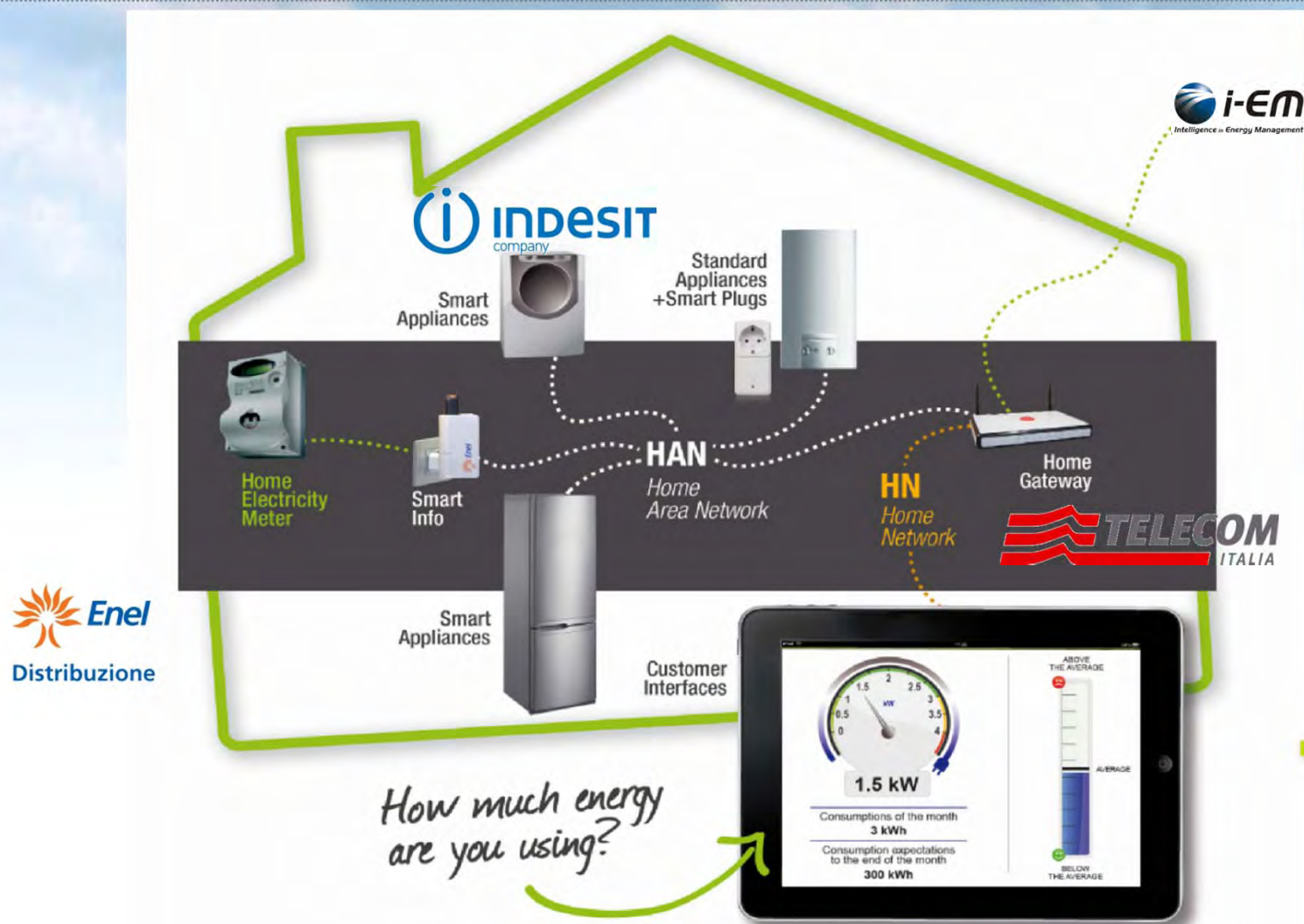# Energy@home trial: washing machine functionalities and results

Lucio Bianchi
Smart Grid Program Manager
Indesit Company

Energy@home system

Trial kit composition

Energy Box

- Connects to ADSL modem via Ethernet cable
- Java run-time + OSGi
- Energy Box Application + GUI
- Connects to cloud platform for data storage and aggregation
- LED + Buzzer

5 Smart Plugs

- Consumption information (power + energy)
- On/Off

Smart Info

- Consumption + Generation Data
- Contractual information
- Push + Pull (on-demand)
- 1 Smart Info per Meter

Connected WM

- Instantaneous consumption data
- Per-phase schedulable
- Visualize cost and consumption
- Overload warning buzzer

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Functionalities

✓Energy awareness (kWh, €)

    ✓Total House, per-device, stand-by

✓PV Production: forecast & comparison with

actual

    ✓Real-time visualization of buy/sell/self energy

✓Scheduling (PV + time of use pricing)

✓Overload warning

✓Weekly summary per-device usage reports

(includes also stand-by report)

✓Consumer's Behaviour Social comparison

✓Energy efficiency suggestions

Scouting and deploying

Users selection considered different type of homes, family numerosity, geographic area, technology inclination.

Pilots growth

	DEC 12	MAR 13	APR 13	JUN 13	AUG 13	OCT 13
# homes	8	18	26	33	45	53

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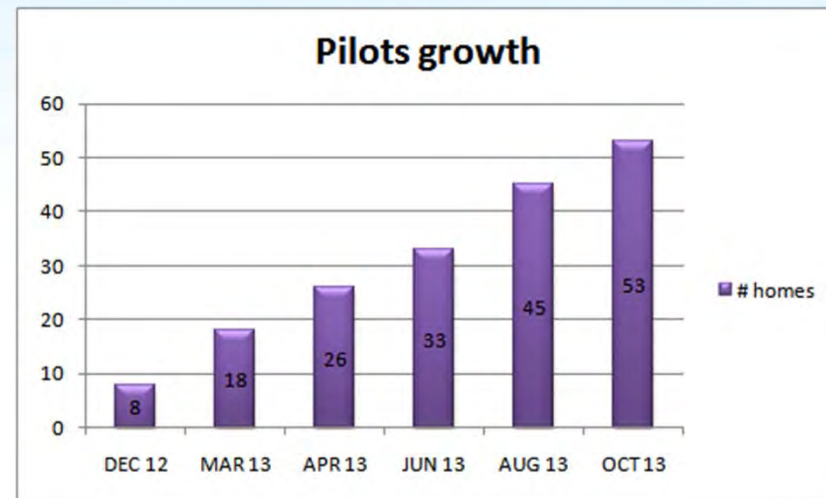
Main quantitative results from the trial

- *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 CO_2 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

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Indesit Smart Appliance: Smart Aqualtis

Smart Aqualtis is the first Indesit washing machine designed to be integrated in "Smart" ecosystems, covering a wide range of use cases

Energy & Cost Awareness
- ▸ Estimated power consumption and cost for the washing cycle
- ▸ Real time energy and power consumption
- ▸ Smart Meter Mirroring on the display

Coaching
- ▸ Visualization of generic text messages

Energy Mgmt
- ▸ Per-phase schedulable to optimize power consumption and avoid power overload
- ▸ Safe mode in case of emergency
- ▸ Early overload warning when selecting cycle

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

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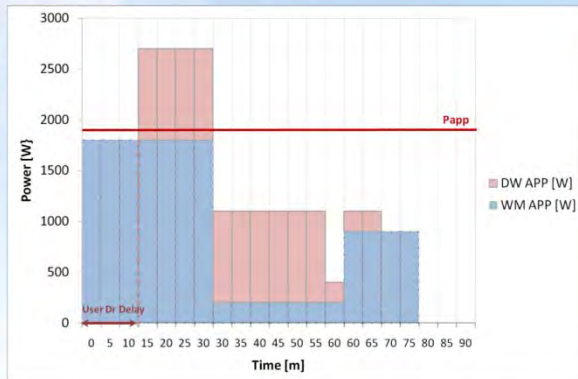INDESIT company

Functionalities: Energy and cost awareness
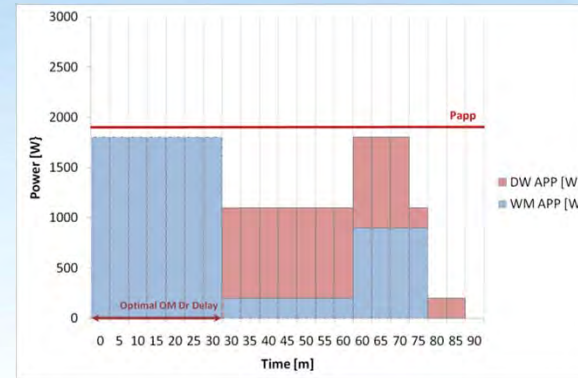
Washing machine User Interface

Functionalities: Overload control and warning

▸ Scheduling of the appliance to avoid the overload

before scheduling

After scheduling
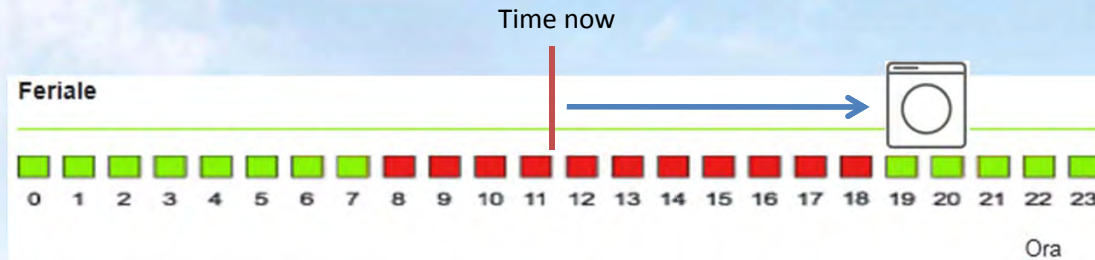
▸ Warning if available total power is not sufficient to run a cycle
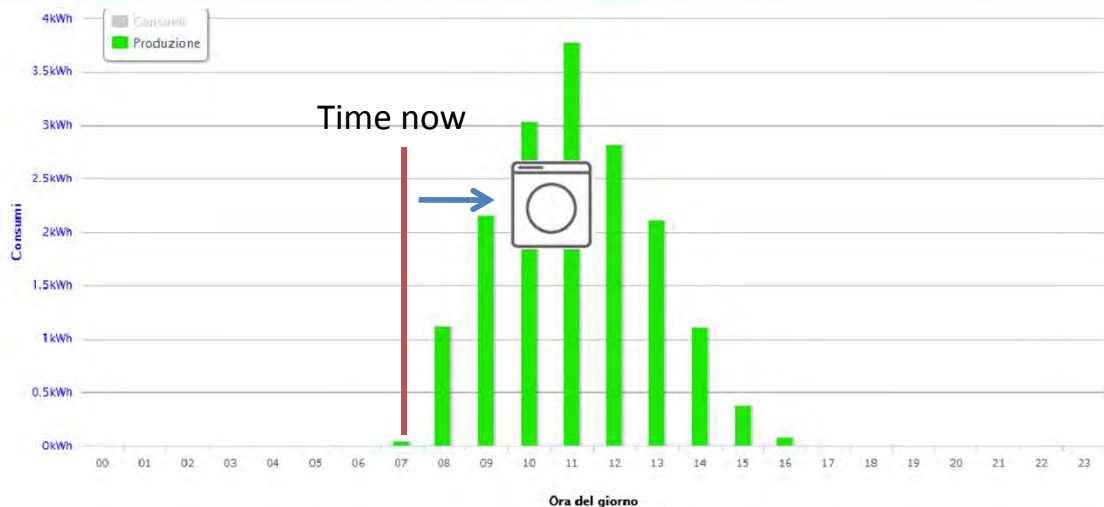
▸ Notification of Home Domain Overload

Functionalities: Scheduling

▶ Scheduling of the appliance when the energy is cheaper

Time now

Feriale

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 |

Ora

▶ Scheduling of the appliance when the energy is greener

Time now

AQUALTIS

M1
M2

COTONE 20°
STANDARD 1600
Partenza prevista 3:08

4kWh
3.5kWh
3kWh
2.5kWh
2kWh
1.5kWh
1kWh
0.5kWh
0kWh

Consumi
Produzione

Consumi

Produzione

00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23

Ora del giorno

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Collecting washing machine data

Energy data from Telecom Italia DataBase

Every 2 minutes:
- WM energy consumption
- WM power consumption

Washing data directly sent by the washing machine to Indesit data base

For every cycle executed:
- type of cycle
- selected temperature, spin, options
- day/hour of execution
- duration of the cycle
- …

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Washing data analysis

More than **4000** cycles data collected and available to analyze user
habit and appliance performance.
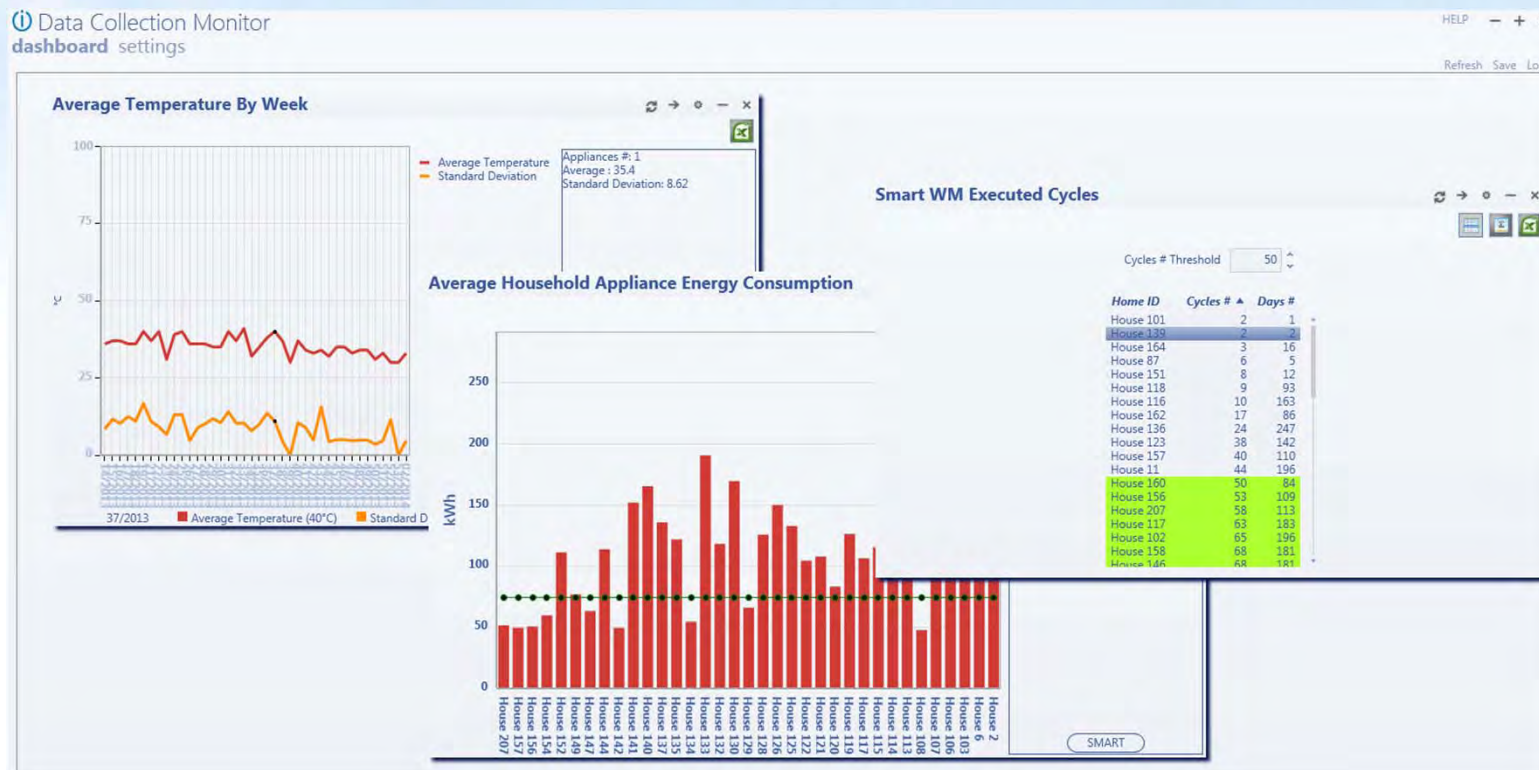
Washing data analysis

Washing data results

General habit and preferences of the users have been collected

Habit changes are also [...] web portal and wm disp[...] the **newsletter**

Quanto consuma mediamente un mio ciclo rispetto agli altri sperimentatori?

800
705   703
700   524
476   376   351   472

#130   #136   #137   #138   #144   #152

Codice di riferimento degli sperimentatori
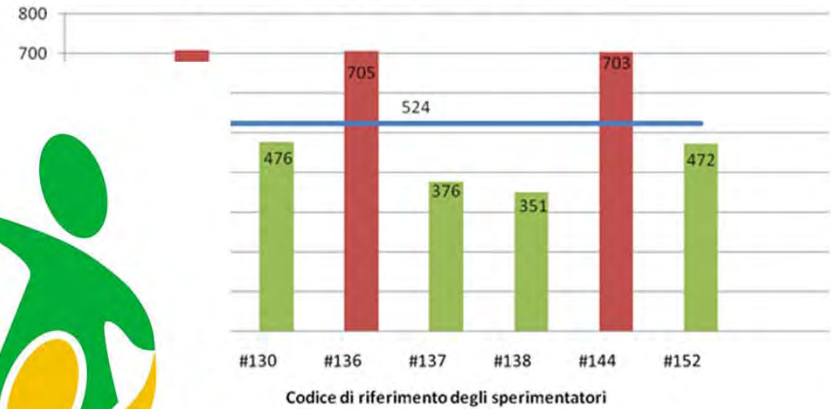
Quali cicli utilizzo più frequentement[...]

70
60
50
40
30
20
10
0

Utilizzo [%]

30° Cotone Scuri
30° Giornaliero
60° 7 giorni
60° Cottone Bianchi
40° Cotone Colorati
90° Cotone Bianchi
40° Cotone Bianchi
60° Sintetici
Centrifuga
40° Cotone Colorati

#121   #125   #130   #136   #137   #138   #144   #152

codice di riferimento degli sperimentatori
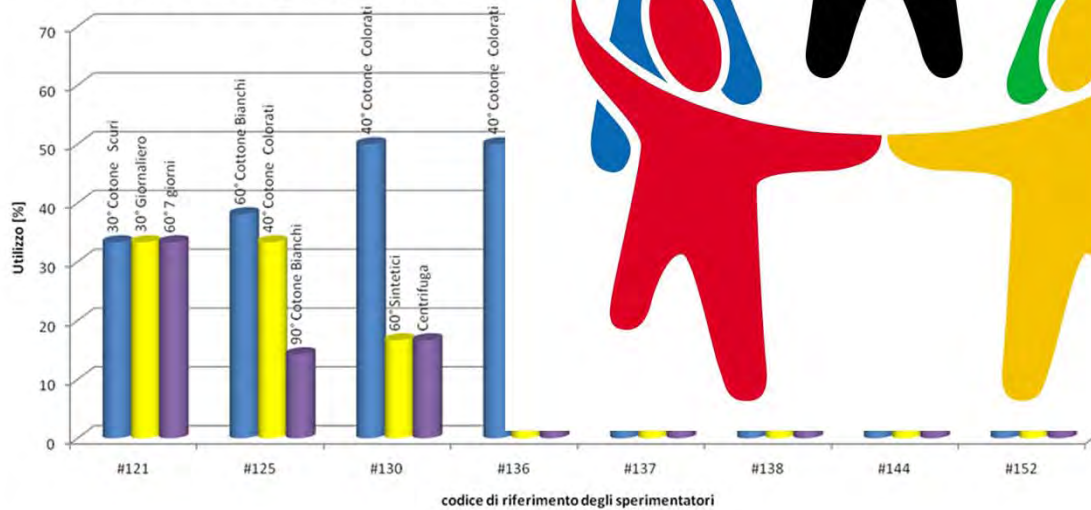
...ali fasce tariffarie uso la lavatrice?

67   65   58   50   50
43   47
30   38   39
16   19   17   36   27   15   26   24
0   11

#121   #125   #130   #136   #137   #138   #144   #152

codice di riferimento degli sperimentatori

F1
F2
F3

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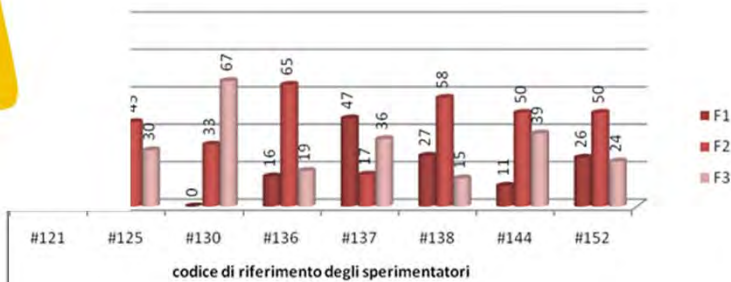
Focus group and Questionnaire results

Main Insights

Washing machine usage is INTUITIVE
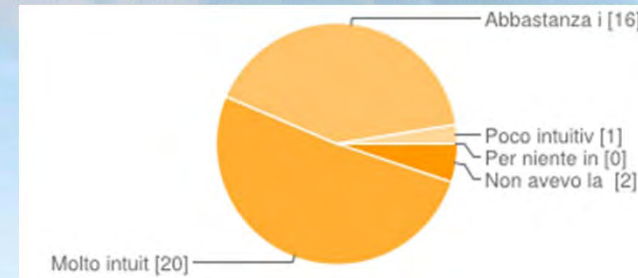
Information on the washing machine display is USEFUL
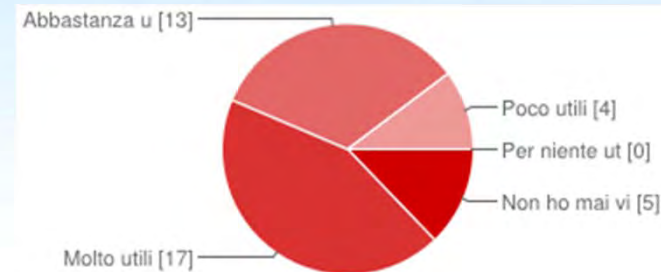
Washing machine consumption: looking for the best cost changing cycle and temperature

Active overload management , defining user priorities on the devices

Automatic energy cost negotiation with the smart grid

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Interoperability
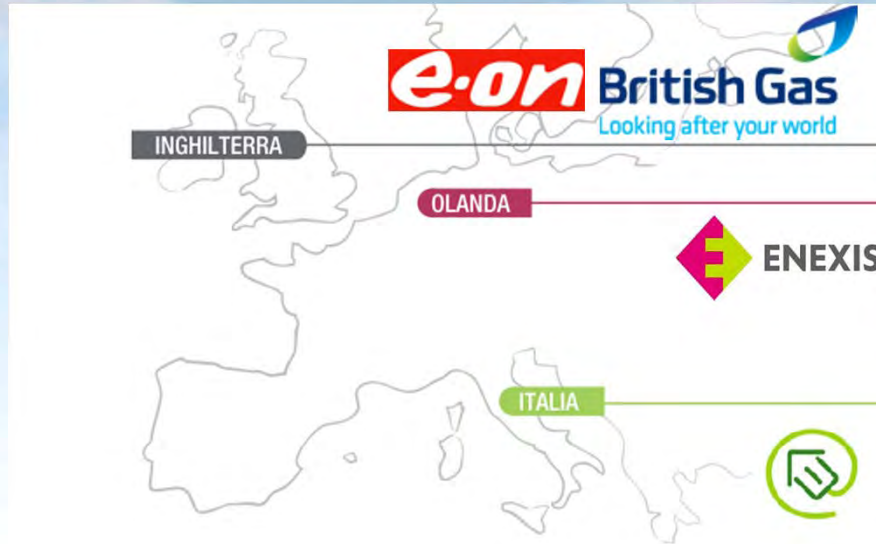
Smart Aqualtis is a key element in several european trials related to the smart home and to the smart grid:

- disseminating the E@h specifications and protocol
- proving the effectiveness of the use cases
- paving the road for an ecosystem

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British Gas Trial (UK)
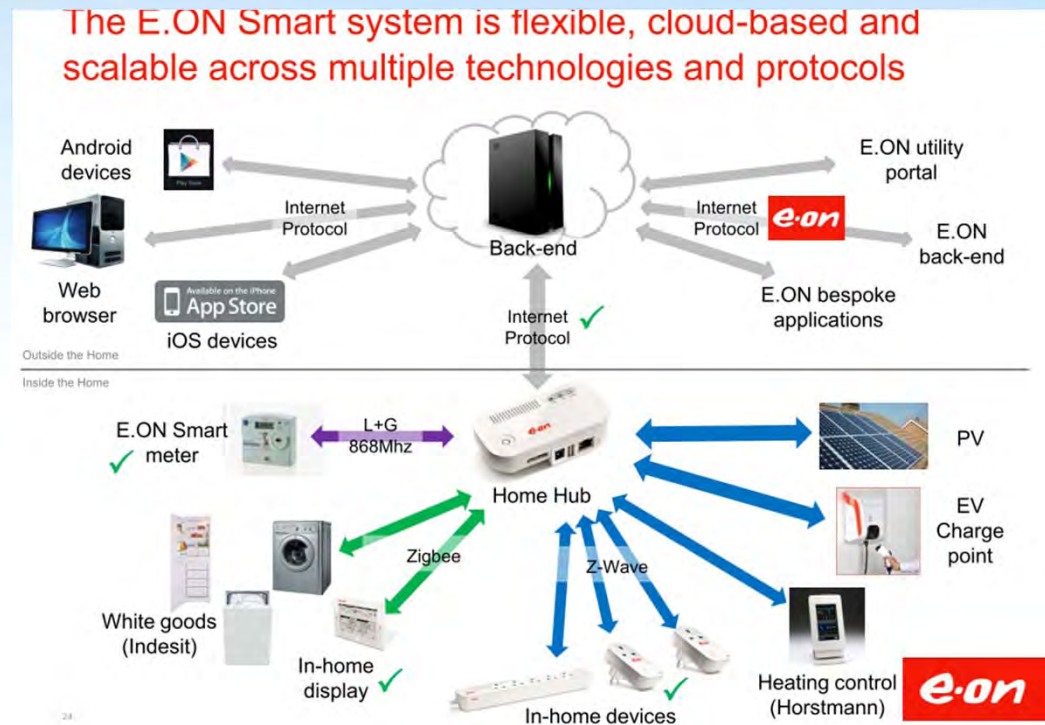
E-ON trial (UK)

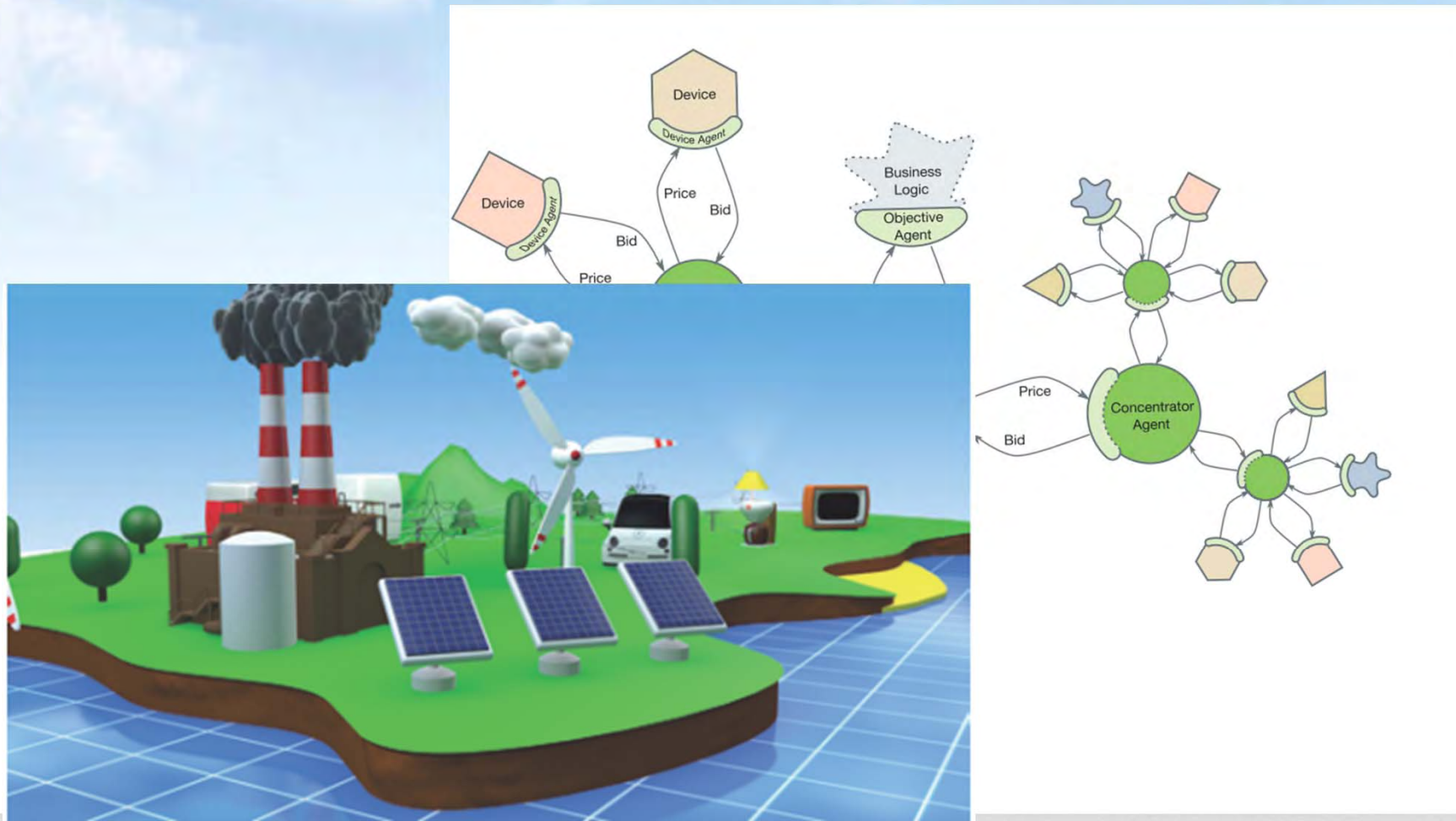E.On Thinking Energy program: 3 complementary trials in Sweden, UK and Germany

- 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 (30 E@h WM, May 2013 – Dec 2014): identify any changes on the cost, confort and carbon benefit for the trialist

The E.ON Smart system is flexible, cloud-based and scalable across multiple technologies and protocols

Power Matcher trial (NL)

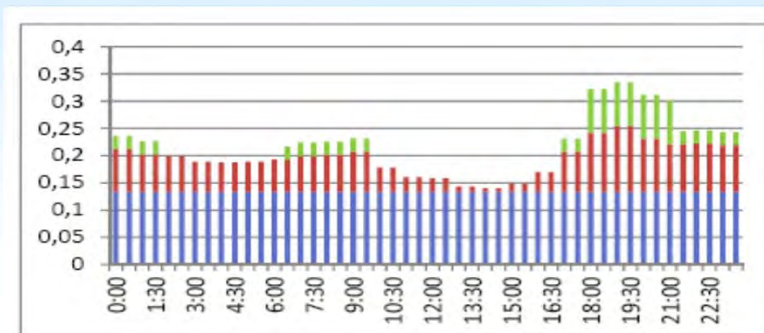http://www.youtube.com/watch?v=Zz4OpVwYWYE

Understand the customer reaction to a flexible usage of energy, based on economic incentive through time to use tariffs and the usage of micro generation (PV) inside the house.
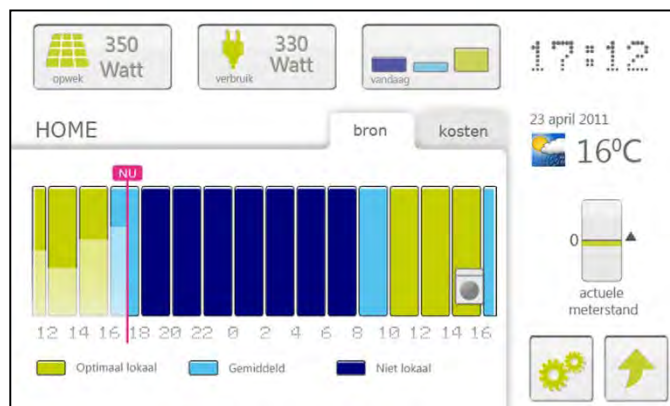

Where: The Netherland (Breda and Zwolle)
What: 300 Smart Aqualtis
When: from August 2012 -> December 2015

Time to Use Tariffs (example)

Demand Side Management
- Promote energy efficiency and cost saving through time to use tariffs (cheap mode)
- Promote eco-behavior and cost saving through PV generated energy (green mode)
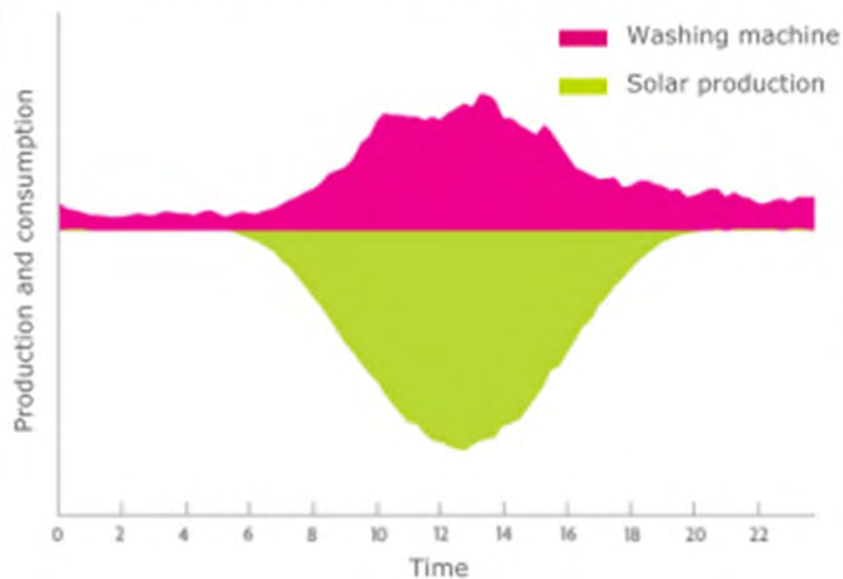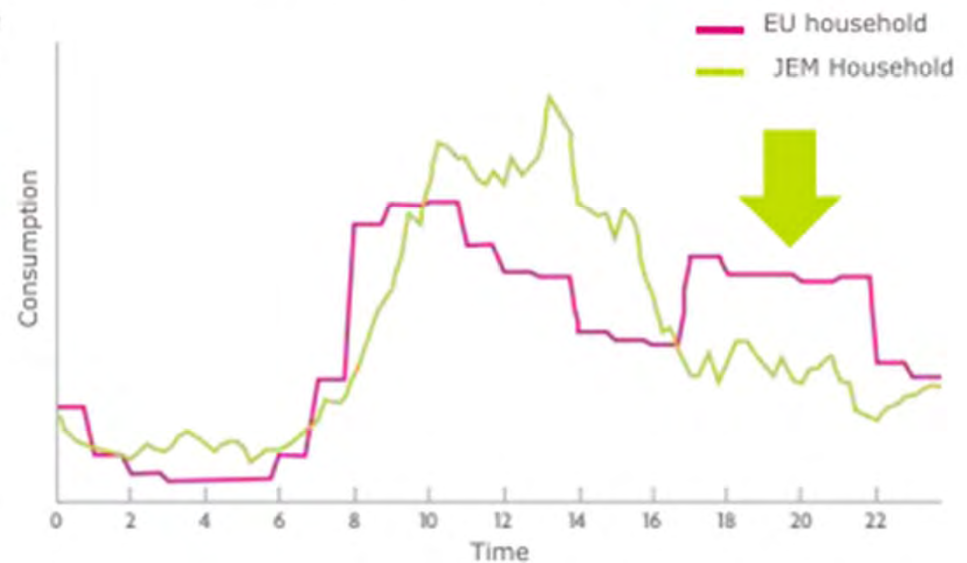- Integration with the thermal control of the house

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

Jouw Energie Moment: January 2013 to August 2013

- Washing machine
- Solar production

Average consumption washing machine (weekdays)

- EU household
- JEM Household

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Thank you!

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