



Energy@home

Energy@home:

***an eco-system for
the energy-aware Smart Home***



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*Workshop Smart Grid
Standardisation
May 16th 2013*

Outline of the Talk

Energy@home Association

Smart Grid Connection Point

Customer Value Proposition

Occupant Behaviour & Data from the Pilot

What next

Energy@home Association

Smart Consumption is a challenge that requires involvement of several types of industries

Energy@home is a no-profit association registered under the Italian laws with the purpose of developing & promoting technologies and services for home energy efficiency based upon device to device communication.

Founding Members



Electrolux



Ordinary Members



Aggregate Members

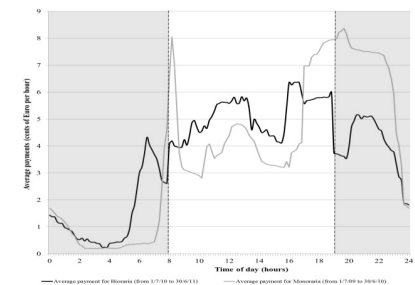
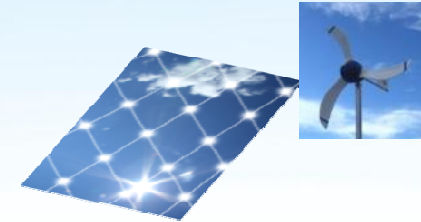


Energy@home vision

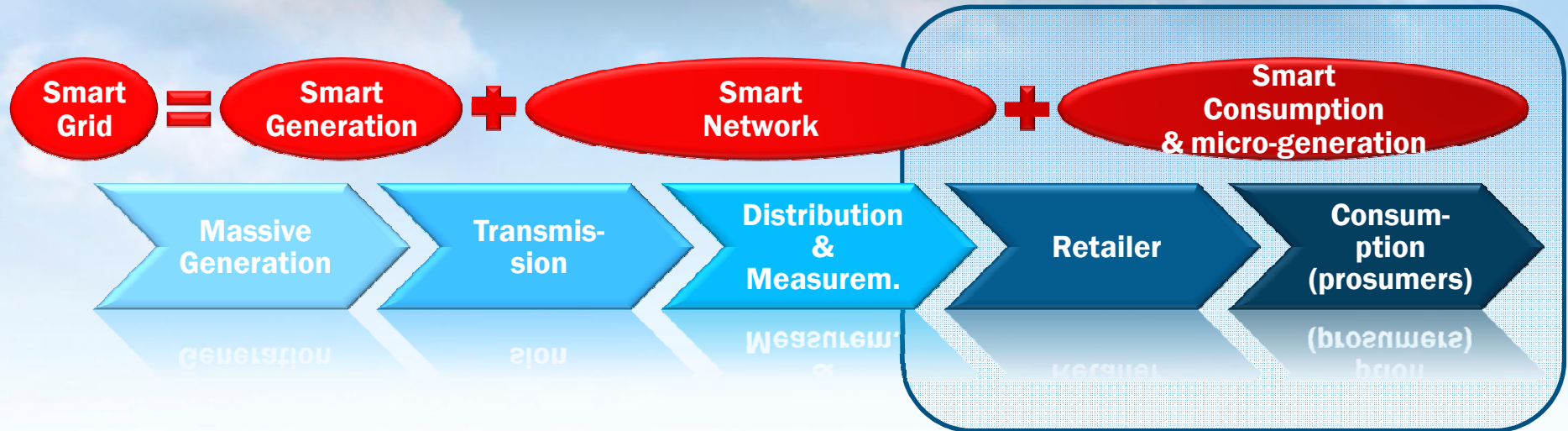
Energy@home Association envisages a progress from the consumption reduction of each appliance towards an household holistic approach comprising:



- coordinated energy consumption optimization between all the appliances
- energy micro-generation and consumption
- education of the consumer to a virtuous use of appliances towards a more sustainable lifestyle
- time of use and dynamic tariff schemes



Scope : Smart Consumption



Some trends in Smart Consumption

Electric Cars



Time of day Tariffs

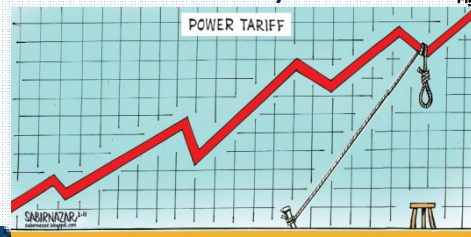
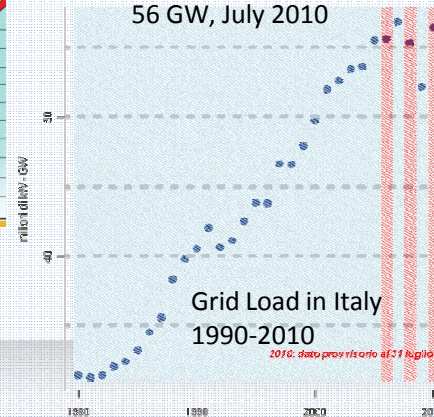


Figura 18 - Carico massimo sulla rete Italia - 1990 - 2010 (provvisorio)

Peak reduction

56 GW, July 2010



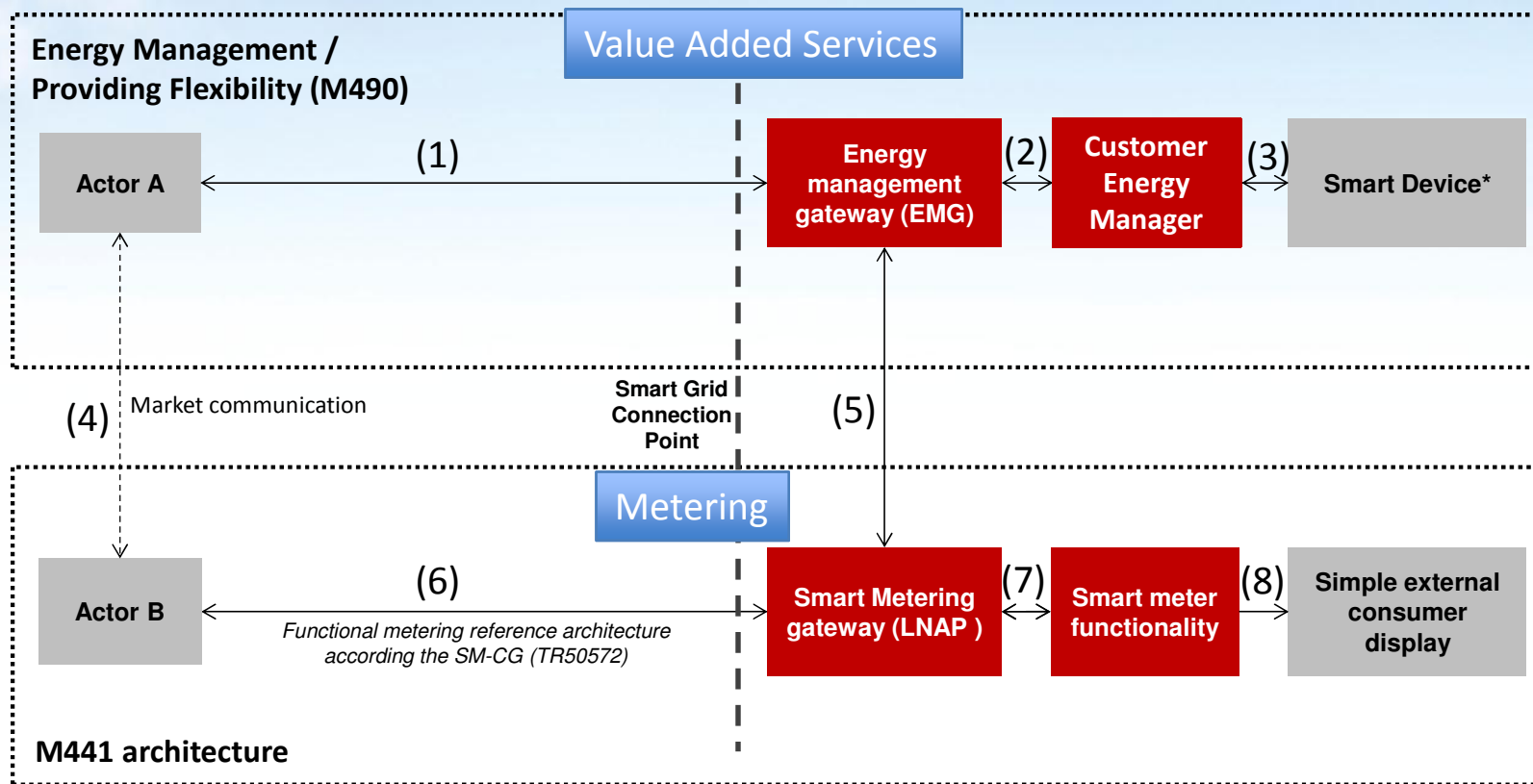
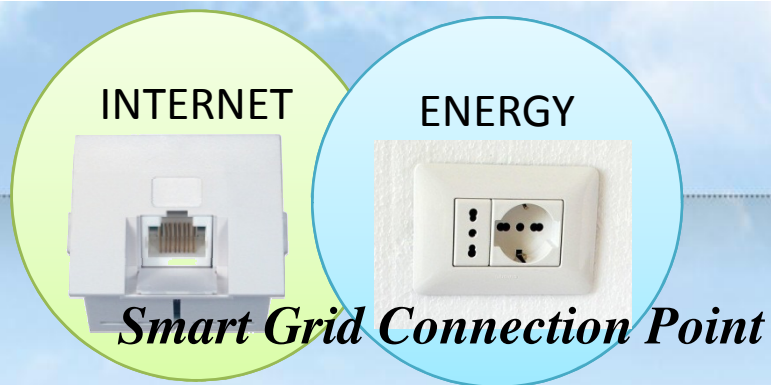
Efficiency



Tools to empower consumers

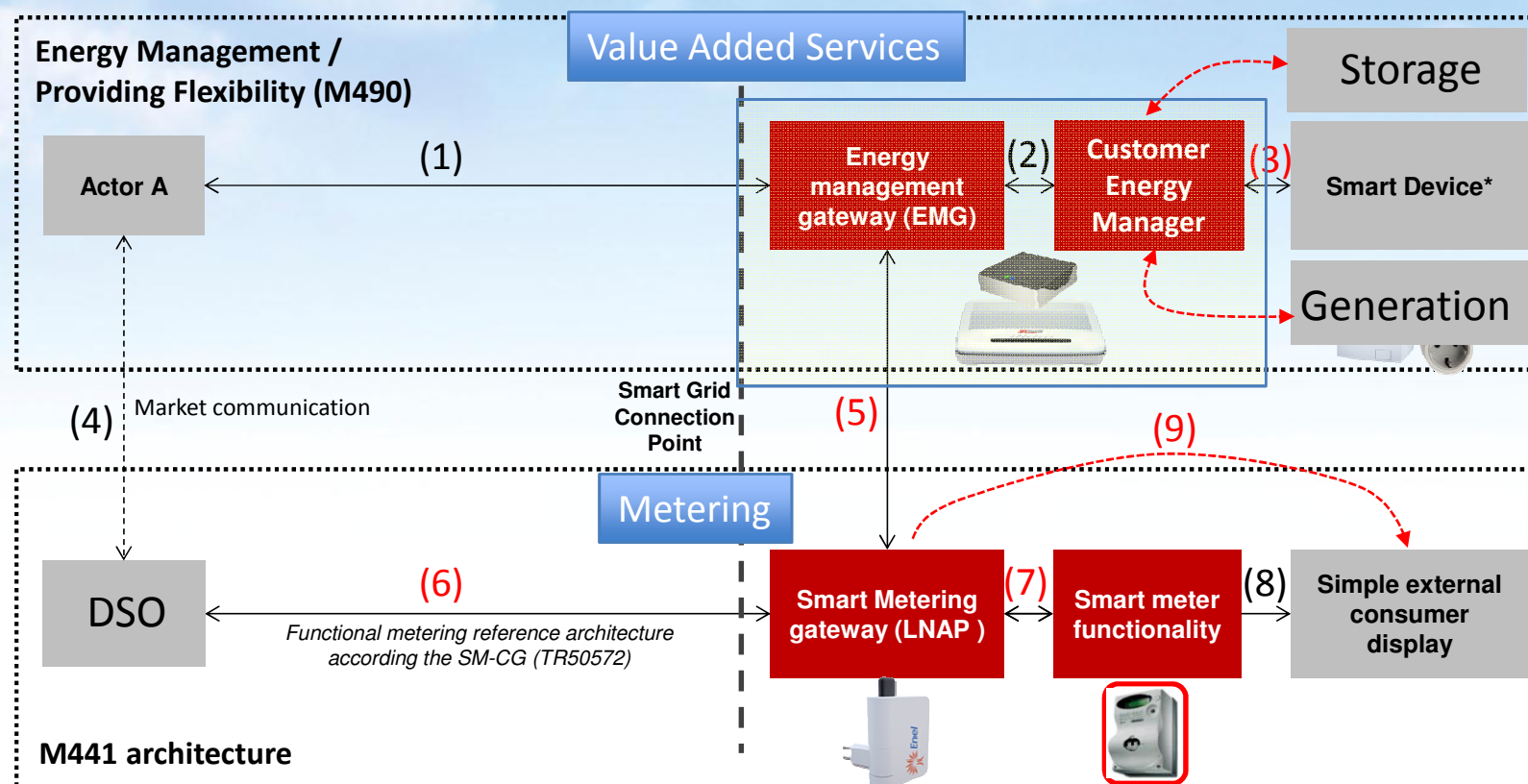


Distributed Renewables



* e.g. HBES device, smart appliances, storage, generator, domestic charger for EV, complex display
(source Smart Grid Coordination Group)

Smart Grid Connection Point & E@h reification (so far)



* e.g. HBES device, smart appliances, storage, generator, domestic charger for EV, complex display

List of i/f already defined in E@h:
 (3, 5): ZigBee HA extended with E@h functions
 (6,7): Enel PLC, proprietary
 (9): USB in alternative to (3,5)

Devices integrated in Energy@home, so far

ENEL Smart Info

- Plugged into any house electricity sockets
- Univocally associated to the meter
- Makes available consumption, generation, and contractual data
- Compatible with already deployed smart meters



Telecom Italia Home Gateway

- Home Area Network controller
- ZigBee Trust Center
- OSGi framework to manage VAS via a single box



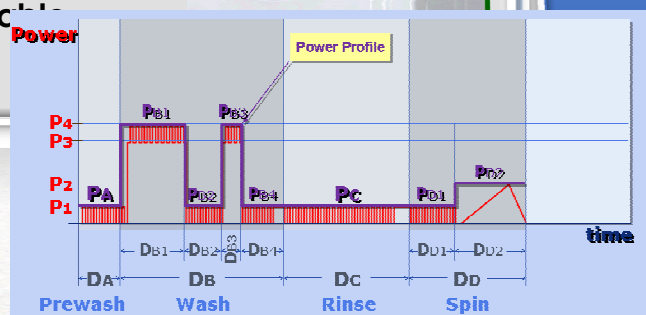
Smart Appliances

- Visualization of cost and consumption
- React to external signals (price, energy colour, pause/resume)
- Per-phase scheduling



Commercial Devices

- ZigBee HA 1.2 compliant
- Energy/power meter
- Switch on/off
- Presence
- Water Leak, door
- ...



Power profile and appliance control data structures

Status

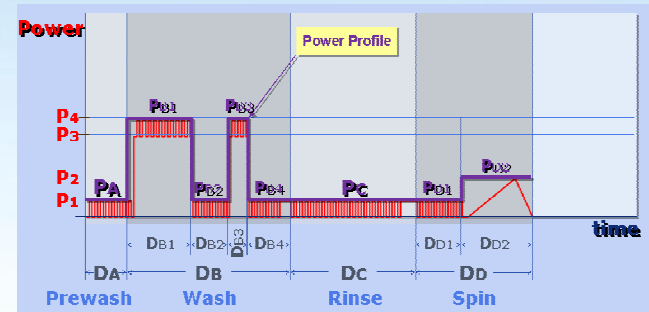
- Status
- Current Cycle and Phase
- Time To End
- Start and Finish Time

Events

- Faults
- Warnings

Appliance control

Power Profile



Power Profile

▪ sequence of electrical loads activation/ deactivation (Power phases); basic “uninterruptable” elements:

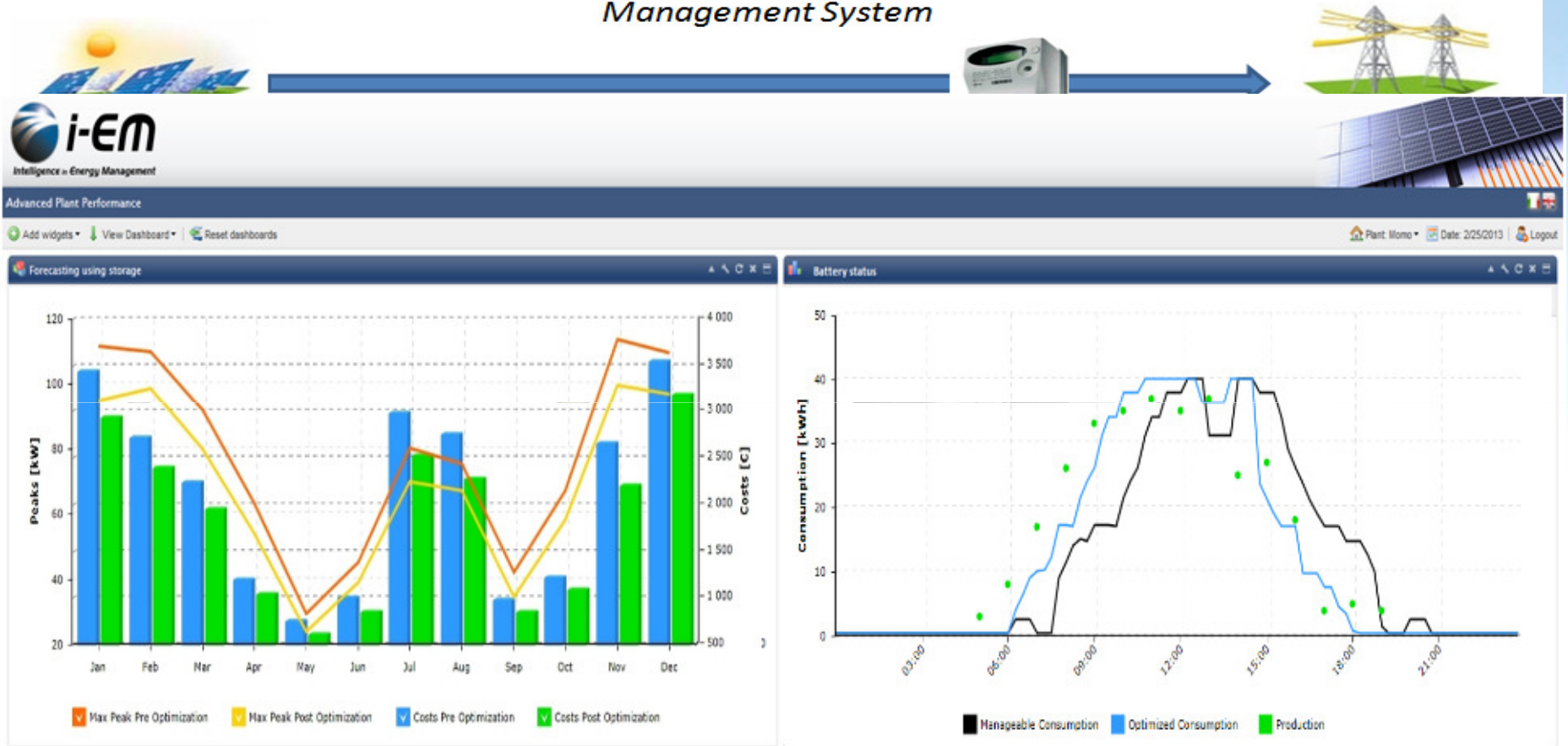
- ✓ Expected duration
- ✓ Peak Power consumption
- ✓ Maximum activation delay
- ✓ Expected Energy consumption

• Sequence of Power phases -> Power Profile

**No more
monolithic
cycles**

DER & Smart appliances optimal management by forecasting

Embedding energy production in peaks/costs **optimization** inside *Home Energy Management System*

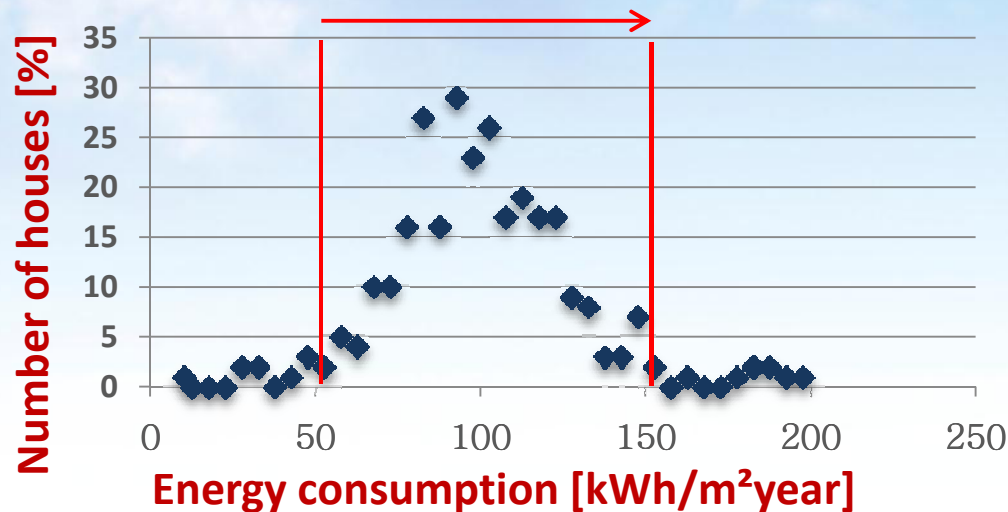


Customer Value Proposition

	ADDED VALUE	€ / year
Quantifiable	Optimal self-consumption of generated energy <i>from 40% to 70%</i>	100 – 280
	Overload control: lower max contractual power <i>from 4.5 kW to 3 kW with same energy consumption</i>	190-240 (*)
	Energy awareness: self-optimization of energy consumptions <i>-5% / -10% consumption</i>	37 - 70
	Dynamic pricing schemes: reduction of cost	In the future
	Low impact in installation (wireless)	
Non Quantifiable	Greater comfort thanks to overload control	
	Ready to internet connection and new VAS	

Occupant Behavior: how to design proper stimuli?

SPACE HEATING ENERGY DEMAND IN 290 "IDENTICAL" HOUSES IN DENMARK



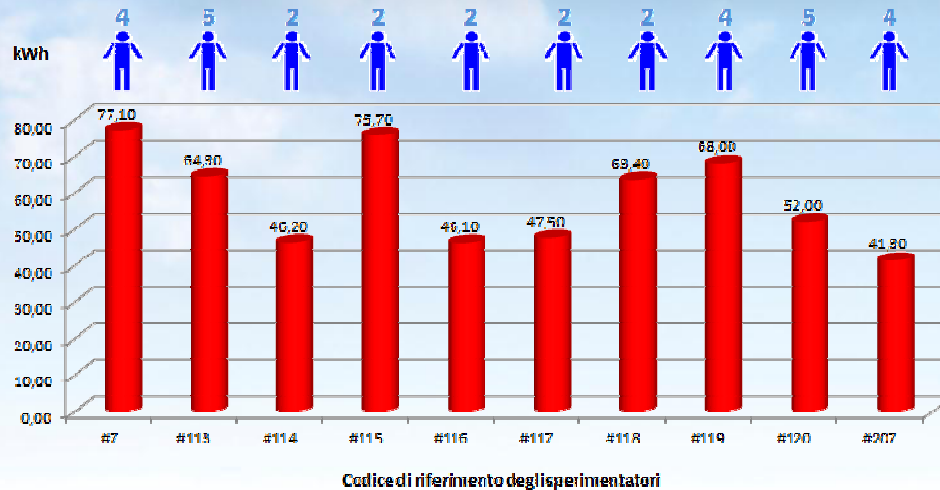
Results:
HIGHEST CONSUMPTIONS
MORE THEN
3 TIMES
HIGHER THAN THE
LOWER ONES

OCCUPANT BEHAVIOUR IS A
CRUCIAL ASPECT INFLUENCING
THE REAL BUILDING ENERGY
CONSUMPTION

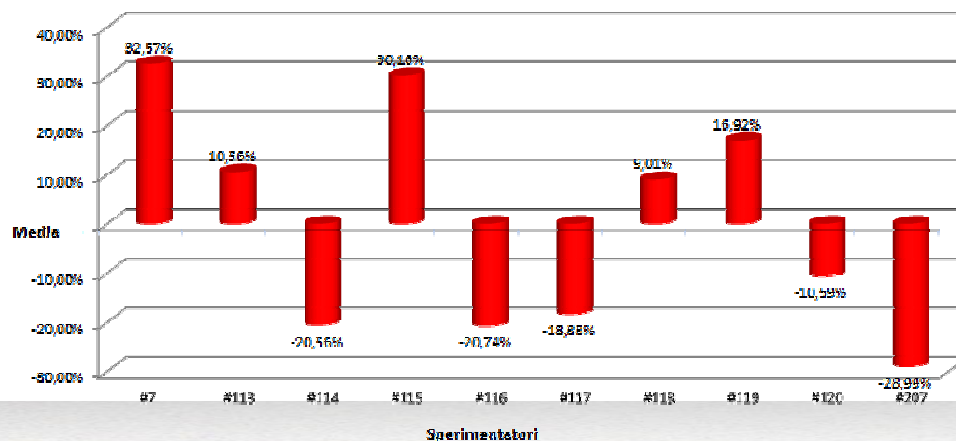


Occupant behaviour – Persuasive Feedback

Energy consumption this week [kWh]



... in comparison with the average [%]



«I'm pleased this week I saved 3.84 KW/h in respect to last week: a small quantity but it's a good start.»

«Since when I saw the consumption of my PC, I never leave it again switched-on when I don't use it»

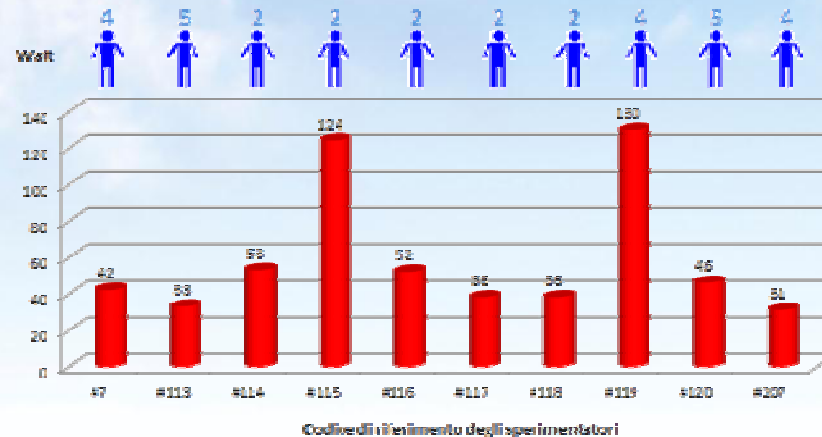
«I discovered where I have a large consumption: it is the fridge! Thanks for let me discover that.»

«the verdict was very cruel to me given that only a family with four members has consumed more than me, while I have consumed more than other families with five and four components, and all the other trialists have consumed much less than me.»

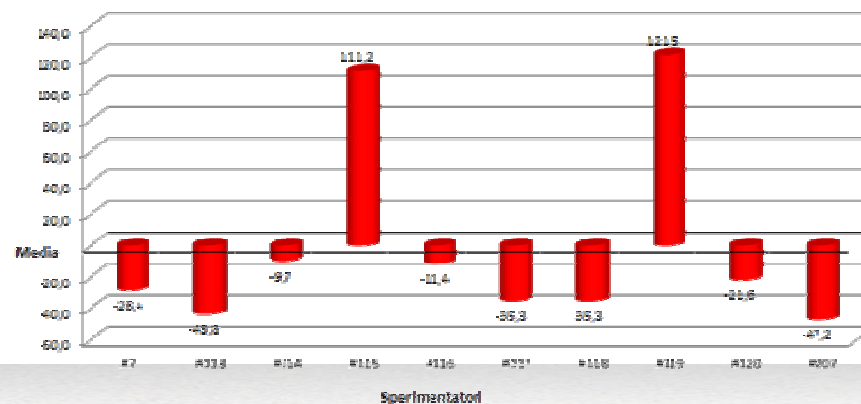
«We attempted to reduce costs by operating appliances such as washing machine and dishwasher in the off-peak times, but we can get small cost savings. However I am satisfied with seeing the other participants' consumption because I am in the middle of the classification, even if of course I would be pleased to further improve my position»

Stand-by consumptions: Persuasive Feedback

Stand-by consumption [Watt]



... in comparison with the average [%]



«This report is absolutely interesting as I can see I am quite virtuous! I knew already stand-by consumptions have a significant impact on annual bill and so I use to switch off electrical extensions»

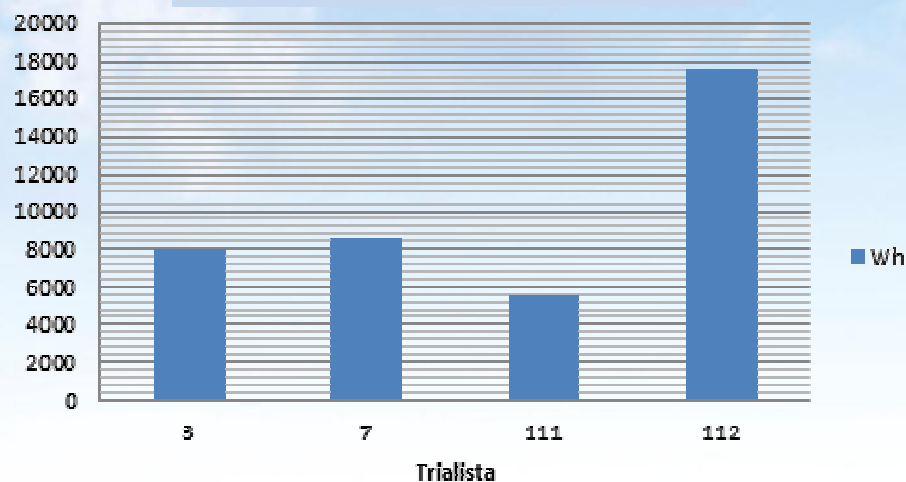
«Very interesting, I am quite virtuous but my stand-by is quite high. How can I reduce it?»

«Thank you, I have 22 devices with standy-by consumptions *(follows the list of devices with the exact stand-by consumption of each device...)*»

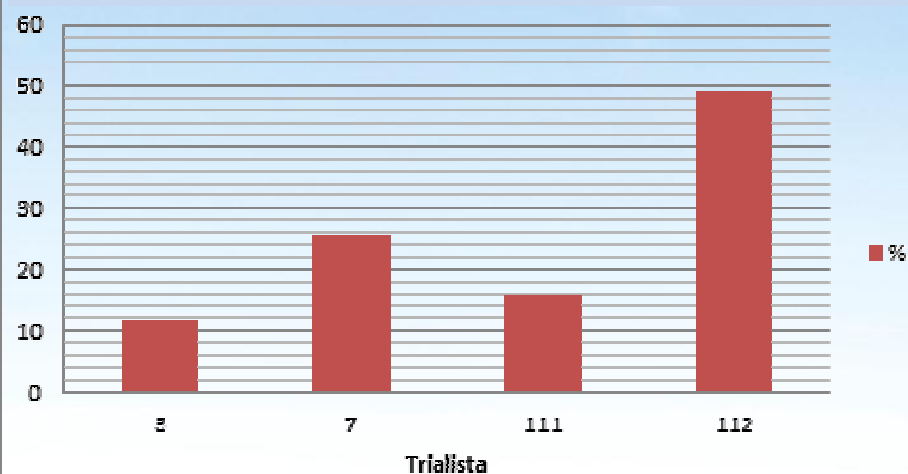
«Thanks. I want to improve my position and reduce stand-by. I decided to switch-off TV and to switch-off the courtesy lights that I have in my corridor»

Trial E@h – comparison between users

Fridge consumption in a week



Fridge consumption (% of the total consumption)

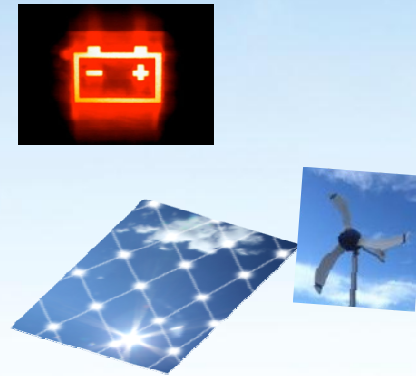


- On average the fridge represents 10 – 25% of the house consumption
- For user 112 the fridge represents 50% of the house consumption
- User 112 is going to pay 100 €/year more than the other users

What next and critical standardization issues

Energy@home is studying new standards interfaces protocols for :

1. Storage devices
2. New smart appliances (fridge, oven,...)
3. DERs (inverters,...)



Energy@Home asks also to its members and the regulatory bodies to invest in filling the current gap in the domain of ICP protocols and related regulatory issues, between the end-user IP identifier and the energy contract.

Energy@Home Contact point

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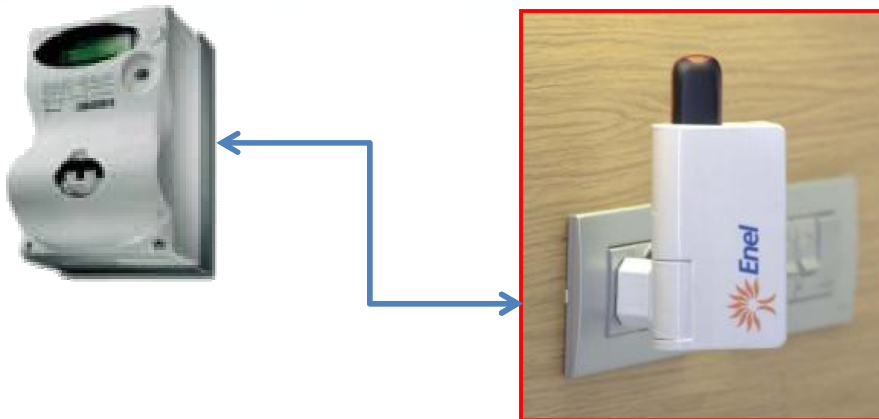
Tel : 011 - +39 011 2285111

Back UP

The devices: ENEL Smart Info

Enel Smart Info has been designed to provide end users with the certified information on electricity consumptions managed by the electronic smart meter.

It can be plugged in every domestic socket to start data collection from the smart meter through powerline.



Metering Data	
Metering data	Active and negative energy in current billing period and in different tariff intervals.
	Active and negative energy in previous billing period and in different tariff intervals.
	Maximum power of active and negative energy in current billing period and in different tariff intervals
	Maximum power of active and negative energy in previous billing period and in different tariff intervals
	Average positive and negative power (different integration periods)
	Reactive Energy in different billing periods and tariff intervals
	Instantaneous power
	Active and reactive energy of current day and previous one.
Contractual and configuration information	Contractual power and power thresholds.
	Customer ID
	POD (Point of delivery) code
	Tariff intervals
	Credit left (for pre-paid contracts)
	Date and time (from the Smart Meter)
	Last alarm with type and timestamp
	Meter device details
	Bidirectional transmission of custom data.

White goods: Smart washing machine

designed to be integrated in “Smart” ecosystems,
covering a wide range of use cases:

Calculation, visualization and dispatch to the HAN of the energy and power consumption before and during the cycle execution

Forecast and visualization of the estimated cost for the selected cycle based on time based tariff

Visualization of the total power consumption of the house

Coordination with the others connected appliances and to micro-generation to optimize the power consumption in the house

Scheduling of the starting time to ensure the cheapest or the greenest cycle, always respecting the users constraints

