



Energy@home

ENERGIA@HOME

Energy@home: the italian pilot

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The reason why

- ▶ To prove the technical solution based on the smart gateway, the smart info and the smart washing machine
- ▶ To validate the maturity of the use cases for residential consumer capable of an active load control and a simplified usage of renewable energy and of time of use and dynamic tariffs
- ▶ To verify the acceptability and satisfaction in the usage of the system
- ▶ To guarantee a proper growth of the Association ecosystem through the trial results

Devices



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 Gateway

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



Smart Plugs

- ▶ Power and energy meter
- ▶ Switch ON/OFF

Devices



Smart Washing Machine



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

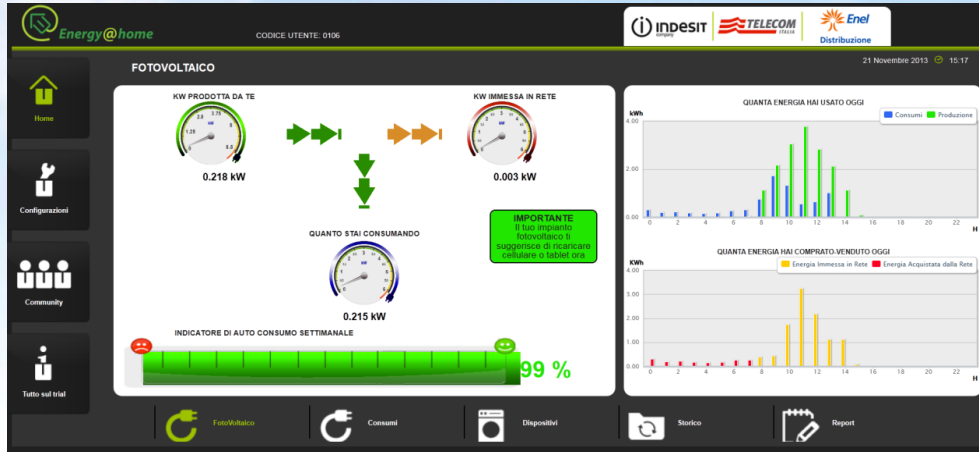
- ▶ Scheduling of the starting time to ensure the cheapest or the greenest cycle, always respecting the users constraints

The system

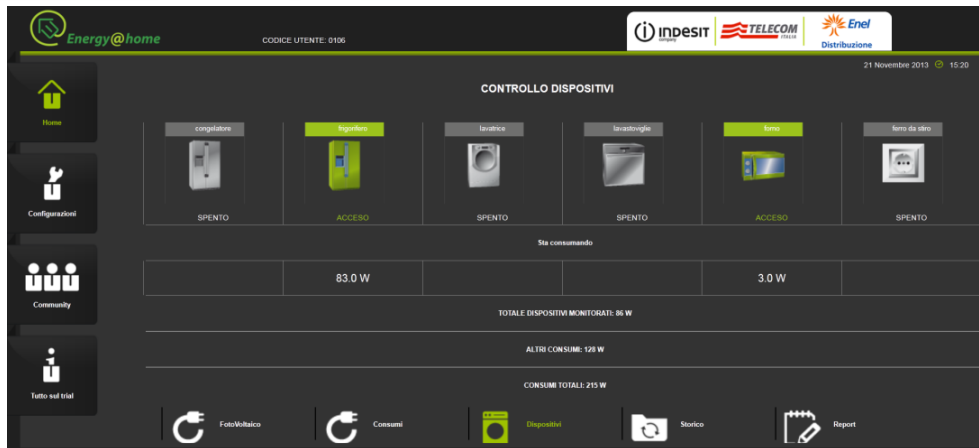


Functionalities: Energy Awareness

WebPortal User Interface, remotely accessible

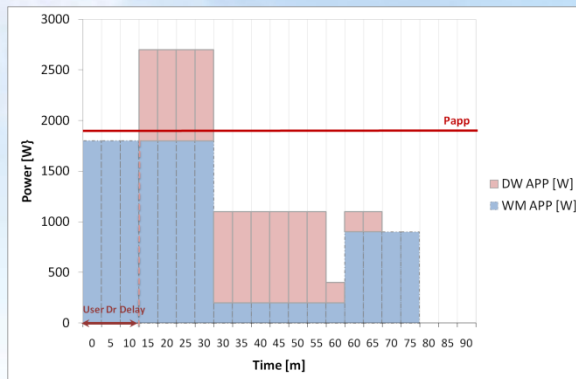


Washing machine User Interface



Functionalities: Overload control and warning

- ▶ Scheduling of the appliance to avoid the overload



before scheduling



After scheduling

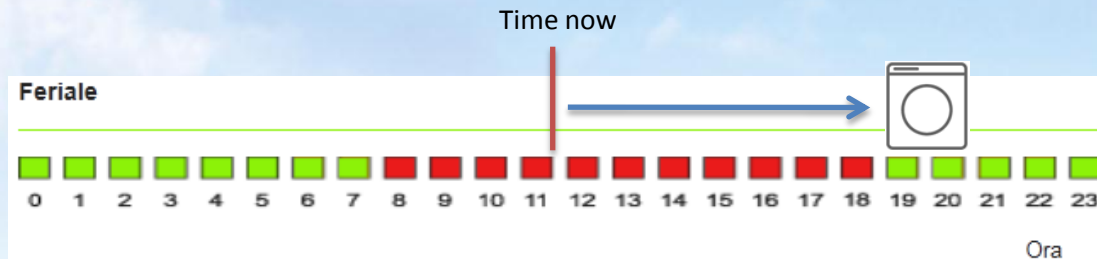
- ▶ Warning if available total power is not sufficient to run a cycle

- ▶ Notification of Home Domain Overload

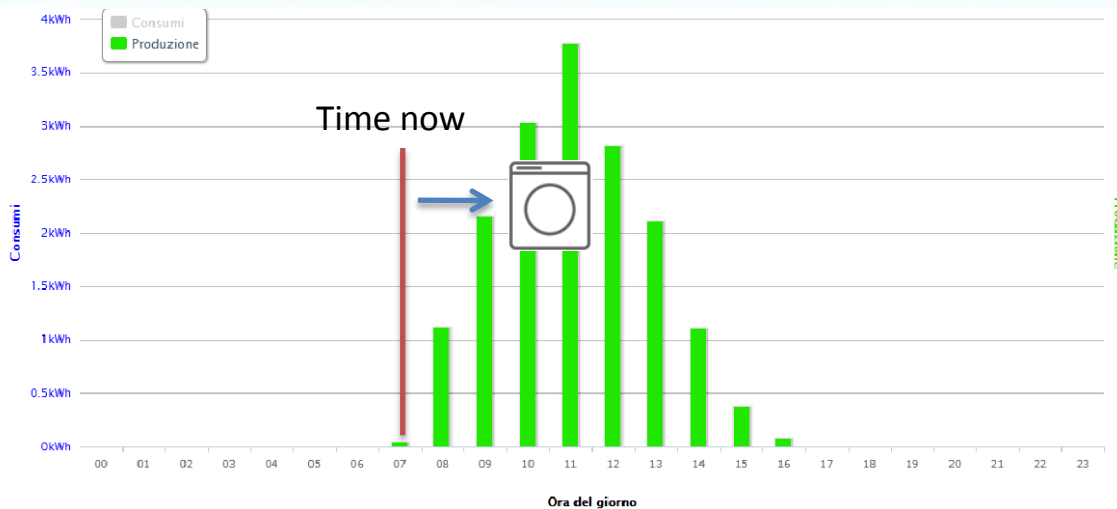


Functionalities: Scheduling

- ▶ Scheduling of the appliance when the energy is cheaper

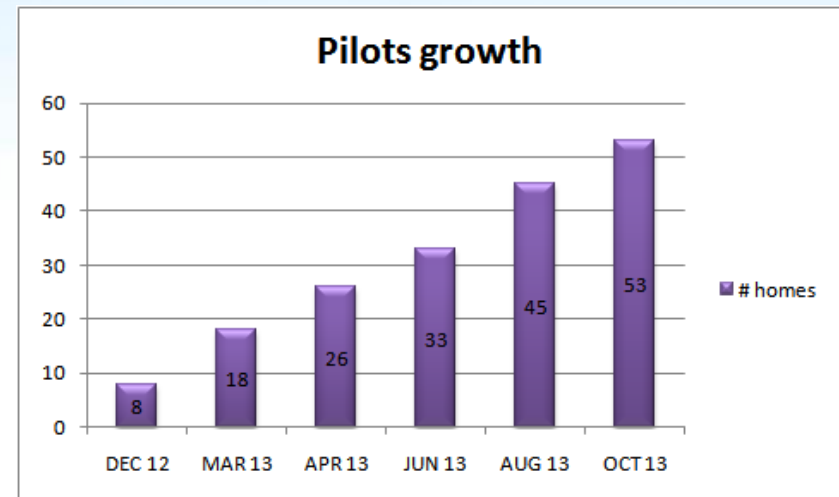


- ▶ Scheduling of the appliance when the energy is greener



Scouting and deploying

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



How we communicate with the users

Web questionnaire

Utilizzo del sistema

7. Quanto frequentemente hai usato il sistema Energy@home?

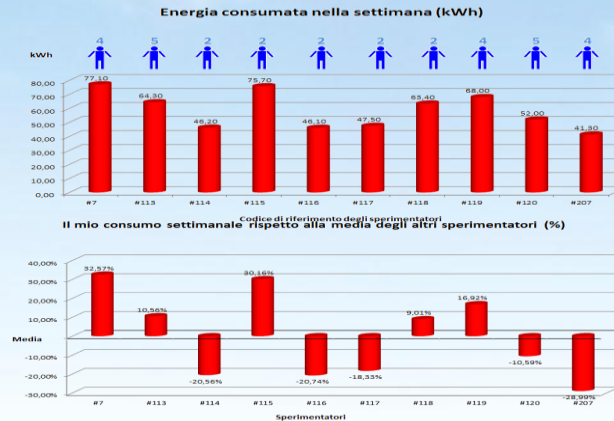
- Tutti i giorni: non ho mai spento niente in tutto il periodo di sperimentazione
- Quasi tutti i giorni: ho spento il sistema solo in rarissime occasioni
- Spesso, eccezion fatta quando stavo fuori casa a lungo (es. trasferte di lavoro, vacanze, ecc.)
- Poco: è più il tempo che l'ho tenuto spento che quello in cui l'ho usato
- Per niente: non l'ho praticamente mai acceso

Solo SE hai risposto "poco" o "per niente" alla domanda precedente:

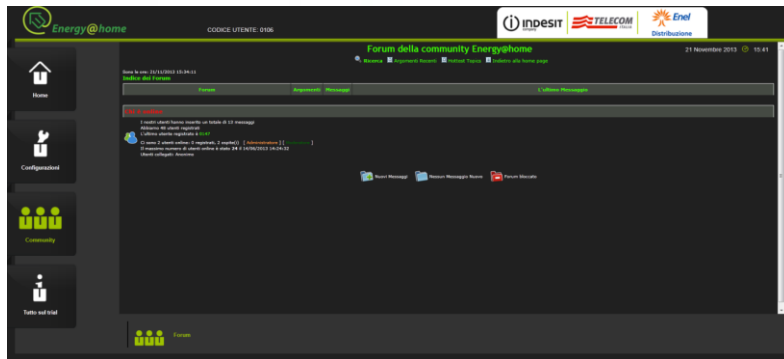
7a. Indica **PERCHE'** hai usato poco/per niente il servizio Energy@home? -E' possibile dare anche più di una risposta-

- Perché non funzionava bene il modem
- Perché ho avuto dei problemi con le prese smart plug
- Perché ho avuto dei problemi con il dispositivo di Enel
- Perché ho avuto altro problema tecnico (Specificare quale _____)
- Perché non mi piaceva dover tenere il modem acceso 24 ore/giorno
- Perché non mi piaceva lo era scomodo tenere le prese smartplug
- Perché non mi piaceva lo era scomodo tenere il dispositivo Smart Info di Enel
- Perché non mi piaceva lo era scomodo tenere il dispositivo smart gateway vicino al modem
- Perché una volta capiti e letti i miei consumi, il servizio non serve più
- Perché mancavano funzionalità importanti di mio interesse (Specificare quali _____)
- Perché è difficile da usare
- Perché non è utile
- Altro (specificare _____)

Newsletter



Forum



Focus group

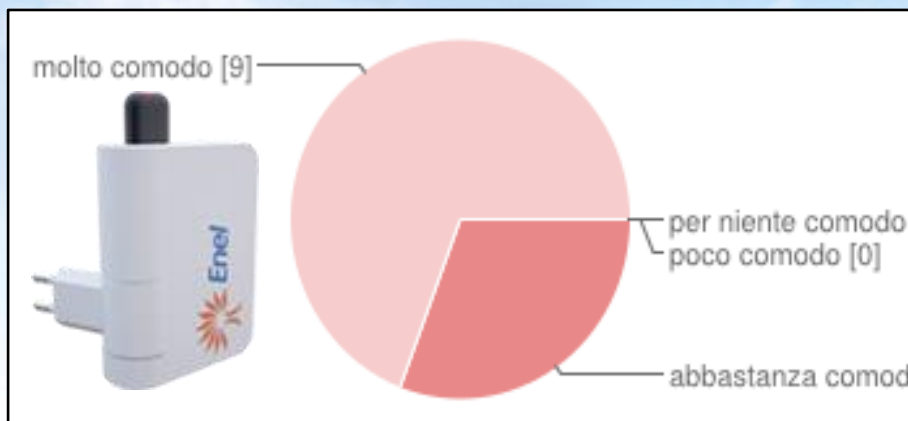


Dedicated email and phone number

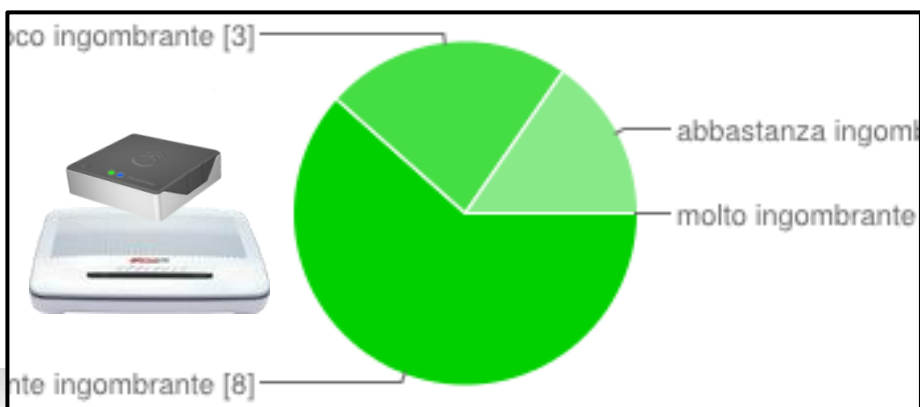
Installation

first insights based on 13 users

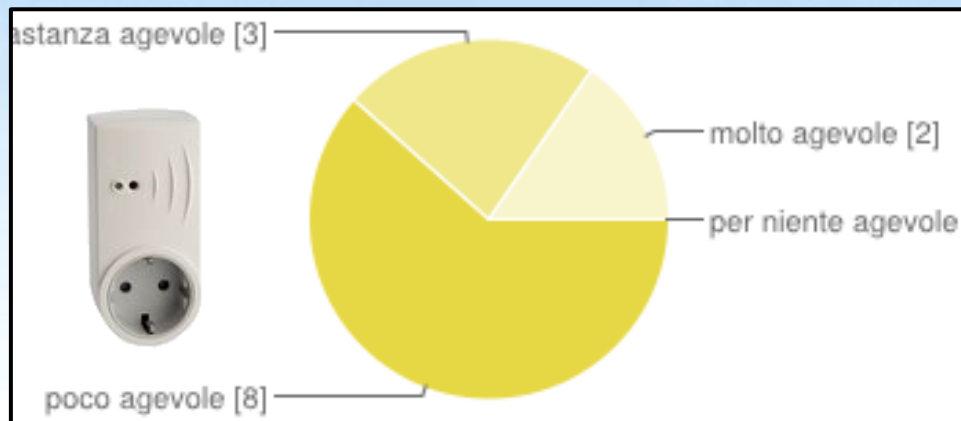
Connecting the smart info of Enel is «easy»
for all users. 70% say «very easy»



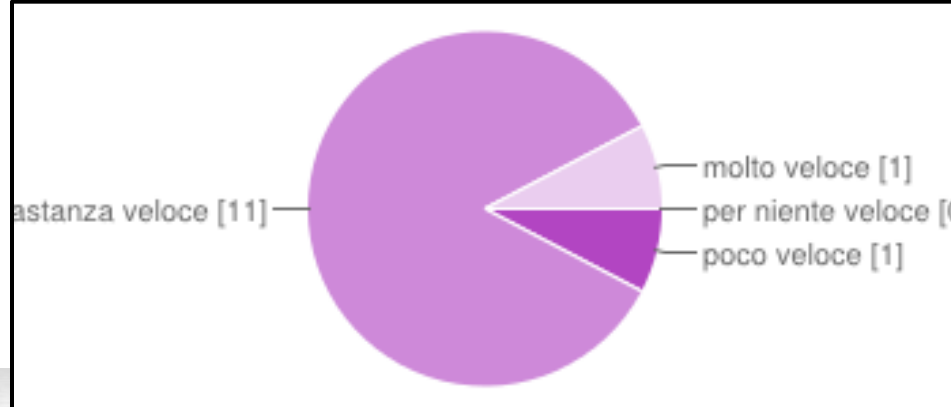
The box on the broadband gateway is not cumbersome. 62% say «quite not cumbersome»



Connecting the Smart Plugs to the whitegoods is not so easy. 62% say «not easy»



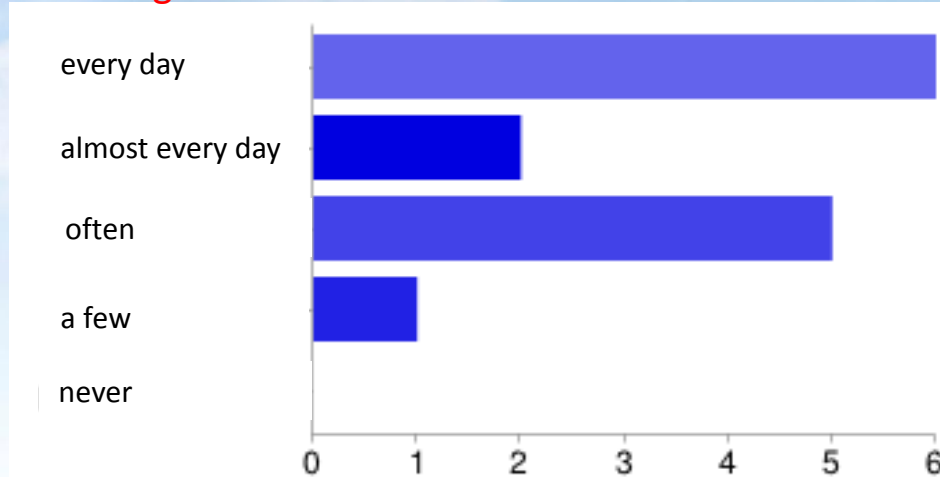
Installing the kit is quick.
Just 1 over 13 users says «not quick»



Usage

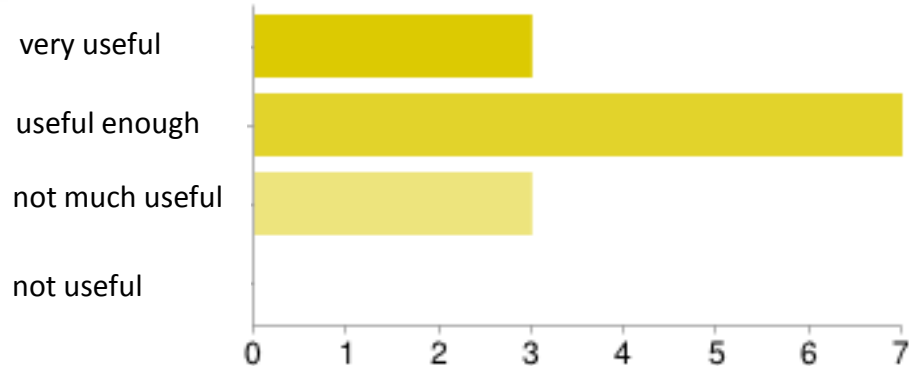
first insights based on 13 users

Running time



- ▶ I don't like a 24h running system
- ▶ I have limited internet connectivity

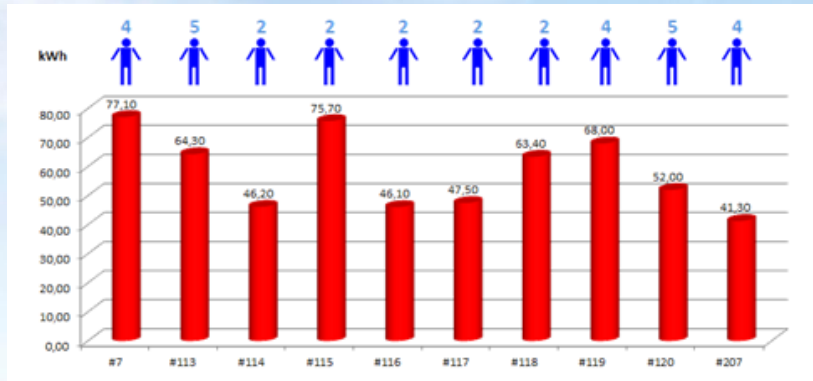
Usefulness



- ▶ Once I saw my consumption it's not necessary to check it frequently
- ▶ After a first period, I need new stimuli to check the WebPortal

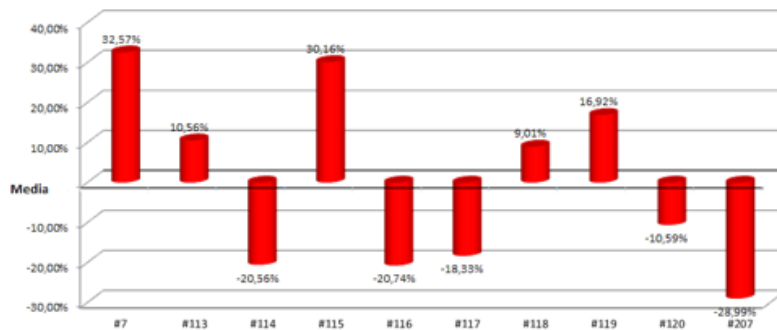
Occupant behaviour and competition

Weekly energy consumption [kWh]



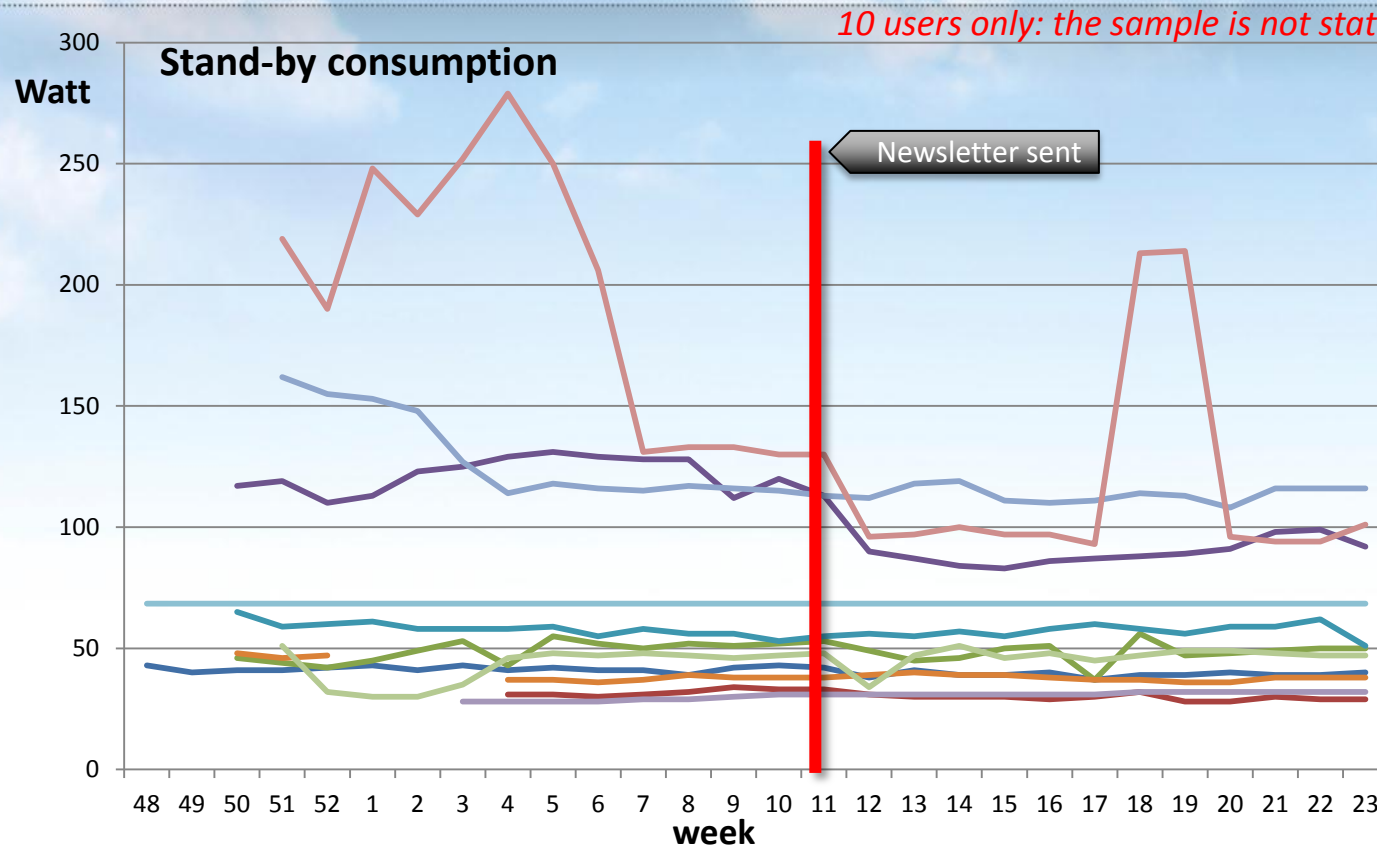
- ▶ «I'm pleased this week I saved 3.84 KW/h in respect to last week: a small quantity but it's a good start.»
- ▶ «Since when I saw the consumption of my PC, I never leave it again switched-on when I don't use it»
- ▶ «I discovered where I have a large consumption: it is the fridge! Thanks for let me discover that.»
- ▶ «Thank you for the info. I suspected stand-by consumption impacted but I had no idea how much»

... in comparison to the average consumption



- ▶ «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, even if 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!»
- ▶ «If the others can, it means there must be a way also for me to save energy...»

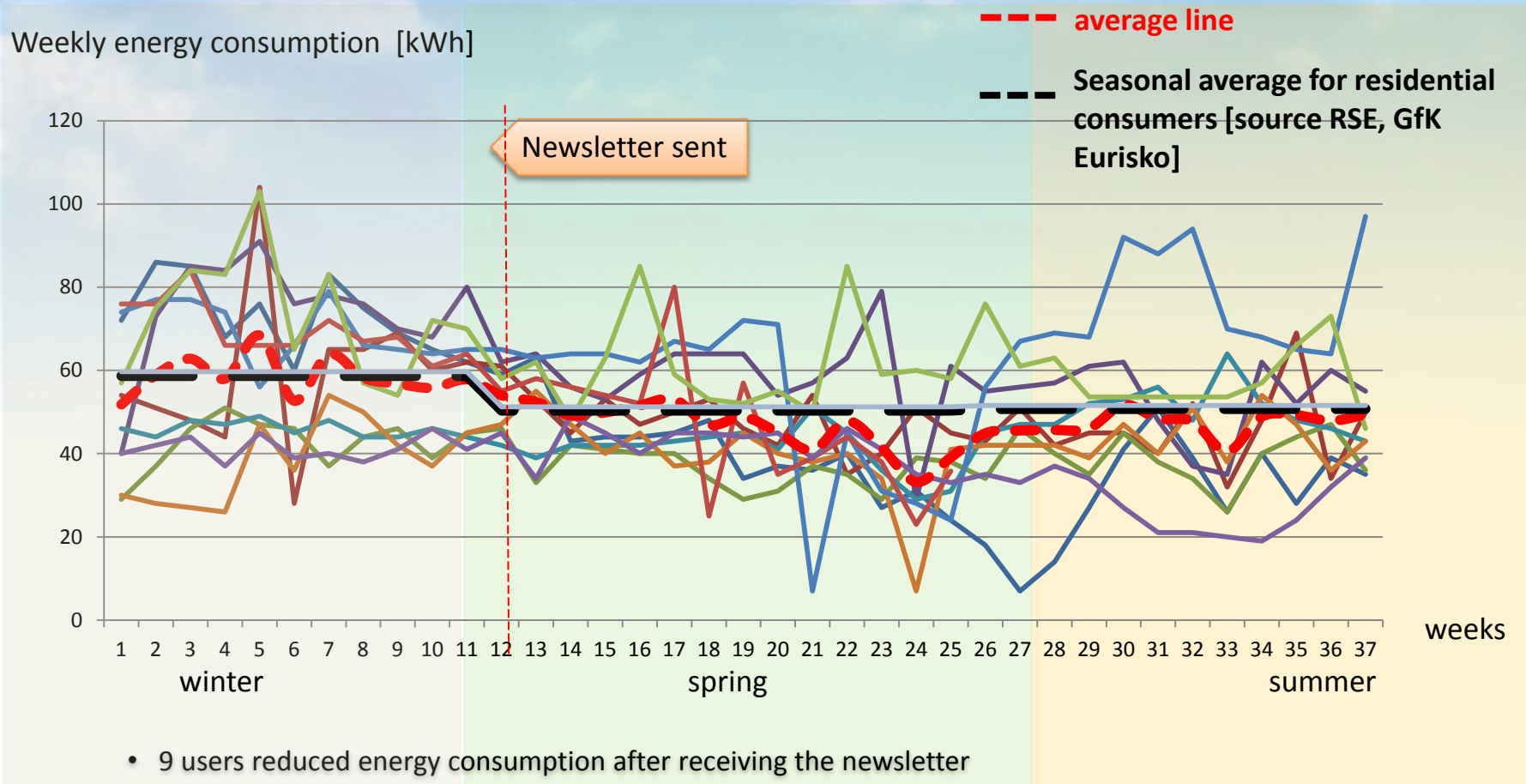
Effect of the newsletter



- 6 users (over 10) reduced stand-by consumption after the newsletter
- 3 users reduced by more than 10 Watt
- The champion saved 77 Watt (-40%), corresponding to an annual saving of ~125€; another user saved 34 Watt (-27%) corresponding to ~ 50€/year

Effect of the newsletter

10 users only: the sample is not statistically significant!



- 9 users reduced energy consumption after receiving the newsletter
- Discarding best&worst, on average they saved 10 kWh/week (-18%) corresponding to ~100 €/year
- The champion saved 21 kWh/week (~ 200 €/year), 60% of which thanks to the 77W saving in stand-by; another user 18 kWh/week, 25% of which thanks to 28W saving in stand-by
- **In respect to the seasonal average we measured 7% further saving**

Can users lower their contractual power?

5 Users with 4.5 kW Contractual Power, 686 days of monitoring in total (avg 137 days/user)

Only 3 times the absorbed power was > 3.3 kW for more than 20 minutes

3 Users with 6 kW Contractual Power, 386 days of monitoring (avg 128 days/user)

Only 5 times the absorbed power was > 4.9 kW for longer than 20 minutes

Conclusion: with energy awareness and with a smart appliance all these users can lower their contractual power

Summary



- ▶ Usage and consumption shift of the planning function of the smart washing machine
- ▶ Users Clustering



- ▶ We received a lot of feedbacks
- ▶ Standby and global consumption reduction is the key point
- ▶ Competition
- ▶ The system completely matches the target to increase the user energy awareness

Thank you!