Energy@home Association

valuing the demand side flexibility through
a Smart Home eco-system

Latest update 9/9/2015

1. **Vision & governance**
2. Achievements so far
3. Next steps for 2014 and beyond

Energy@home vision: Smart Home Eco-system

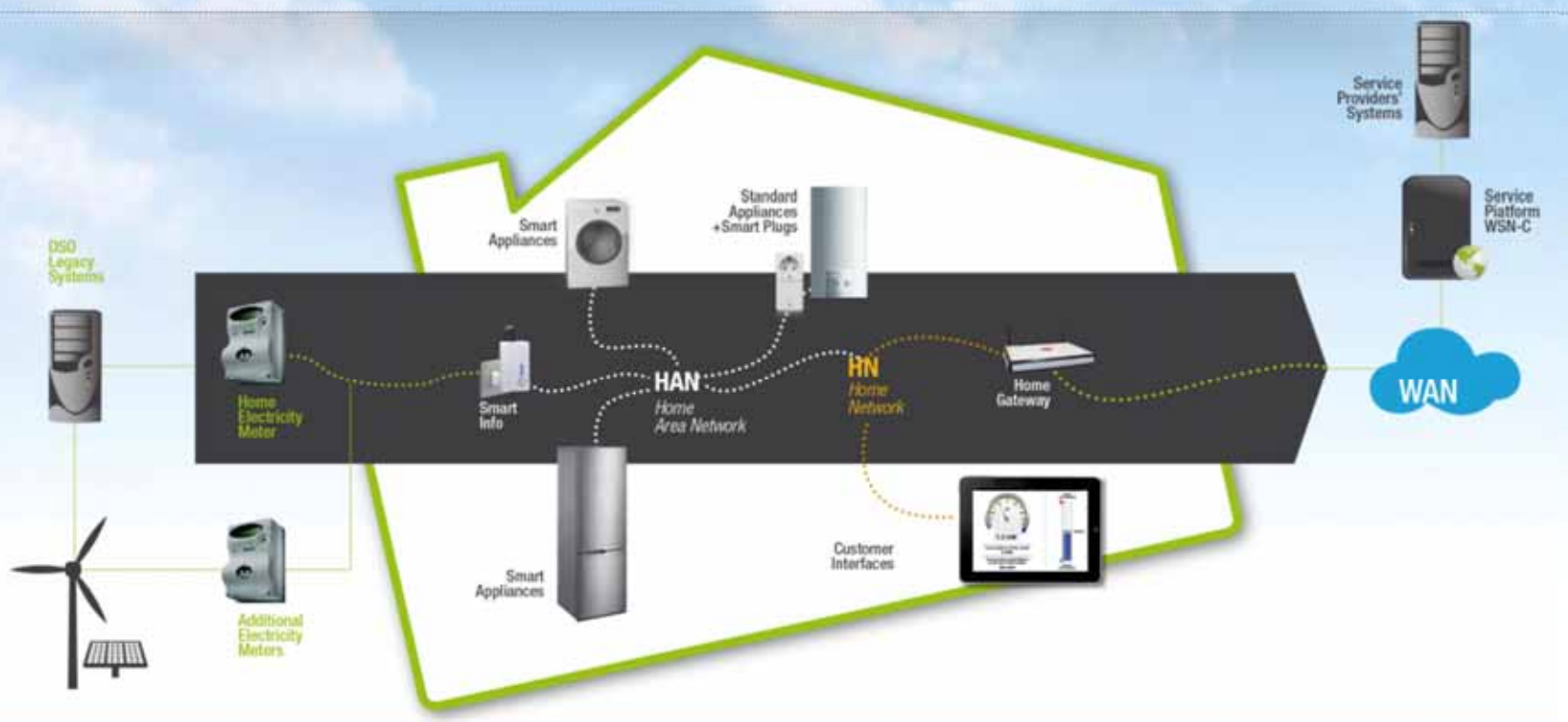
Eco-system:

- Adds new value into the overall system
- Provides a homogenous user experience
- Exploit scope synergies
- Bases for a unifying service provisioning architecture

A cross-services partnership-oriented horizontal solution versus vertical independent silos solutions

Values the role of makers and sw developers

Vision: consumer's flexibility can be managed and valued



All customers have a degree of demand side flexibility

- in time, in power, in energy

Flexibility can be managed to adapt & locally optimise the demand

- time of use pricing, reduced contractual power, maximise incentives through self-consumption
- It can exploit the same service provisioning infrastructure of the Smart Home Services

Flexibility enables also Customer 2 Grid Services

- to increase grid quality and grid reliability and to reduce balancing costs

Smart Grid & Smart Appliances: Energy benefits evidence

MDA's account for ~43% of the residential electricity consumption
They can provide flexibility in the way and timing they can be used

REFRIGERATION

- Pre-cooling prior to peak
- Optimize defrost to run it during off peak

LAUNDRY

- Delay start: remote auto start for laundry cycle to off peak hours
- Dryer – short delay and/or power down heating element

CLEANING

- Delay start: remote auto start for laundry cycle to off peak hours
- Short delay and/or power down heating element

AIR COND

- Auto set from cooling to dehum
- Reduce power during peak hours
- Suggest settings

WATER HEATER

- Plan water heating based on tariff and energy availability
- Reduce power during peak hours

(source: CECED Italia)

Energy@home Association

Non-profit Association

Scope: smart home & demand side management

Goal: create a market for new Value Added Services based upon device-to-device communication in the Smart Home

Approach:
International Standards, trials, regulations, scope synergies

Types of participation

- **Founding Members**
  - Voting right
  - Permanent member for the Board of Directors
  - Can influence the use of the budget
  - Fee: 10 k€/fiscal year

- **Ordinary Members**
  - Voting right
  - Active and passive electoral (right to vote and to be nominated as a candidate) for the Board of Directors
  - Can influence the use of the budget
  - Fee: 10 k€/fiscal year

- **Aggregate Members**
  - No voting right
  - Can participate to meetings, have access to technical material
  - Fee: 3 k€/fiscal year

Organization of the activities

Board of Directors

- Fabio Bellifemine, Telecom Italia, Director
- Sergio Brambilla, Enel D, Secretary & Treasurer
- Stefano Frattesi, Indesit Company
- Nicolas David, Electrolux
- Lorenzo Montelatici, Edison
- Davide Cabri, Whirlpool

Federico Caleno, ENEL
Honorary Chairman

General Assembly
(all member companies)

Working Groups

Standard
A. Ranalli,
E. Arione

Use Cases
S. Di Carlo

Policies & Regulations
E. Molinari

Reference Implementation
R. Tomasi

Energy@home Approach

WG Standards

Application Layer

ZigBee HA 1.2

WG Ref Impl

Demo

WG Use Cases

Use Cases

IEC TR 62746-2

Data Model

IEEE P2030.5
IEC CIM
ZigBee SEP 2.x
ETSI?

Reference Implementation

JEMMA Open Source Project

Trials

Protocols

ZigBee Pro

Wi Fi (in progress)

WG Policies

Policies & Regulations

1. Vision & governance
2. **Achievements so far**
3. Next steps for 2014 and beyond

Activities

System Integration

Trials (UK, NL, IT)

JEMMA
Open Source Project

ZigBee
Control your world

HGI

INITIATIVE EEBUS

@GORA
Smart Sweet Home

Data Model

Energy@home

IEC International Electrotechnical Commission

IEC TC57, WG21,
Use Cases, TR 62746-2

CASA JASMINA

Open Innovation

ZigBee
Control your world

Technical Standard
ZigBee Home Automation 1.2

Autorità per l'energia elettrica il gas e il sistema idrico

DCO 232 on user awareness

Energy@home

Main achievements so far

ZigBee Home Automation 1.2

- Energy@home is an acknowledged main contributor
- Integrates Energy@home use cases and technical specifications
- Energy is just 1 of the services of the Smart Home

Prototype system

- Integrates 11 different devices and systems from E@h partners/off-the shelf products
- Presented at EU Utility Week, M2MForum, Designing with Freescale
- Permanent demo at ISMB and Telecom Italia premises

Open Source

- ZigBee Gateway
- Sw of the client side
- Java for OSGi

Trials

- 5 trials in Europe, one is in Italy

Regulations

- acknowledged contributor to CERRE report on Smart Metering (Centre on Regulation in Europe)
- acknowledged in DCO 232 of Italian Authority on user awareness
- Contributor to Confindustria cost-benefit analysis

Energy@home *adapts and adopts* International Standards

On Jul. 2011, Energy@home and ZigBee Alliance signed a collaboration agreement that brought on July 2013 to the ZigBee Home Automation 1.2 standard

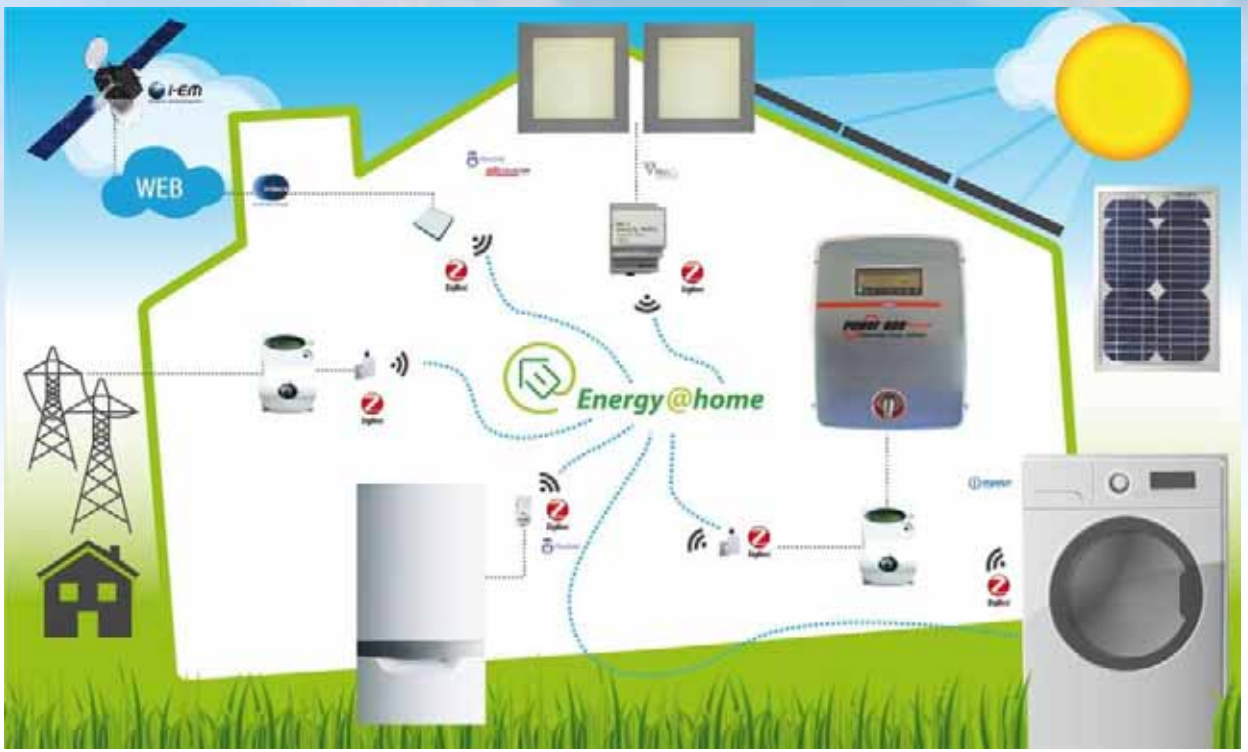
ZigBee Alliance:

- 400+ member companies (40% Americas, 30% EMEA, 30% Asia)
- 800+ certified products

Market leader with most deployed low power wireless mesh standard

A plethora of services can be based upon the same service provisioning infrastructure: communication standard + home gateway + cloud

Energy@home demonstrator



- Integrates devices and sub-systems from 11 different vendors
  - Gateway, smart meter, inverter, whitegoods, thermostat, lights, smart plugs, temperature sensor
  - Cloud platform, gateway sw environment, PV forecast system

m2m FORUM 2014
since 2002 the premier M2M matchmaking event
Milano
20 Maggio 2014
XIII edizione

ZigBee Smart Homes Day
Venice, 17 Oct 2014

European Utility Week
STAND 4.G20
Amsterdam, 4-6 Nov 2014

ONE EUROPE
ONE LANGUAGE
ONE SMART HOME
EBUS
@GORA Smart Sweet Home

The devices: Smart Home Gateway

Multi-function Smart Home Hub

- OSGi Service Execution Environment

Single box in the near future

- Dual box before the market takes off

ZigBee Coordinator

- Certified implementation of ZigBee Gateway Device
- ZigBee Trust Center
- May host multiple network interfaces

Smart Home Cloud Platform

- Data base of users, devices, data

Bank of customer data

- Protect data & privacy
- Increment value of data

The devices: ENEL Smart Info

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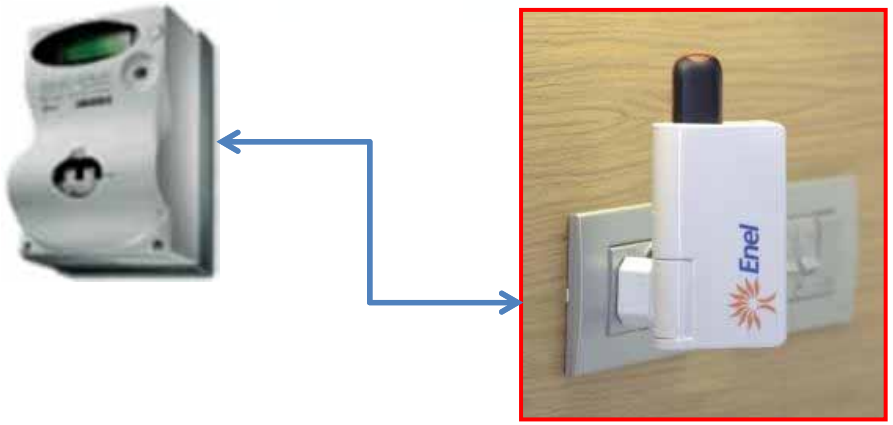

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Energy & Cost Awareness

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Coaching

- Visualization of generic text messages

Energy Mgmt

- Per-phase schedulable to optimize power consumption and avoid power overload
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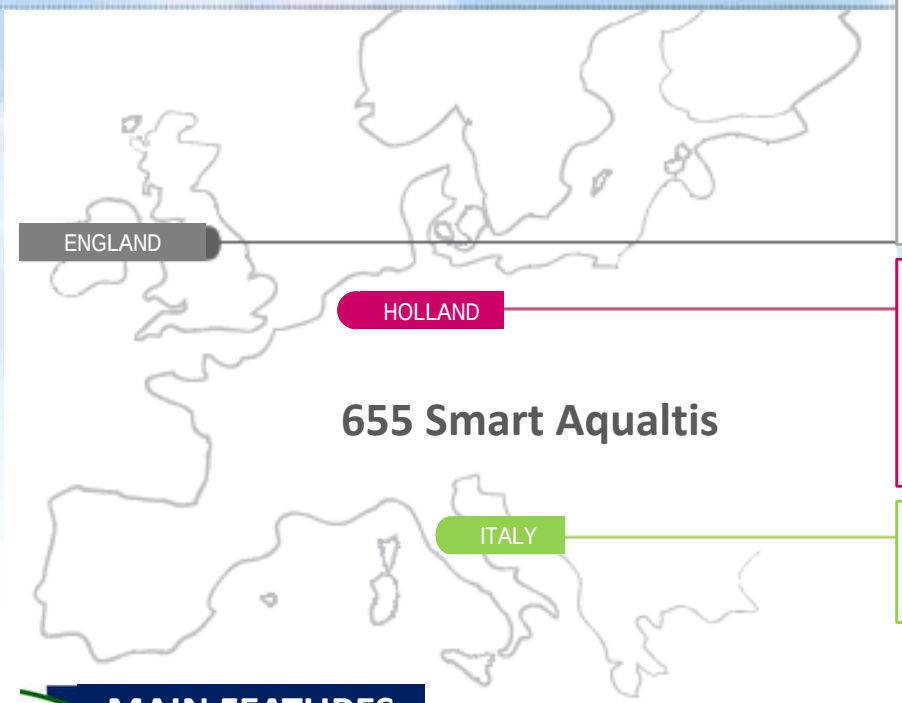
Optimal Start

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

Energy@home trials



ENGLAND

HOLLAND

655 Smart Aqualtis

ITALY

British Gas — Looking after your world — 165 Smart Aqualtis Ongoing …

e·on — 30 Smart Aqualtis Ongoing..

ENEXIS — 380 Smart Aqualtis Ongoing …

PowerMatching City — 25 Smart Aqualtis Ongoing …

Enel Distribuzione / TELECOM ITALIA — 50 Smart Aqualtis Ongoing …

MAIN FEATURES

Energy & Cost Awareness

Coaching

Coordinated Energy Management

Optimal Start

Energy@home Italian trial

56 users in Italy (20 have a PV plant)

User functionalities:

- Awareness:
  - monitoring (kWh, stand-by, €)
  - aggregated reports
  - social comparison
- Automatic scheduling
- Overload warning

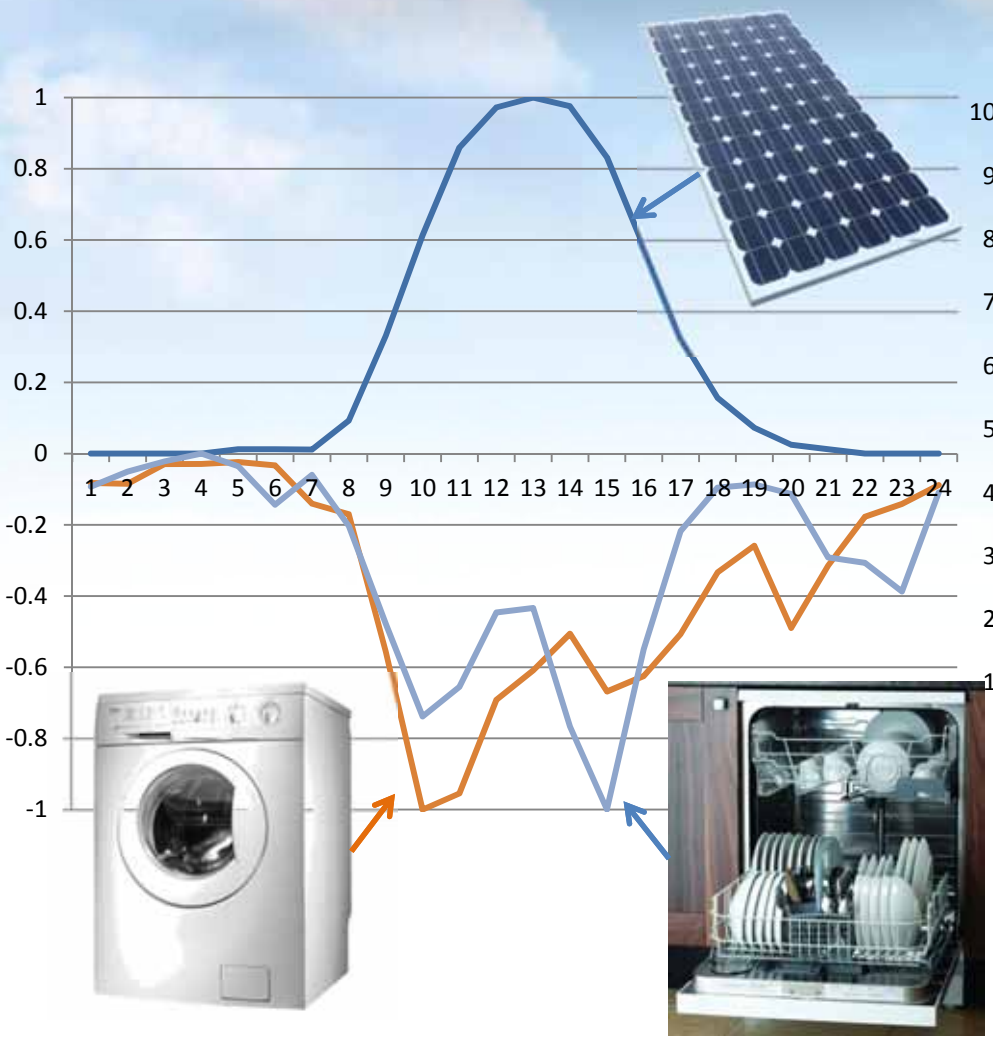
LIKE

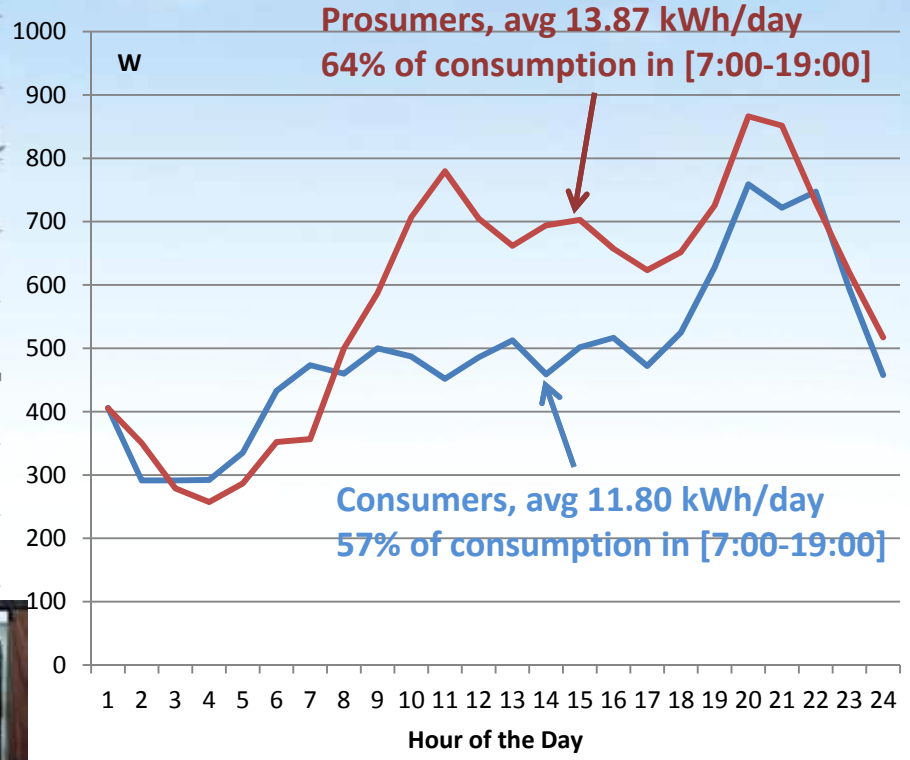
- 9% avg energy saving
  - at country level means 5.6 TWh, ~ 3 M tons CO2
- 5% energy shifted to off-peak hours
- 15% reduction stand-by consumption
- Social comparison as a benchmark
- Smart Info, Smart Appliance, Smart Gateway

DISLIKE

- Automatic decision systems are required!
- Smart Plugs
- More smart home services are expected

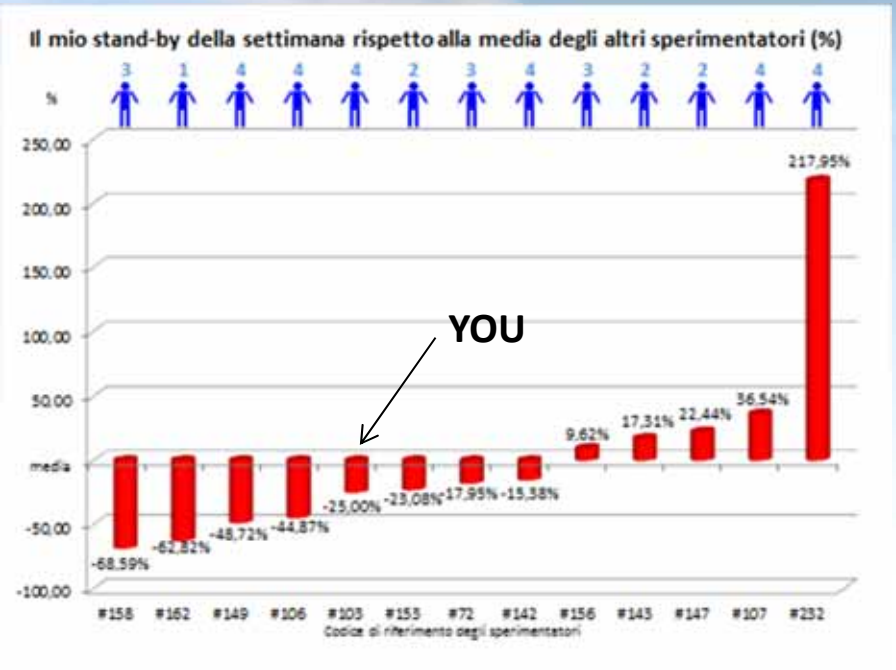
Prosumers synchronize main loads with the generation curve





PV: data averaged over 20 users
No-PV: data averaged over 30 users

Analysis of Occupant Behaviour: Data & Gamification



«the verdict was very cruel to me given that **only a family with four members has consumed more than me**, […] and all the other trialists have consumed much less than me»

«**I am satisfied when seeing the other participants' consumption because I am in the middle of the ranking**, of course I would be pleased to further improve my position»

«**I am very satisfied that my fridge has the least consumption**: it is an A+ class and I bought it very recently»

«I understood that I could use the quick program of the dishwasher every 2 days and save 25€»

«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»

«I discovered where I have a large consumption: it is the fridge!»

«Thank you for the info. I suspected stand-by consumption impacted but I had no idea how much»

JEMMA Open Source Project

JEMMA (Java **E**nergy **M**anage**M**ent **A**pplication Framework)

Implements the Energy@home Technical Specifications and the Energy@home gateway application

Implements the ZigBee Home Automation 1.2 standard and the ZigBee Gateway Device standard

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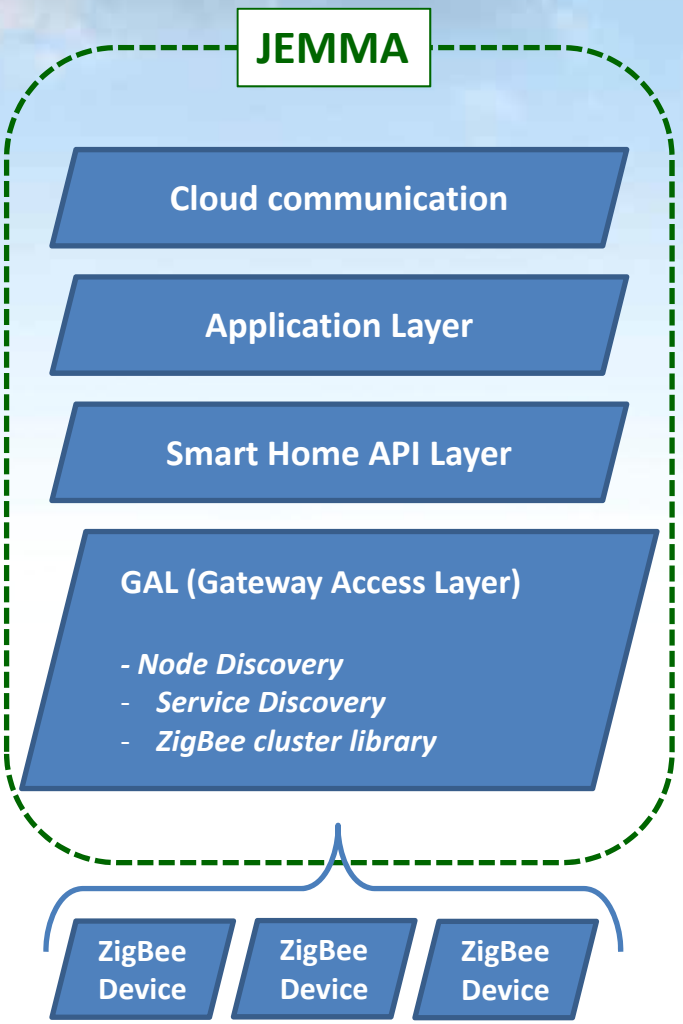
It is on github at
http://jemma.energy-home.org



Cost-Benefit Analysis

User Category	ADDED VALUE	€ / year
Prosumers	Optimal **self-consumption** of generated energy *from 30% to 60%*	100 – 280
High contractual-power users	**Overload control**: lower max contractual power *from 4.5 kW to 3 kW with same energy consumption*	190-240 (*)
Every Consumer	**Energy awareness**: self-optimization of energy consumption *-5% / -10% consumption*	37 - 70
	Dynamic pricing schemes: reduction of cost	For the future
	Demand-side Flexibility: new revenue stream	For the future

Reviewed by RSE, Enea, CECED

Public available as a Confindustria document, includes also the cost analysis

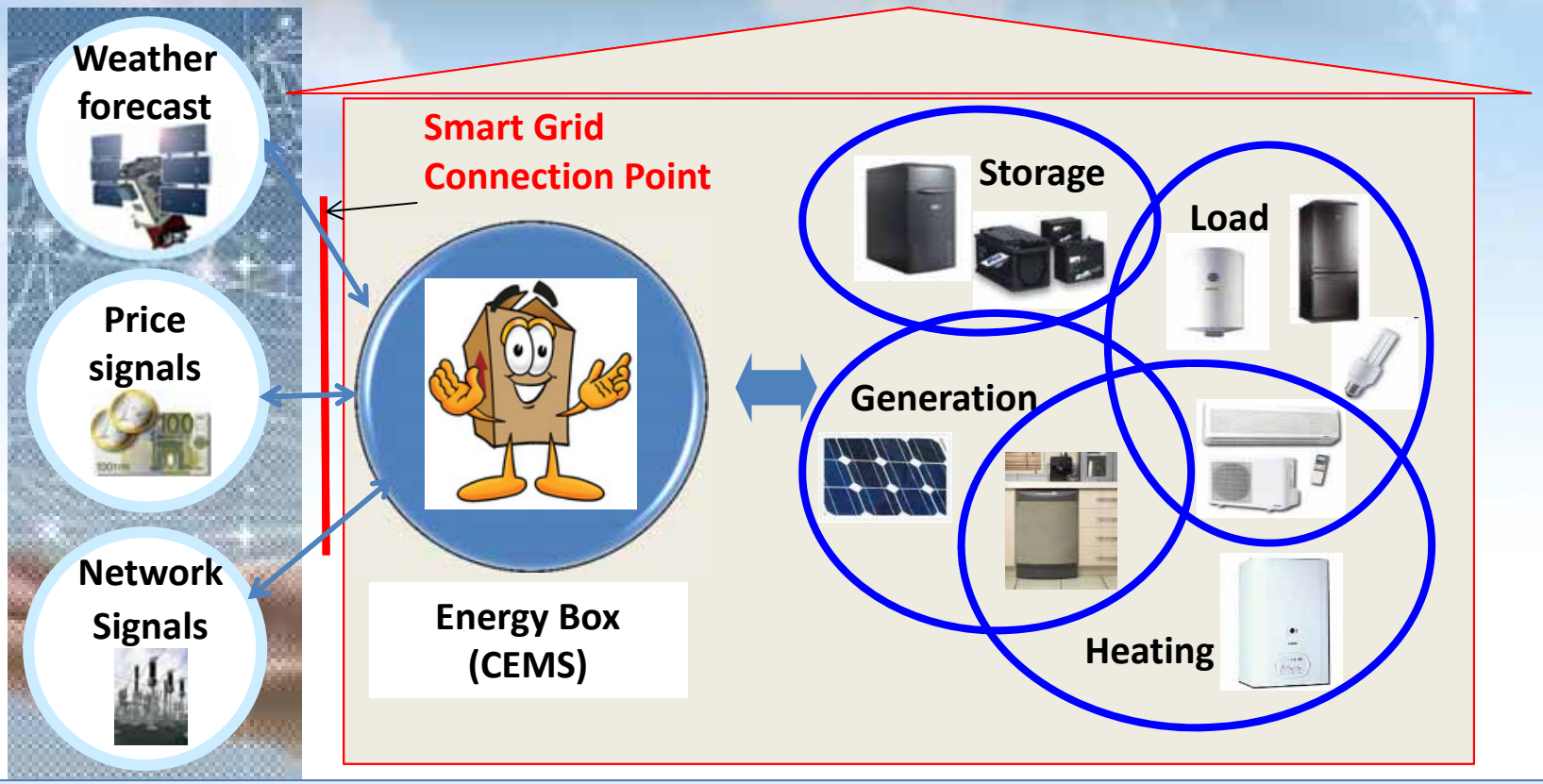
Conclusions: for some classes of users the payback is in 3 years under some conditions

Cost estimations based on average consumption in Italy 2.700 kWh/year, tariff «maggior tutela», data from trovaofferte AEEG, 3Q2013

(*) 190 € for a consumption of 4047 kWh/year, 240 for 2700 kWh/year

1. Vision & governance
2. Achievements so far
3. **Next steps for 2014 and beyond**

Energy@home vision: an Energy Box to increase efficiency and to provide Value Added Services



The Smart Grid requires a Smart Home able to increase efficiency through:

> making users aware of their consumptions

> driving users towards efficient behaviours

> supporting users to exploit ToU Pricing

> making flexibility a service from the house to the grid

Communication is the main enabler of these scenarios (Device2Device in the HAN, Grid2CEMS, …)

(elaboration of RSE architecture)

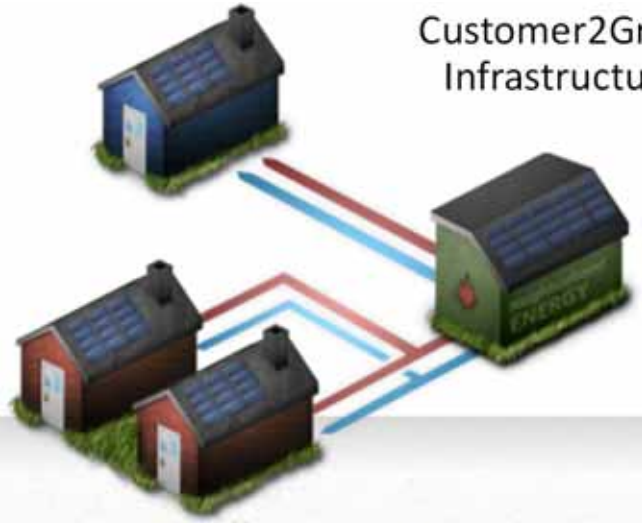
The path towards FlexibilityAsAService goes through a number of incremental steps

Local infrastructure

Tools for User Awareness

Tools & Methods to Drive and Motivate changes in user behaviour

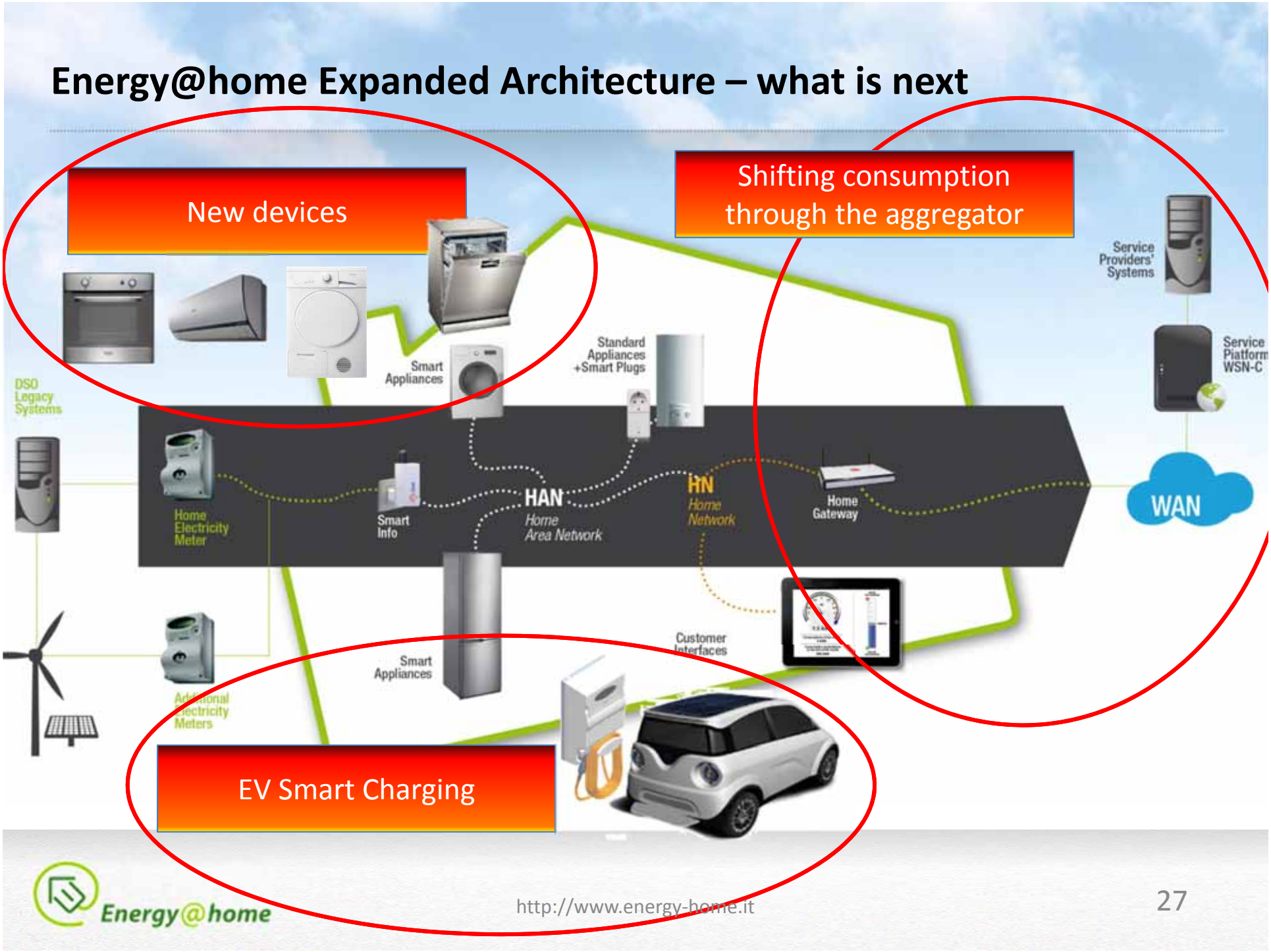
Automatic system (requiring no user intervention)



Customer2Grid Infrastructure

Flexibility as a service

Energy@home Expanded Architecture – what is next



Energy@Home – Focus areas 2014

- Go-to Market (technical solution & PR/communication)
- Demonstrator & JEMMA
  - Integration for storage and IP appliances
- Technical specifications
  - Release documentation & advertise
  - PAN-EU approach (DGConnect, others)
- Active Demand / Demand-Response
  - Interaction with Energy Box
  - Dynamic Pricing and/or hourly-based pricing
    - What is the value for users ? For retailers ? Achievable with Smart Info? How ? How to test further ?

Energy@home is an acknowledged stakeholder at DGConnect Project for a Unified Ontology for the Smart Home

Mr Rogelio Segovia
European Commission – DG Connect
H5 Smart Cities & Sustainability
Avenue Beaulieu 31 (BU31) 06/52
B-1049 Brussels
rogelio.segovia@ec.europa.eu

10 December 2013

Subject: Project for a Unified Ontology for the Smart Home

Dear Mr Segovia,

We, the undersigned, represent a number of industry fora/SDO working on aspects of the smart home and we are writing with regard to the *Study on the available semantics assets for the interoperability of Smart Appliances.* With this letter, we express our support to Commission's initiative for a unified ontology for the Smart Home. At the same time, we recommend harmonisation of this project with existing initiatives to avoid duplication of ongoing work, and we offer our consultation and collaboration towards this goal.

Goal:

- Agree upon common Data models
- Agree upon common security solutions

Status so far:

- Acknowledged stakeholder
- Submitted E@h Data model
- Will be contacted asap to review the 1° deliverable of DGConnect

Why 24 companies decided to join…

- Networking
  - Workshops, sw integration meetings, …
  - Participation in public funded projects
  - Partnerships
- Know-how
  - In adjacent businesses
- Impact
  - With EU (e.g. DGConnect, CERRE, ZigBee Alliance)
  - With AEEG – Italian Energy Authority
- Business potential
  - There is evidence of business potential in smart home and in smart grid
  - To be exploited there is a need for large partnerships and eco-systems

Summing up: Unique Value Proposition of Energy@home Association

- Integrated communication with the Smart Meter
- Integrated communication with Smart Appliances
- Seamless integration with other smart home services
- Consumer-centric
- Open and International Standard
- Bringing together key stakeholders from different industries
- Integration events, integrated demonstrators, trials

How to join

Energy@home is an open Association, willing to increase the consensus around it to reach its ambitious goals.

MEMBERS TYPE

- **Ordinary members**: can participate to all Association activities, have right vote, have right to elect/be-elected in the Management Board, 10K€ yearly fee
- **Aggregate members**: can participate to all the Association activities, but have no right to vote neither to elect members of the Board, 3K€ yearly fee

IPR rules

Any member accepts to release its own necessary(*) IPRs under FRAND (Fair, Reasonable and Non Discriminatory) license

(*) "Necessary IPRs" means those IPRs (including, but not limited to, all patents and patent applications, database rights or copyrights) throughout the world, existing now or hereafter issued or filed, that cover or directly relate to one or more of the Proposed Specifications, i.e., that would necessarily be infringed by implementation of one or more of the Specifications.

Back-up slides

Scope: Smart Consumption

Smart Grid = Smart Generation + Smart Network + Smart Consumption & micro-generation

Massive Generation | Transmis-sion | Distribution & Measurem. | Retailer | Consum-ption (prosumers)

Regulated | Unregulated

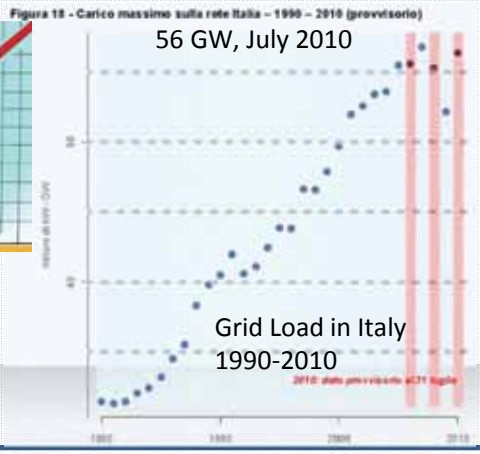
Some trends in Smart Consumption

Electric Cars

Time of day Tariffs

Distributed Renewables

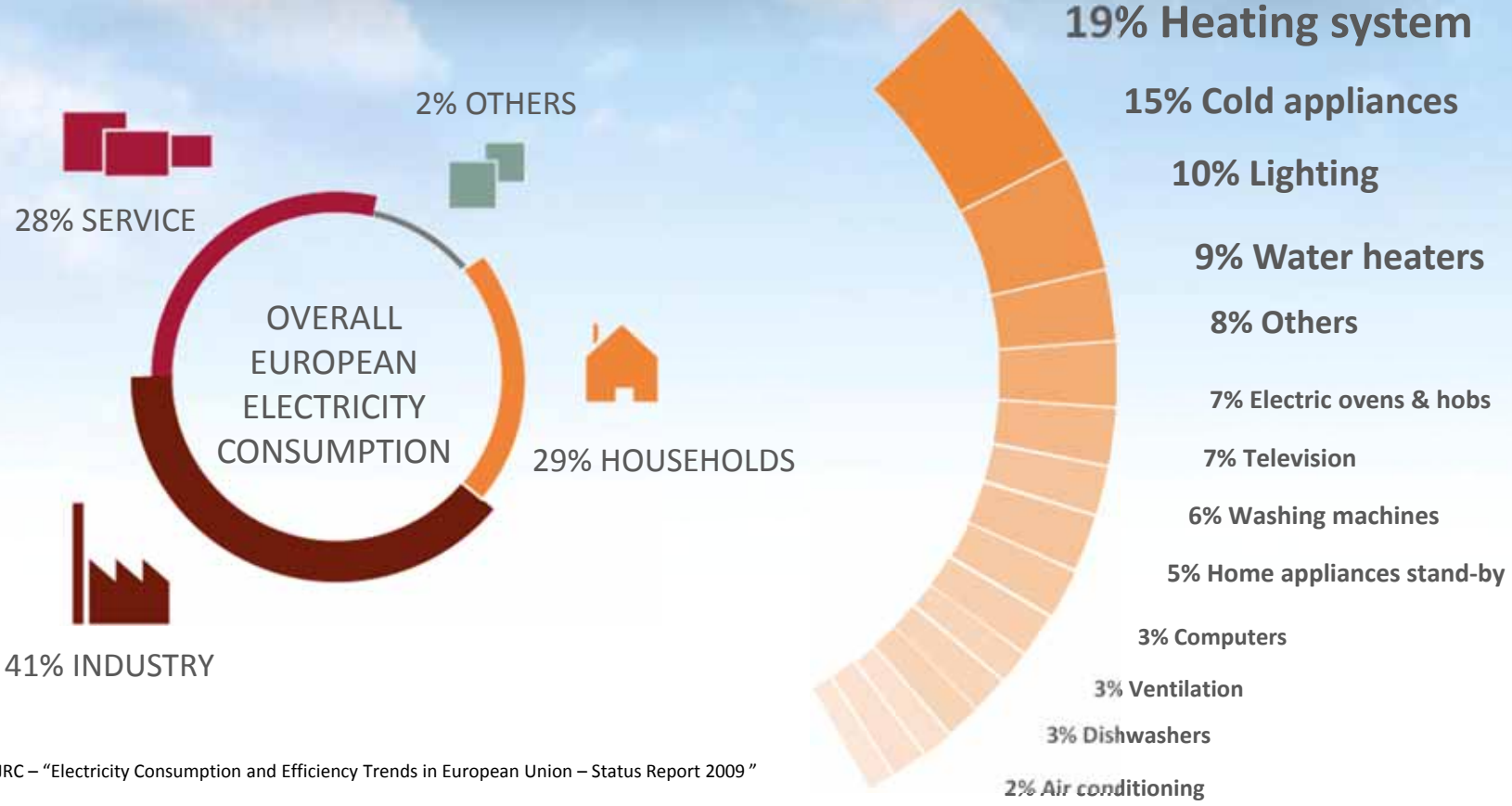
Peak reduction



Efficiency

Tools to empower consumers

Energy Consumption Scenario



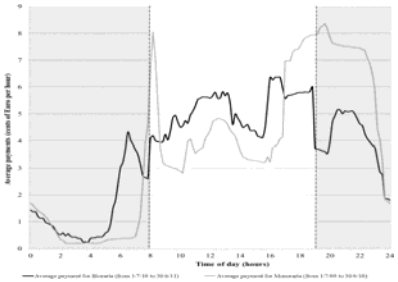
Sources: JRC – "Electricity Consumption and Efficiency Trends in European Union – Status Report 2009 "

An important effort from many different organizations is currently dedicated to reduce these highly fragmented consumptions.

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**



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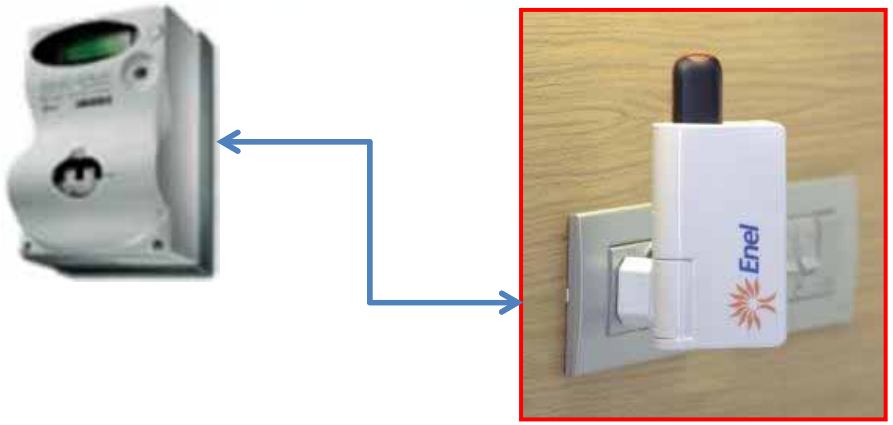

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Optimal Start

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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

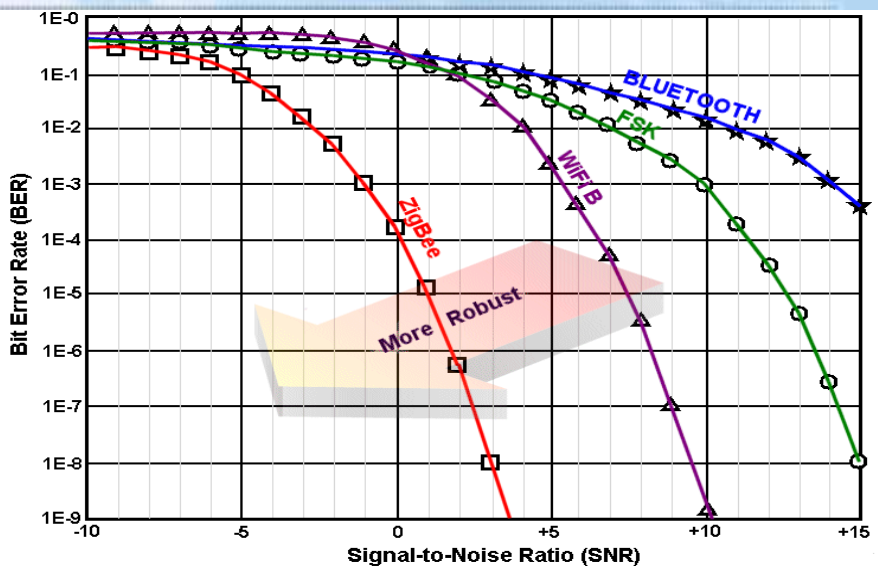
Power Profile

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

Why ZigBee Pro Protocol

- Cost
- Performance of IEEE 802.15.4
  - Energy efficiency
  - Performance in low SNR environments
  - Extended coverage through mesh topology
- Openness & Diffusion
  - Open specifications
  - Multiple vendors,
  - Large availability of products
  - Certification Program available
- Extendible



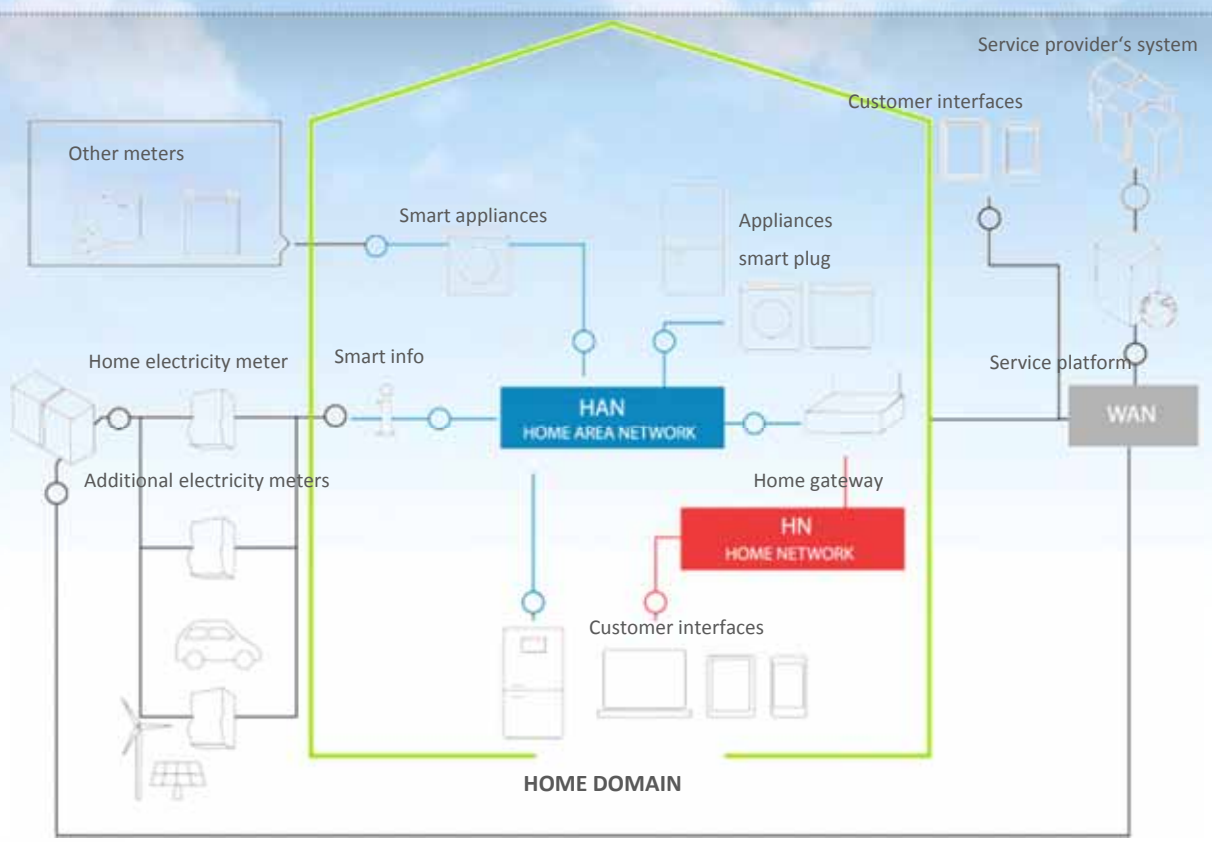
Excellent performance in low SNR environments

Specifications of Public Profiles

Energy Home Telecom Health Building

Other protocols might be adopted depending on Energy@home Members Products

Technology

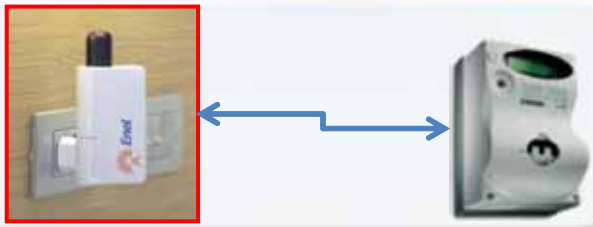


E@h is designing a communication infrastructure and an open protocol that enables brand new Value Added Services based upon information exchange related to energy usage, energy consumption and energy tariffs.

Devices integrated in Energy@home, so far

ENEL Smart Info

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



Smart Appliances

- React to external signals (price, energy colour, pause/resume)
- Per-phase schedulable
- Visualize cost and consumption

Lighting

- On/off
- dimming
- colour

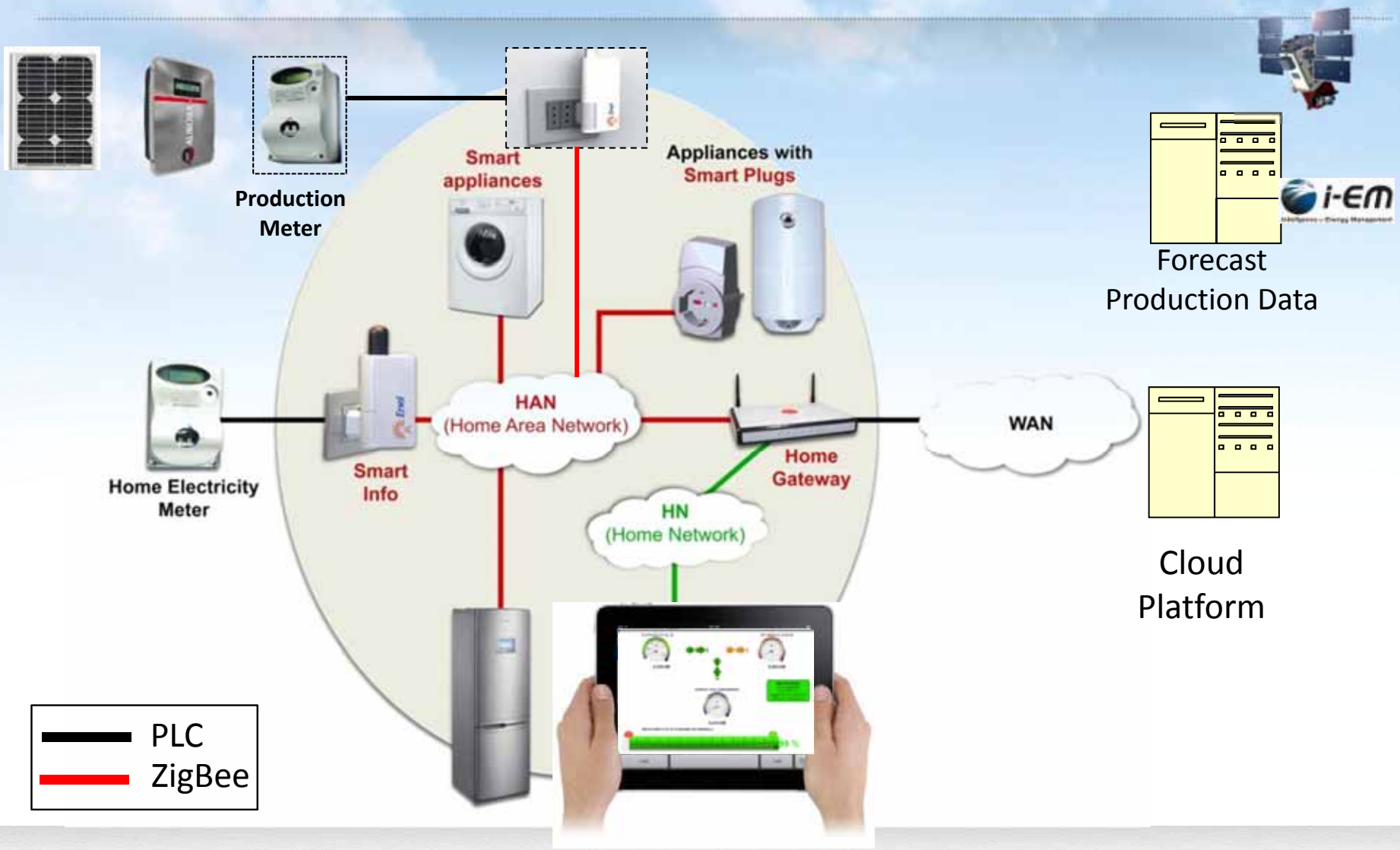
Other Commercial Devices

- ZigBee HA 1.2 compliant
- Energy/power meter
- Switch on/off
- Presence, Thermostat
- Water leak, door…

Telecom Italia Home Gateway

- Home Area Network Controller
- ZigBee Trust Center
- OSGi framework to manage VAS's via single box

Energy@home Architecture



Functionalities: (1) Energy/cost Awareness on user displays

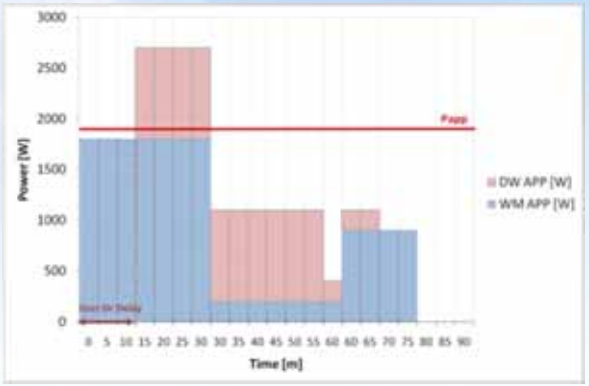
WebPortal

Tablet, mobile

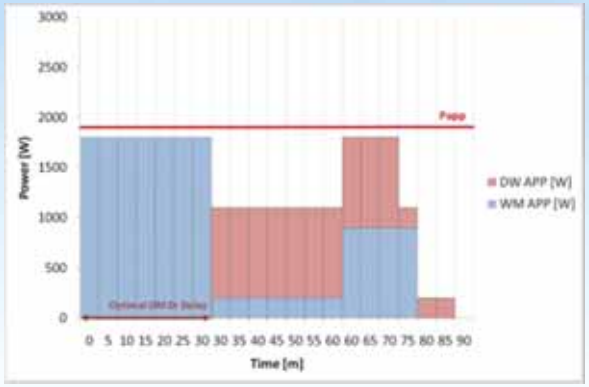
Washing Machine Display

Functionalities (2) Overload control and warning

- Scheduling of the appliance to avoid the overload



before scheduling



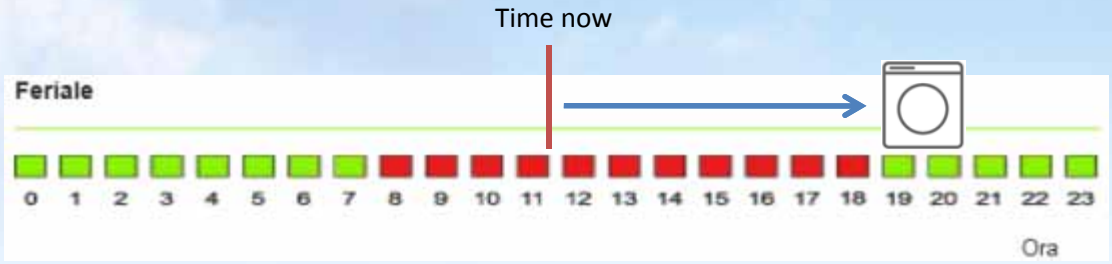
After scheduling

- Warning if available total power is not sufficient to run a cycle

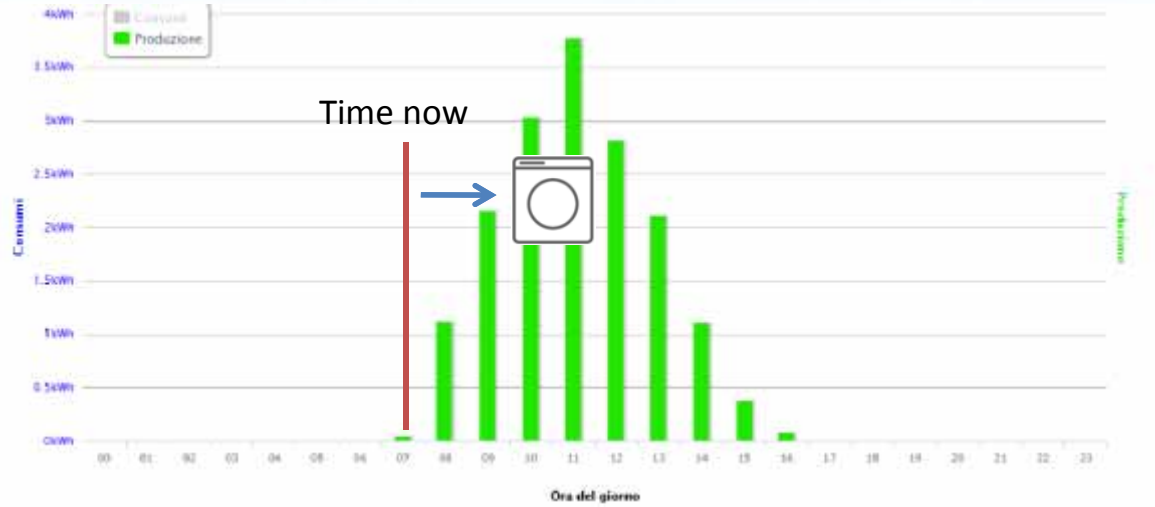
- Notification of Home Domain Overload

Functionalities (3) Scheduling for ToU Pricing

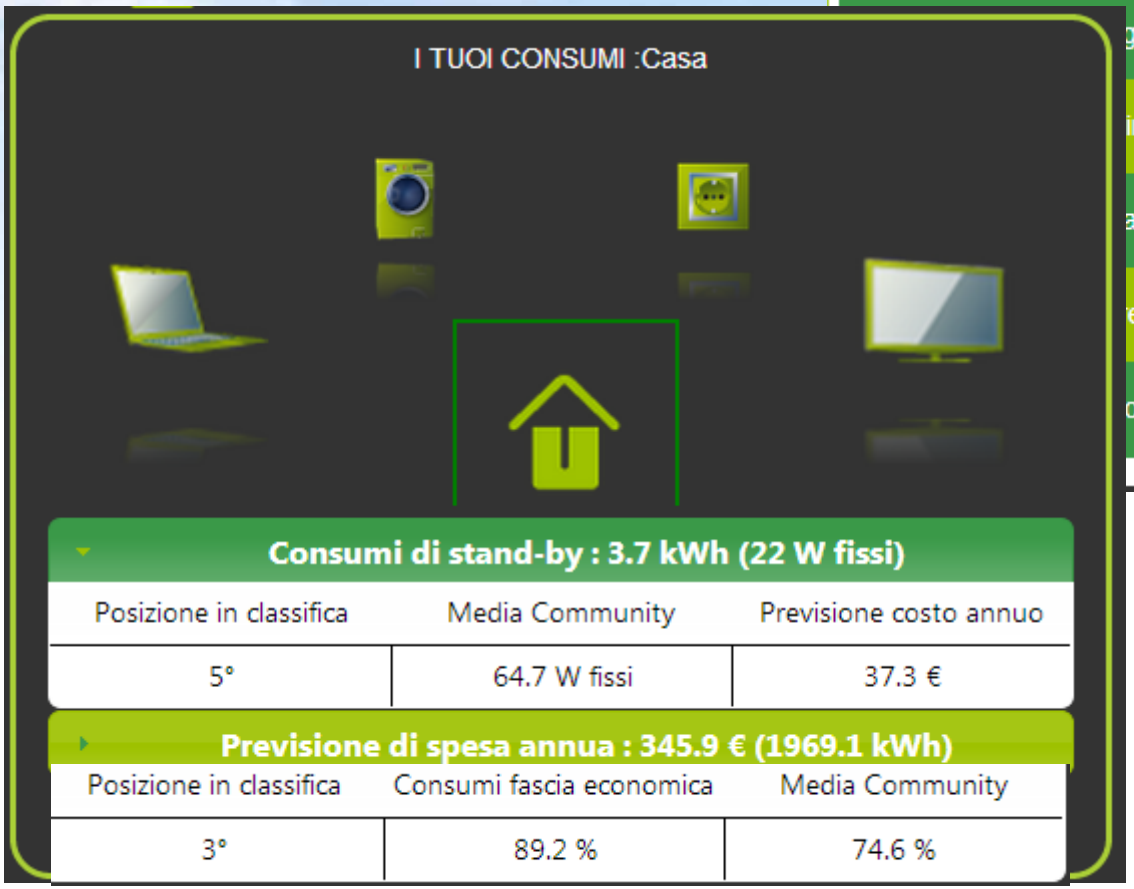
- Scheduling of the appliance when the energy is cheaper



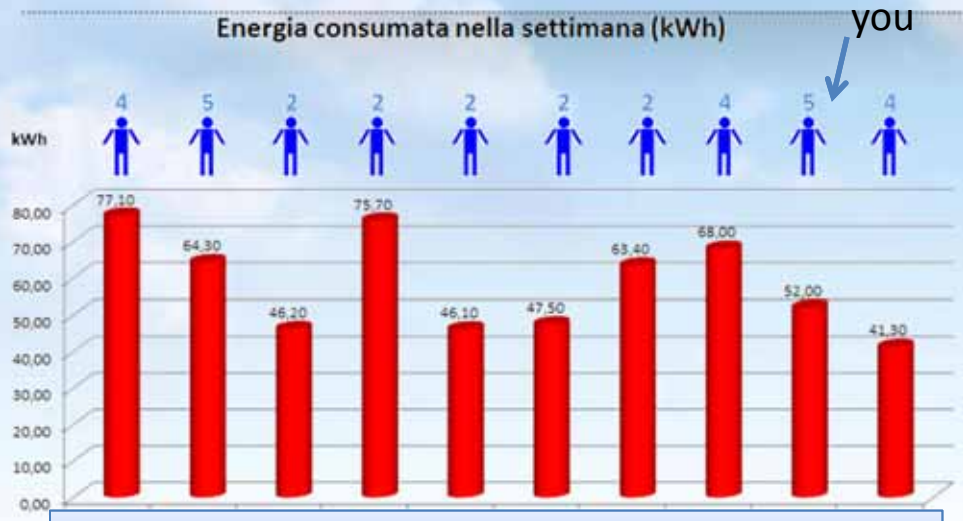
- Scheduling of the appliance when the energy is greener



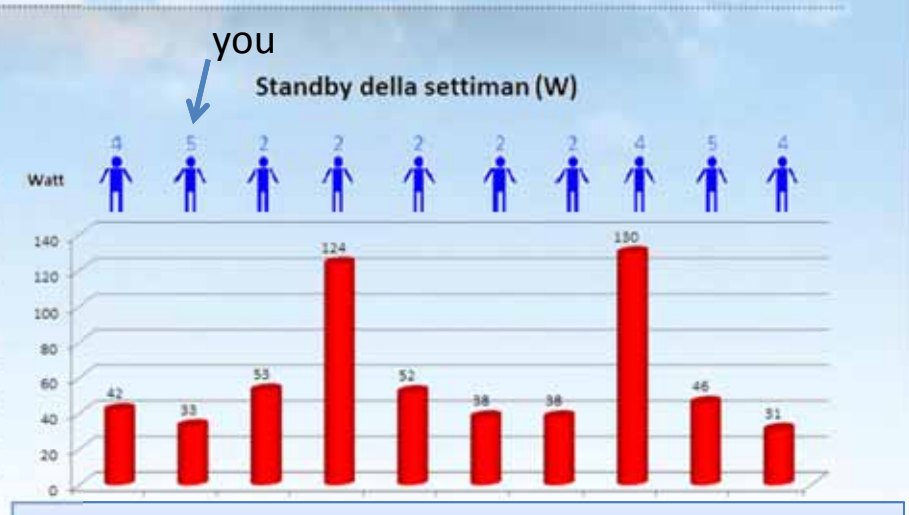
Functionalities (4) Reports, summary info, & comparisons



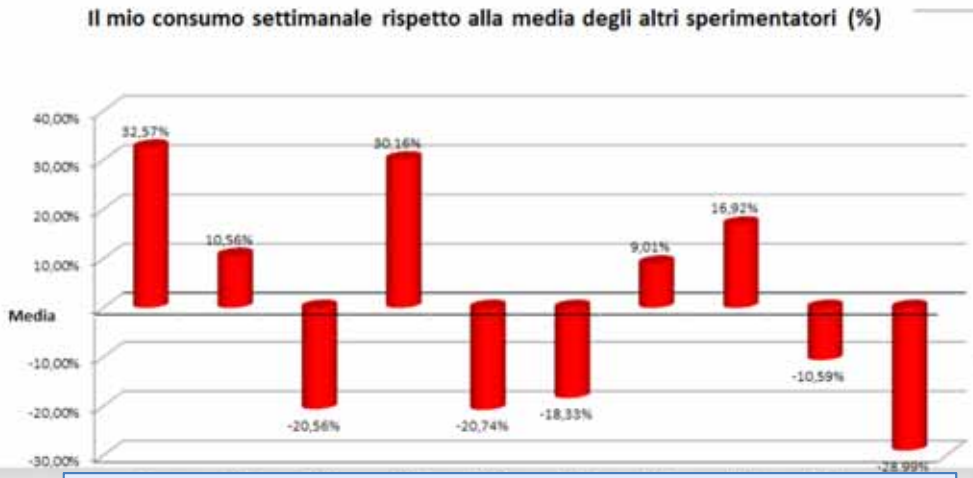
Functionalities (5): newsletters



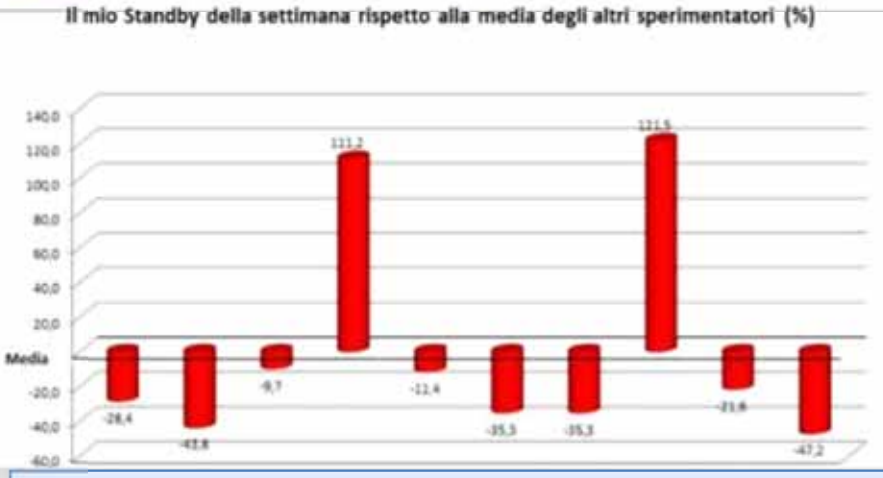
Weekly energy consumption [kWh]



Stand-by consumption this week [W]

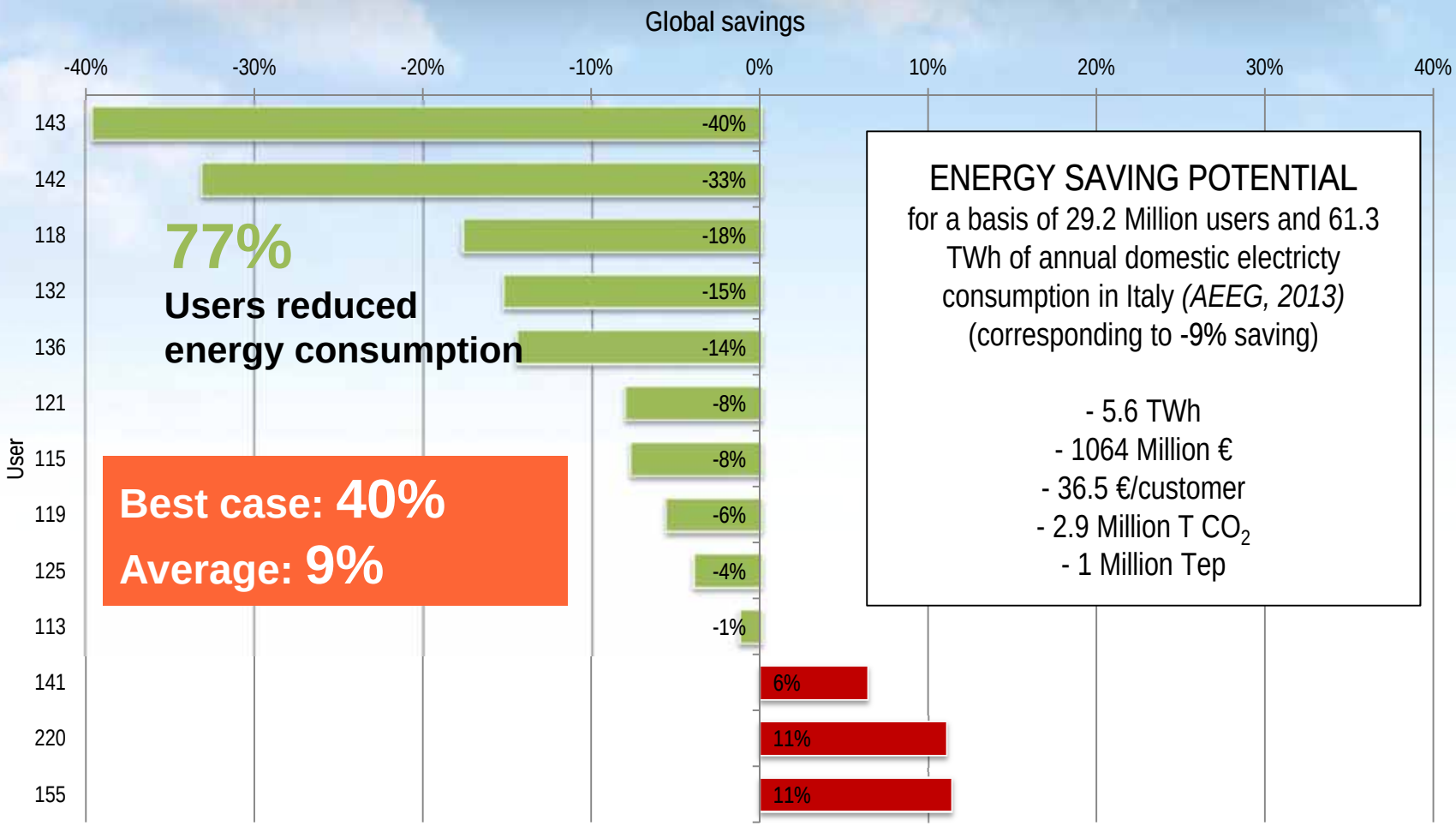


… in comparison to the average consumption



… in comparison with the average

Trial: Energy Saving results



77%

Users reduced energy consumption

Best case: 40%

Average: 9%

ENERGY SAVING POTENTIAL

for a basis of 29.2 Million users and 61.3 TWh of annual domestic electricty consumption in Italy *(AEEG, 2013)* (corresponding to -9% saving)

- 5.6 TWh
- 1064 Million €
- 36.5 €/customer
- 2.9 Million T CO_2
- 1 Million Tep

Main quantitative results from the trial

- *Limited statistical value (sample size)*
- *Users with PV installation not included yet*

Consumption reduced by 9%	If extended to full country (Italy) – means reduction of 5.6 TWh, avoiding emission of ~ 3 M tons of CO2 with average saving of ~ 40 €/user/year
Opportunity to limit installed power to 3 kW	From 8 users with installed power above 3 kW, only one actually uses it
	With current prices, at same level of consumption, a 3kW contract saves more than 180 €/year (vs. 4.5 kW contract)
Moving ~5% of consumption to off-peak periods	Impact is bigger than the mere night/day tariff scheme
Reduction of stand-by consumption by ~15%	For many users, just a simple and free way to save on electricity Biggest saving: 80W reduction, i.e. 700 kWh/year = ~130 €/year

Main qualitative results from the trial (users' feedback)

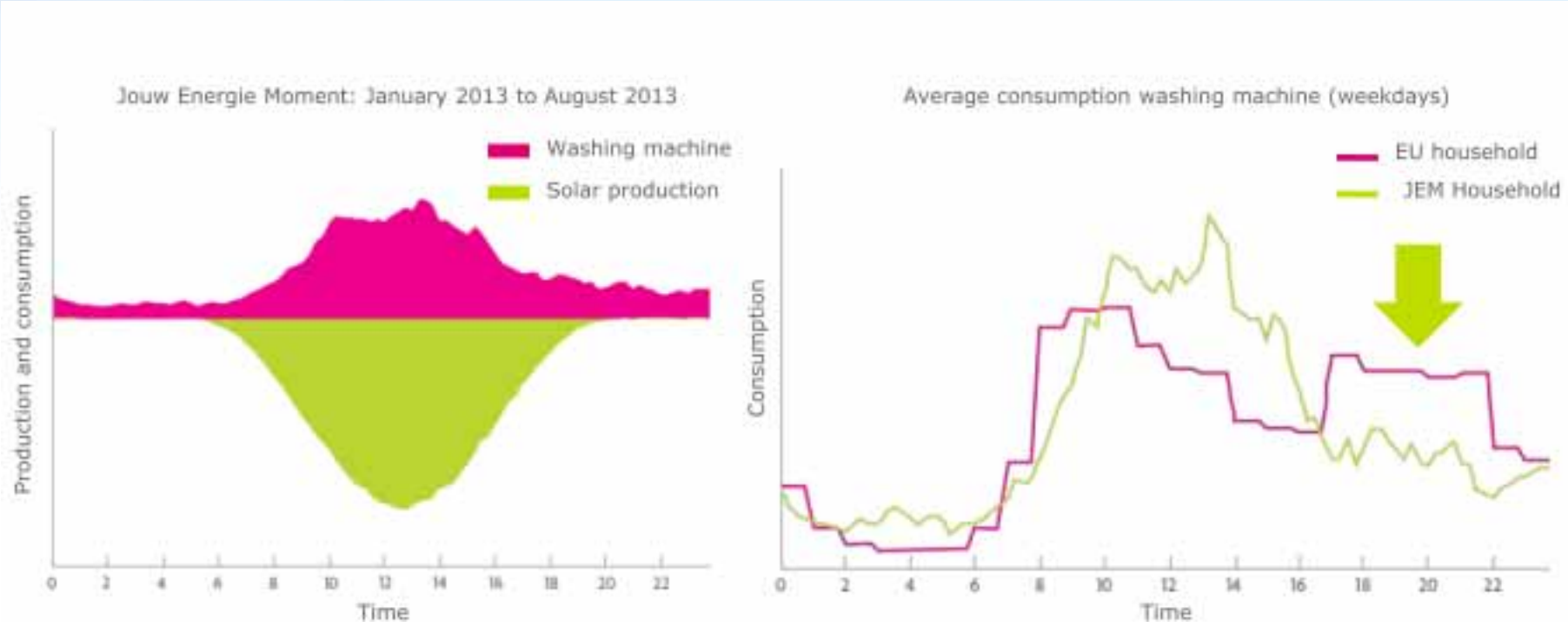
- **Users like Energy@home!**
  - **Avg score > 7.5/10, è**' E@h is perceived as «**innovative**» and «**saving**»
  - It involves: 75% of users sent at least one feedback, some gave more than 10; 70% answered the questionnaire. Most users used it "every day"
  - Most users would suggest E@h to a friend and would like to keep the system even after the trial. After 2 months from the trial closure, **23 of 36 users is still using E@h!**
  - 95% users say it is easy to use/install and it is usefull («help me to save money»)

- **It is not an entertainment platform**
  - Major benefit for «analytical» users, eager to track data to understand and modify own consumpition pattern in order to reduce electricity bill
- **The service fulfills the goal of increasing awareness on limiting consumption:**
  - Most interesting information: stand-by consumption and how to reduce it, comparison with other consumers and their consumption patterns
  - 'community effect': knowing others' consumption is an incentive to improve one's own
  - Actions to reduce cosumption can be induced either directly (from service itself) or indirectly (through personalized suggestions)
  - Very few users would not pay anything for it

- Smart plugs
  - are cumbersome, space-consuming, hard to fit behind appliances, high number required to measure single usages
- Software is sometimes unstable

ENEXIS trial (NL)

1. Big investments can be avoided
2. Acceptability is there
3. Consumption shifts
4. Important motivation is money



British Gas Trial (UK)

British Gas
Looking after your world

SMART ENERGY UNIVERSE

Customer-Led Network Revolution

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CLICK HERE FOR LATEST NEWS

Smart WM EOI

register your interest to participate in our smart washing machine trial

The Customer-Led Network Revolution has been formed to help understand current energy usage and how to best meet future energy needs. We will achieve this by monitoring the energy use in a large number of homes, and by introducing innovative ways in which customers can play a part in reducing peak electricity demand and keeping energy prices stable.

As part of this trial we will be supplying a limited number of a new 'smart' version of the Hotpoint AQUALTIS washing machine to selected customers, which will allow us to monitor how you use the appliance via an internet connection, and enable some advanced features concerning the timing of selected machine cycles which we would like you to test throughout the trial period.

Technical Specification

Loading Capacity: 11Kg
Energy Class: A+++
Spin Speed: 1600rpm
Display: LCD

Special Features:
- Super Silent system
- 10 years warranty on motor

Grid-integrated washing machine aims to make UK greener

2 September 2013 By Tereza Pultarova

Share

150 households will be equipped with indesit's super-smart washing machine in the framework of the Customer-Led Network

Indesit's Aqualtis washing machine, considered the smartest in the European market, will be installed in 150 UK homes to facilitate a shift towards low-carbon economy.

Save to PDF

Print page

Related news

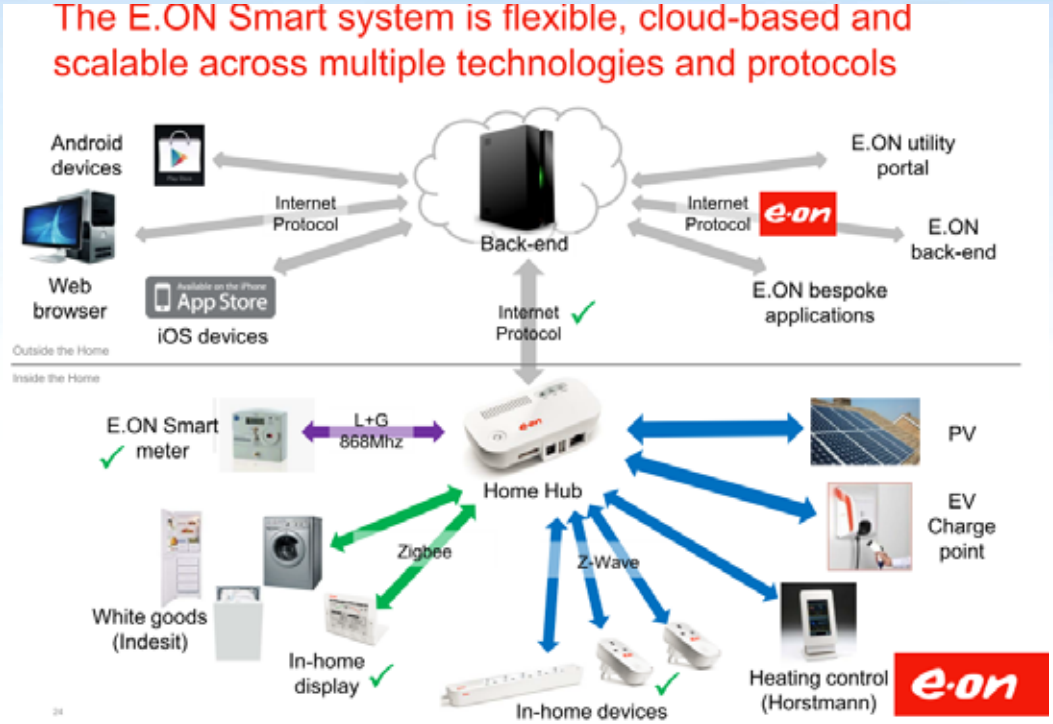
operation

E-ON trial (UK)

E.On Thinking Energy program: 3 complementary trials in Sweden, UK and Germany

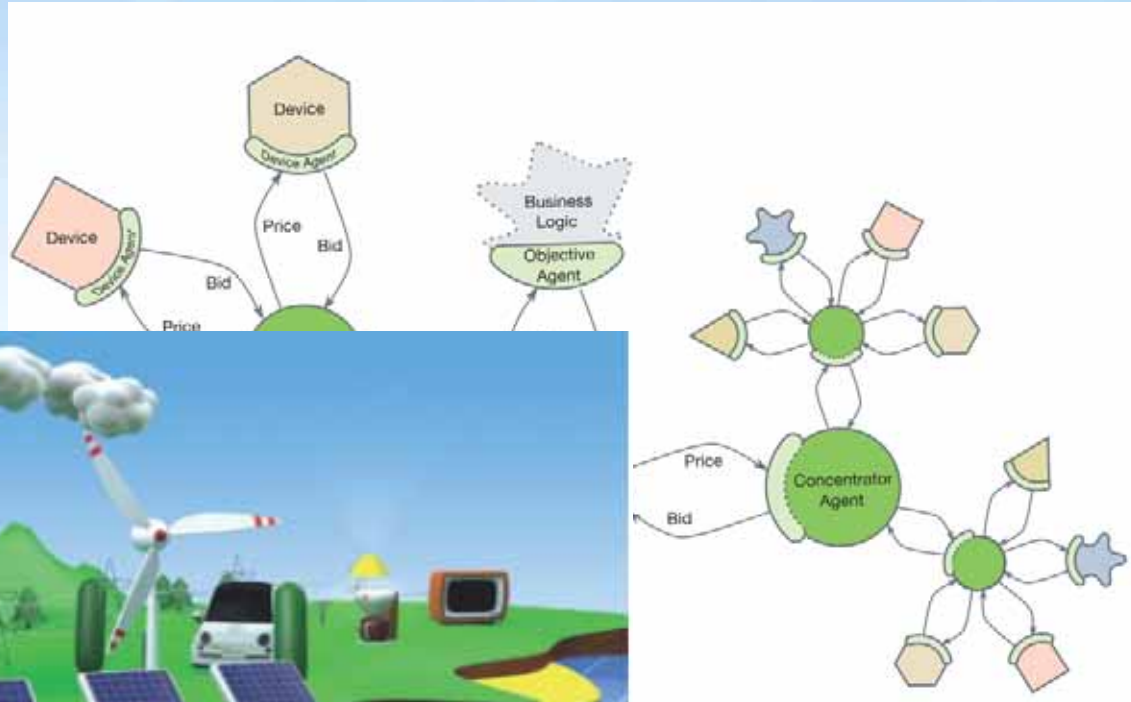
- Indesit Company will be involved in the UK trial where up to 75 users in Milton Keynes will use in an incremental way smart services and devices (heating, washing machine, heat pump, electric car)

- Trial target (25 Indesit Smart Aqualtis, May 2013 – Dec 2014): identify any changes on the cost, confort and carbon benefit for the trialist



Power Matcher trial (NL)

http://www.youtube.com/watch?v=Zz4OpVwYWYE



Energy@home is pursuing a pan-EU approach to the Smart Home

On Dec. 2012, Energy@home and EEBus E.V. Initative signed a **collaboration agreement** with the goal of converging on a **common (and standard) Data Model**

- Regular meetings are hold

2014 goal: extension to Agora

- common EU workshop
- common security solutions
- Under discussion the integration of devices and systems from the 3 organizations

Energy@home Association

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

Enel Distribuzione

Indesit company

Telecom Italia

Ordinary Members

Edison

ST life.augmented

Whirlpool EMEA

vodafone

Aggregate Members

FlexGrid

MAC srl

Gemino

intecs the Brainware company

ISMB Istituto Superiore Mario Boella

power-one Renewable Energy Solutions

i-EM Intelligence in Energy Management

Renesas

eurotherm radiant comfort systems

freescale

altran