestion dynamique de la charge sur le réseau électrique », REE - Revue de l'électricité et de l'électronique, N° 1, janvier 2010, p. 111-118.



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Project Progress

- Control unit is already installed

PREMIO - Central setup

Process management

Control > Processes >

Contract editor

EDF - PREMIO - Contract editor v0.1

Content of the contract with id: 12

Return to contract's list

General parameters

Plant	GRU2
Vendor	SEP
Service	HSC
Instance	1
Start at	2009-09-15 15:00:00
End at	2010-09-15 15:00:00

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Financial clauses

Contract	EPRI/AMTRM/MS	Value
Total cost	Contract name	Value
Start cost	START_COST_DEFAULT_VALUE	Value

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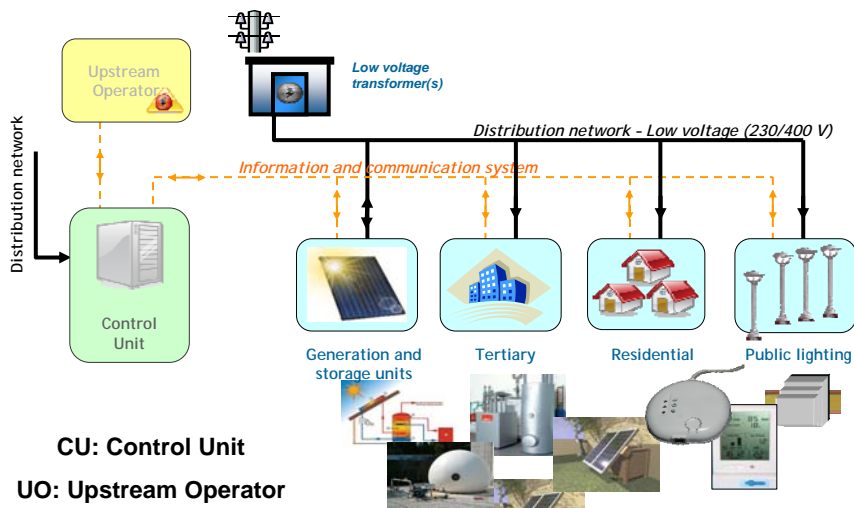
Project Progress

- Communication tests between technologies and the control unit in progress
- Difficulties:
 - Recruitment of big installations (public funding)
 - Delay during technologies installation
- First results are foreseen for June 2010

Questions?



PREMIO's Architecture



CU: Control Unit
UO: Upstream Operator
DR: Distributed Resources