Learning by observing and decrease of energy consumption

Results in Southern France

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Motivations

- 1) Decrease the **invisibility of energy consumption** and increase awareness of citizens

- 2) Reducing the asymmetry between demand and supply and increase **learning about of citizens and consumers**

- 3) Create potential '**learning by interacting**' between utilities and households **with or without** new digital services in the energy field.

A pioneering scientific experiment

in Southern France

Field experiment

in Biot Municipality .
In 2012 over a period of 12 months

Goal

Reduction of energy consumption

2 groups

Group 1: control
Group 2: real time information .

Very significant results for all groups

Potential replicability with diverse tools.

The ernergy sector in France

1) The **European regulation** concerning energy saving, encourages the **implementation of individual meters to show real consumption combined with accurate billing.**

2) Utilities such as Electricité Reseau Distribution France (ERDF), have introduced **R&D programs oriented to the deployment of SM** which have been tested since 2009 (e.g. see the local LINKY meter) but highly contested innovations.

3) Willingness to provide **cheap and abundant electricity** to French households and to deliver electricity at **lower prices per kWh** compared to other European countries (Eurostat, 2017).

4) French Households expect low prices and **lack of awareness about their daily consumption**

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Smart meters and feedbacks

- Feedback can promote changes to behaviors and energy practices in certain contexts by **giving real time information**.

- Results for the U.S. show average savings ranging from 0%-7% to 9%-18%

- Results depend on the nature of the feedback received:

1) **Self-monitoring** procedures (with improved billing, or weekly billing);

2) Direct feedback (**real-time** information on energy consumption; or detailed information at the appliance or "**real-time plus**" level) .

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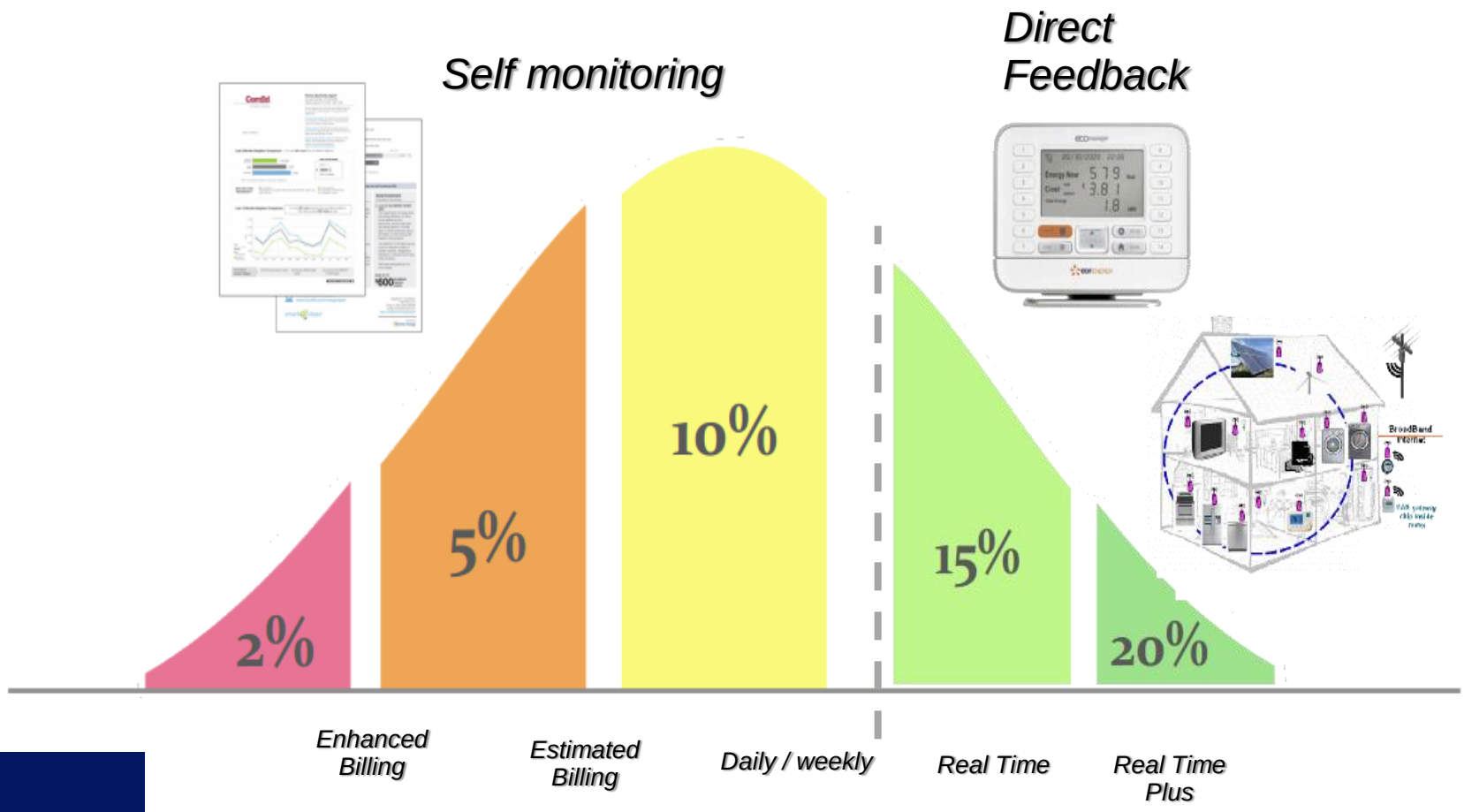
Diverse feedbacks



Experiment conducted

- To test the impact of feedbacks to citizens in Southern France (Biot close to Sophia Antipolis), an experiment was conducted.
- The project **was overseen by academics** from the University of Nice Sophia Antipolis and involved three main actors: a startup called Ubinode, the Biot municipality, and OFCE (The French Economic Observatory).
- Ubinode, the **startup, provided ICT** devices to monitor electricity consumption (SMs with ergonomic interfaces with home computers, called the “Home Energy Pack”). The Energy monitoring devices (EMD) facilitated direct feedback to households to enable a better understanding of the structure of their consumption.
- The package consisted of a **web application and sensors which could be installed in various locations in the home and provide feedback** representing near “r**eal-time** information” on general consumption and detailed information or “**real time plus**” feedback related to individual appliances.

Enrollment of volunteers

- To avoid bias the flyers did not specify whether citizens would be able to save energy or not. More than 100 households were enrolled

- The sampling strategy thus rests on the recruitment of households **on a voluntary basis**, as it is the case in many opt-in designs.

Recruitment phase and data

Size of the final sample: 65 households:

-**Group 1**: the **control group** includes the 35 households involved with no feedback.

- **Group 2**: the **treatment group**, is made of 30 households equipped with energy-monitoring devices and subdivided into two subgroups (**G21 and G22**).

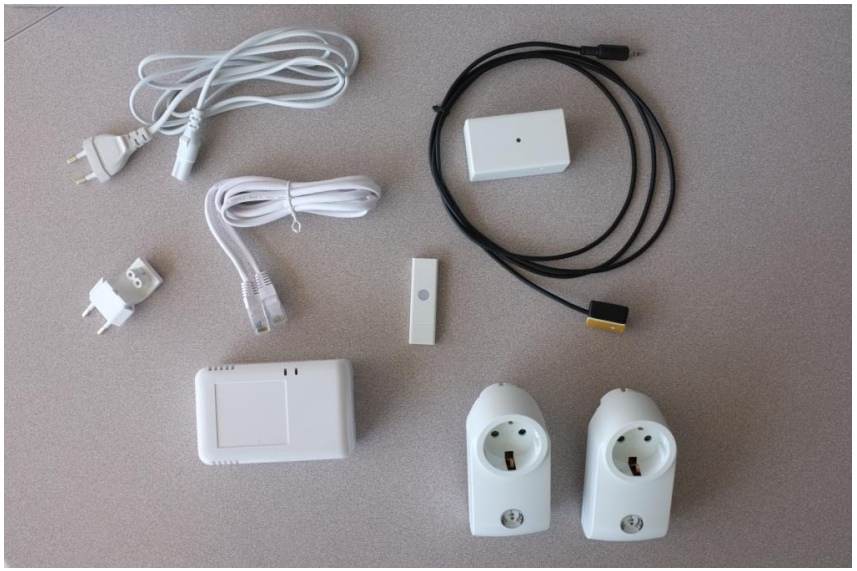
G21 : the **‘real-time’ group,** 14 households are equipped with interactive ICT which measures their consumption every two minutes.

G22 : 'real-time plus' group received the most detailed information on its electricity consumption with sensors.

Panel data quantitive and qualitative data **during 12 months**

- **2 short questionnaires** were administered (before and after the experiment) .
- This included more specific questions on the type of housing, consumption habits, household composition, and attitudes to environmental issues and sustainable development

The Energy Monitoring Devices (EMD)



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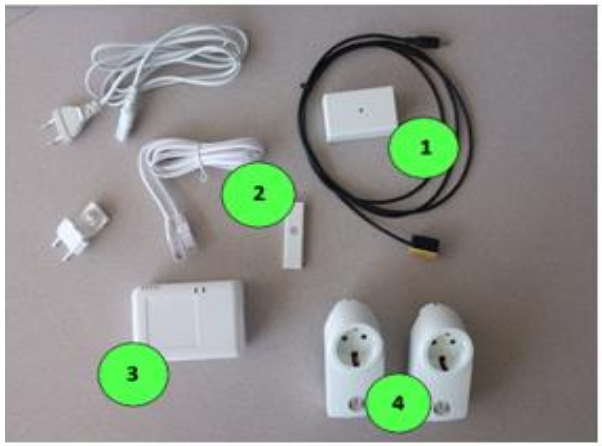
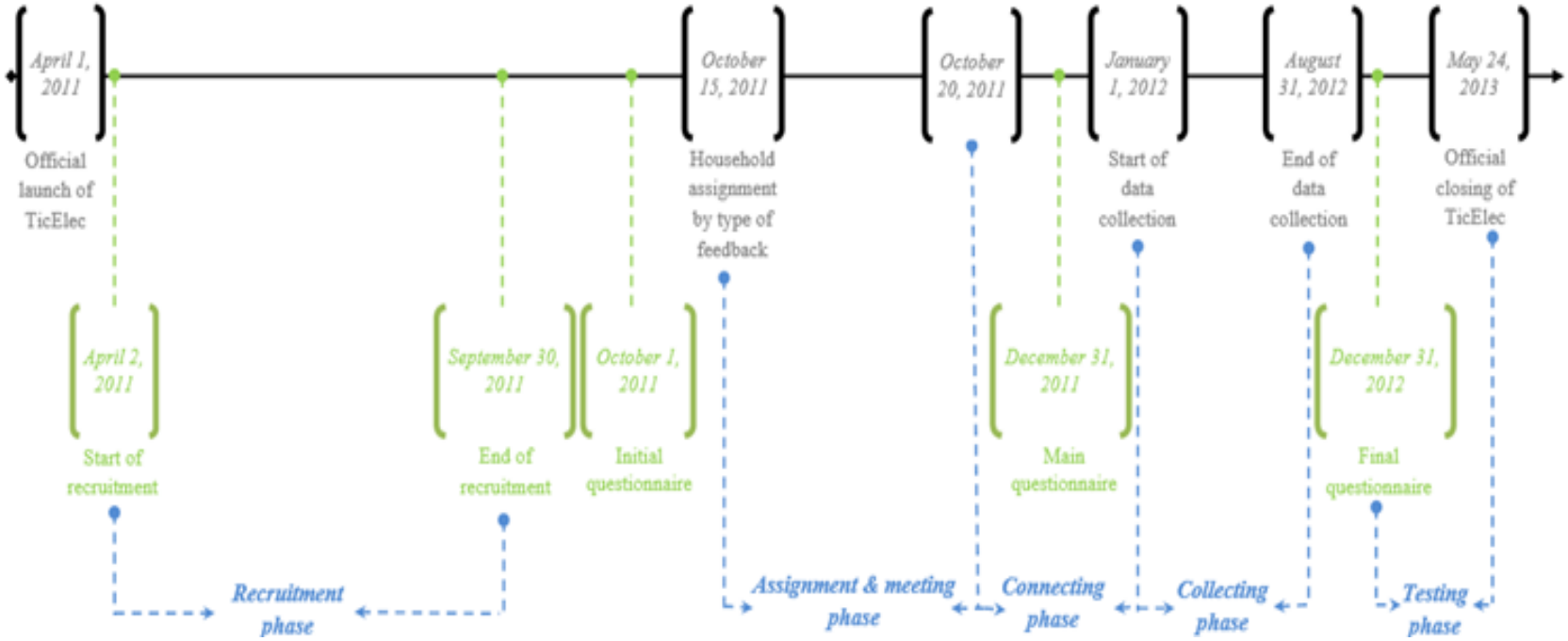
Equipment provided to groups



	G1 - Self Monitoring	G2 – Direct Feedback	
	G1 - Self Monitoring	G2.1 – Real Time Feedback	G2.2 – Real Time Plus Feedback
1. General Counter Sensor	✗	✓	✓
2. ZigBee Coordinator	✗	✓	✓
3. Communication Gateways	✗	✓	✓
4. Nomad captors	✗	✗	✓
5. Web Feedback	✗	✓	✓

Time frame

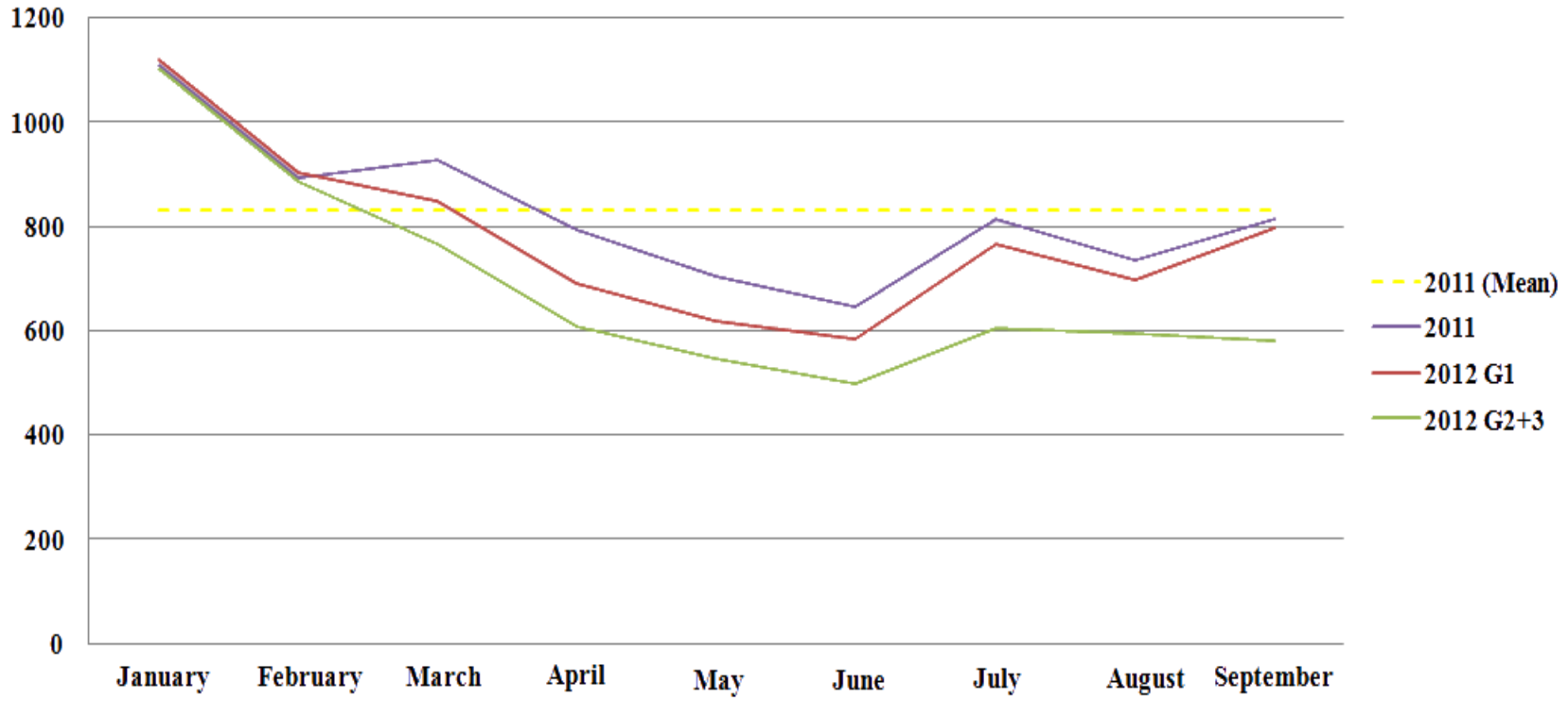

April 1, 2011
Official launch of TicElec
April 2, 2011
Start of recruitment
September 30, 2011
End of recruitment
October 1, 2011
Initial questionnaire
October 15, 2011
Household assignment by type of feedback
October 20, 2011
December 31, 2011
Main questionnaire
January 1, 2012
Start of data collection
August 31, 2012
End of data collection
December 31, 2012
Final questionnaire
May 24, 2013
Official closing of TicElec
Recruitment phase
Assignment & meeting phase
Connecting phase
Collecting phase
Testing phase

Results

- Results show that **all the groups observed reduced their electricity consumption** very significantly between 2011 and 2012.
- The G1 group reduced its consumption by 13% (1,078 kWh), G21 by 22.2% (1,783 kWh), and G22 by 23.3% (1,867 kWh). In comparison, consumption in the PACA region and Alpes Maritimes decreased by 1% over the same period.
- **13 %** in G1 group
- **22.2**% in G2.1 group
- **23.3** % in G2.2 group

- **Our results are significantly higher than those found in other studies** - and especially for the G1 group where we did not expect such a large reduction in consumption.

Decrease of consumption in diverse groups



Significant variables

- We used the OLS (Ordinary Least-Squares) regression method to analyse the changes in the dependent variable (electricity consumption expressed in kWh) associated with multiple explanatory variables:

- Feedback direct (+)
- Environnemental values (ns)
- Surface (+++)
- Socio-economic group (employees +)
- Electric heating (--)
- Change of habits : peak-load shift (++)

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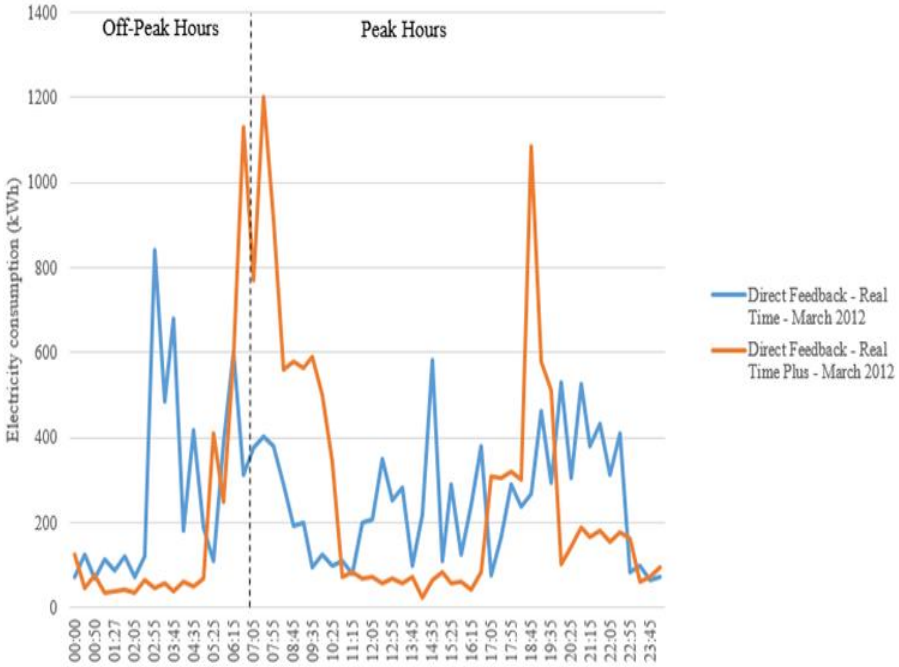
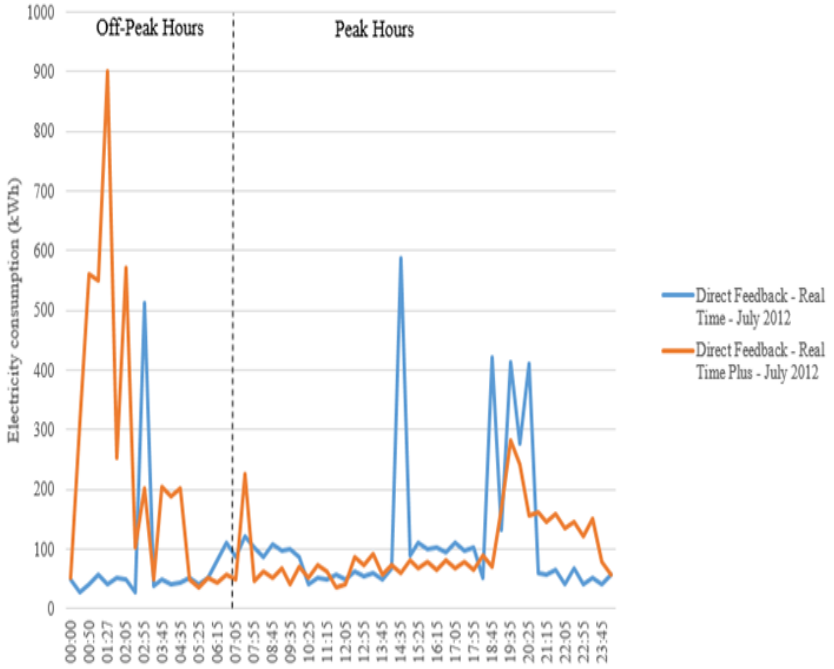
Peak-load shift for G21 and G22

March



July



Learning and peak-load shift in G22

- **Higher proportion of shifters in G22** and the higher 'quality' of their shifting (depicted in the March-July curves) suggest **a higher level of learning** enabled by the more sophisticated feedback.
- In addition G22 was more active (higher number of connections) and detailed information helps to sustain attention and learning

- Learning outcome : only a higher rate of energy savings (22.2% vs 23.3%), the higher degree of actively acquired knowledge (**i.e. through 'learning by looking through connecting')** might lead to a qualitatively distinctive type of energy saving.

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Learning by looking

- TICELEC experiment is very specific and produced different patterns of learning. In line with the abundant literature on feedback, **'learning by looking'** with direct feedback was shown in our study to be very efficient

- All participants reduced their consumption and learnt either directly from feedback or indirectly through self-monitoring.

- The amount of energy savings, which is larger compared to similar experiments, can be explained first, by the **specificity of our sample** (i.e. high income, high level of consumption) which allows for potentially large energy savings, and second high levels of trust and involvement of participants.

Learning and trust

- The unexpected reduction in energy use by the G1 group shows that 'learning by looking' was reinforced by **indirect learning** through a form of social emulation and increased motivation based on the active engagement of households in that group. This **indirect learning is also an enabling condition** for future experiments.

- The large reductions in electricity consumption within the whole sample (included in G1), suggests that all three groups were fully engaged, and their attention was maintained throughout the project.

- Trust and, specifically, **'integrity-based trust**' is a necessary condition for (and a probable a consequence of) the experiment generating energy savings because *'If the source of a message seems untrustworthy, unfair or incompetent, people can be wary or sceptical and either disengage, or react defensively to the inform*ation' (Frederik et al., 2015: 1388).

Potential replicability of our results

- Content and support of learning : **Learning with or without technologies**

- In the future to extent this experiment with diverse groups of low and high income in order to consolidate these results. Both **low and high-income** appears to be very interesting groups to observe : they have high potential for changing their behaviours starting from very different goals and expectations about learning.

- Context and frame of our results (small municipality, high income) matter

- Qualitative form of learning matters: the higher proportion of shifters in G22 and the higher ‘quality’ of their shifting (depicted in the March-July curves) suggest a higher level of learning enabled by the more sophisticated feedback.

Policy making implications

- Learning is an enabling condition….but various ways of learning (nudges, EMD…).**The frame matters** for trust building and real commitment of citizens

- **Utilities** are not perceived **as trustworthy organizations** and are not the good pretenders for conducting these experiments

- **Quality of learning matters** for changing habits in a sustainable manner and avoiding any rebound effect

- **Long term investment** in capabilities **for increasing energy culture** and making visible energy for all citizens with low or high level of consumption

- The **reduction of the bill** appears to be important for citizens dimensions….it can be one of the first reasons to go towards this long learning

- For reducing energy consumption pragmatism is more important than dogmatism