The SHOWE-IT project: an experience sharing on ICT services in social residential buildings

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Social model across Europe, ICT and the European Directives

1) Houses and buildings, when considering their whole life cycles, are responsible for 40% of the total European Union energy consumption.

2) Considering the possibility for a large-scale rollout of ICTs solutions for energy efficiency, social housing is a part of the residential sector with a high replication potential

3) In European countries, social housing accounts for approximately 20% and more of the total housing stock (Netherlands 32%, Austria 23%, Denmark 19%, UK 18%, …)

Social model across Europe, ICT and the European Directives

SHCs can be an ideal starting point to roll out the ICTs solutions on a large scale as they have strong incentives to invest in energy efficiency measures.

In particular, housing owners are interested in:

- Increasing living quality standards of the tenants;
- Lowering consumption costs of the tenants (so that tenants have more disposable income to pay rent);
- Reducing energy consumption and thereby, decreasing CO_2 emission.

Social model across Europe and the European Directives

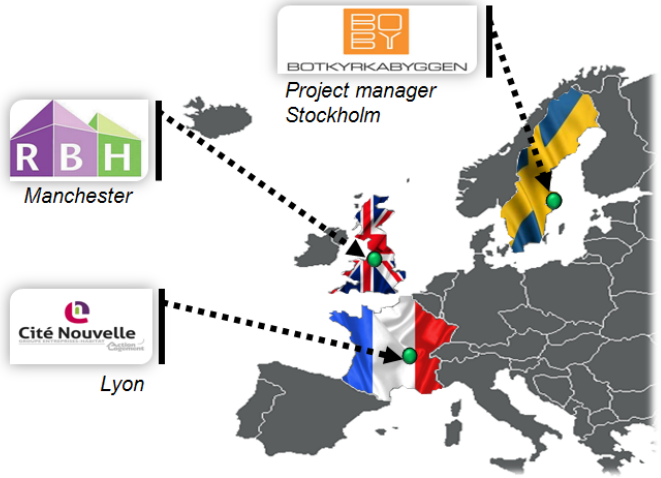
Directive 2012/27/EU obligates to display the consumption data to the users that is precise, real, and understandable and allows them to control their consumption.

Thus, by 2017 all building owners (including the SHCs) have to ensure that the following information is provided to the end users:

1. Consumption in real-time and real cost of the energy;
2. A comparison of the final consumption of the consumer during a certain period compared to the previous year, preferably in graphical form, with possible comparison with an average consumer of the same category or the national average;
3. Specific links with access to information on energy efficiency.

SHOWE-IT

- **A European project**
- **12 industrial partners**
- **3 countries**



Goal: Demonstrate, under real conditions, how ICT systems can allow reducing energy and water consumption by 20 %.

- ❑ **Develop ICT solutions**
- ❑ **Tests in 118 social dwellings +**
  (70 control group households)

The obstacle course of ICTs

Fulfilling these objectives is not an easy task. ICTs systems involve numerous technical elements and procedures such as in the SHOWE-IT project that make their implementation difficult.

First, we will present the perspective of the Social Housing Companies and the difficulties faced during the installation of the ICTs, and the related cost;

Second, we focus more specifically on the expectations of the tenants and their feedback with regard to the ICTs and energy savings.

ICTs-supported solutions

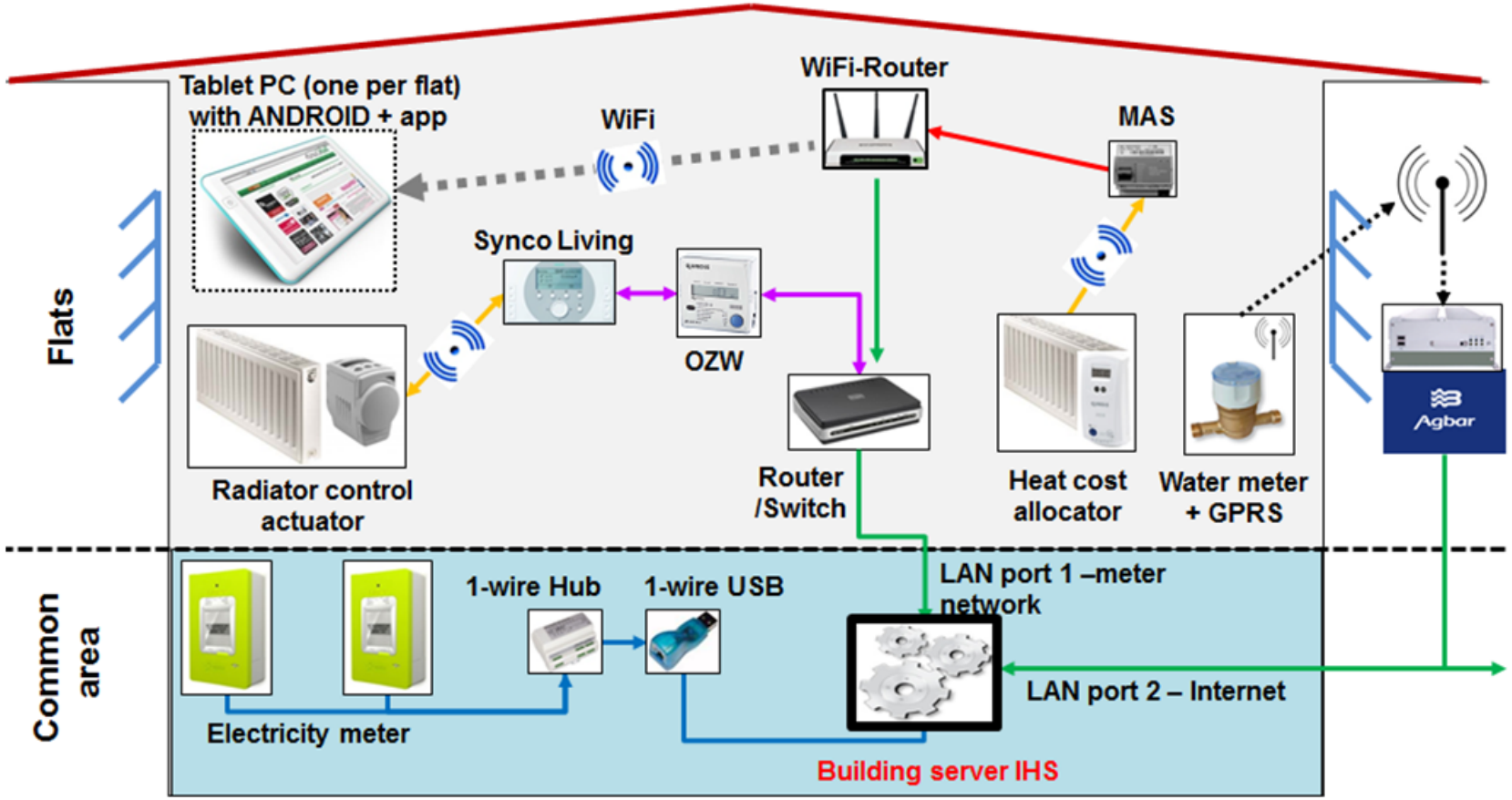


Figure 1 : ICTs-supported solutions developed during the SHOWE-IT project

Complex multi-fluid system of ICTs

Not "off-the-shelf" solutions as was assumed before starting the project

- Installation and use of the IDH was more complex than anticipated owing to outdated technology, poor quality hardware, and devices that did **not have a proven track record of working together harmoniously**
- **No subcontractor who had all the devices** in his/her overall service and product offer
- All three SHCs had to engage **multiple local technical expertise** for the functioning of the installations

Problem of the business model with individual metering in existing buildings

The SHOWE-IT project used a combination of multiple technologies, which turned out to be difficult to integrate, and thus, the cost of the technologies per dwelling was around **€ 3,000 per household** (up to € 7,000 in UK).

We can infer that the particular set of technologies used in the project is not replicable from the financial point of view.

What should be the good price for ICT technologies ? A small exercise

European statistics show that a European household on an average spends € 125 per month on energy (heating), i.e., € 1,500 a year

Assuming an average saving of **20%**, we can calculate the monetary savings to be within approximately **€ 300** annually

Finally, if we expect a reasonably payback period for an investment in the ICTs systems to be **< 5 years**.

This yields that the acceptable cost of the technology should be lower than one year of heating consumption (€ 1500 (€ 300 × 5)

The reality of savings : case of heating

eeMeasure

"eeMeasure enables ICT PSP projects to calculate and record energy saving results using a consistent methodology"

http://eemeasure.smartspaces.eu

Per ICT project

Average saving per year**: 19,3%**

Median : 12,7%;

Min : 0%; Max : 67,67%

Per dwelling

Average saving per year **: 9,8%**

→ 295 kwh

Median : 235 kwh;

Min : 0 kwh; Max : 2126 kwh

The reality of savings : case of heating

eeMeasure

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Considering an annual energy saving of **295 kwh** per dwelling and assuming an energy price between 0,05 (gas in France) & 0,14 €/kwh (electricity, France), we can calculate the monetary savings to be :

For Gas : 15 € (median : 12 €; min : 0 €; max : 106 €)

For Electricity : 41 € (median : 33 €; min : 0 €; max : 298 €)

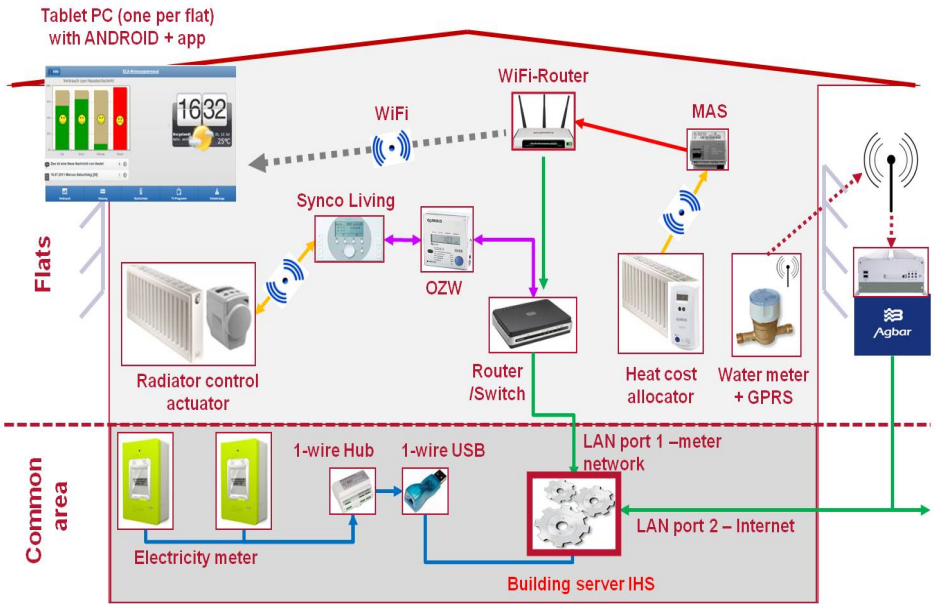
To conclude on the technical and financial model with individual metering in existing buildings

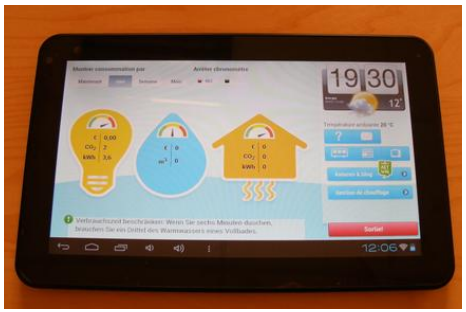
The difficulty with the new EU Directives and individual metering requirements for the SHCs is linked to the following three factors:

1. The real difficulties to have one “off the shelf” technologies for all uses (water, electricity, gas)
2. The uncertain savings that can be obtained owing to these new devices
3. The high cost of installation of individual meters in each dwelling in the context of a collective heating system;
4. The low-to-nonexistent return on investment for the SHCs with such installations.

Lessons learned from sociological and design studies in SHOWE-IT

Ambitious energy efficiency objectives…





…but a need to invest more in social sciences & UCD/UX in such projects

Step 1: analyze complex users' consumption habits & representations with sociological studies

In the 3 sites: tenants had individual electricity but collective heating and water bills that created 3 main information & reflexive problems

Different metering scales

Individual, Building level, Floor level, Collective level

Different billing calculations

Collective or individual, Real / estimated /regulated, Negotiated

Different consumption scales displayed on bills

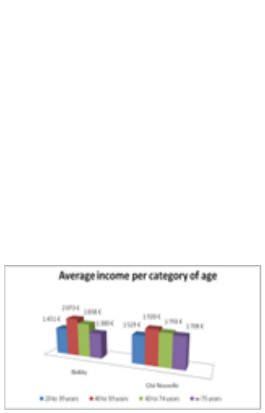
Individual from collective, Real/estimated/regulated, Aggregated/ no info

Complicated and incomplete information

Units and calculation, Rising fee costs, Link consumption/cost , supplier comparison

Step 2: build an efficient mixed method "socio-design" to develop & test interfaces

⇒Iterative process with interviews, testing and heuristic evaluation



STEP 1

Qualitative interviews : Identify the values, consumption habits and current expectations for new energy services

STEP 2

Prototype testing *in situ*

Interaction tenants/ interfaces

Establish the positive and negative aspects of usability of the interfaces directly with tenants

STEP 3

Improving the prototype with tenants' expectations and products tests results until the final product

Synthesis of usability experiments for the designers

STEP 4

User Experience : testing the real uses of interfaces in real conditions with final users

Qualitative interviews

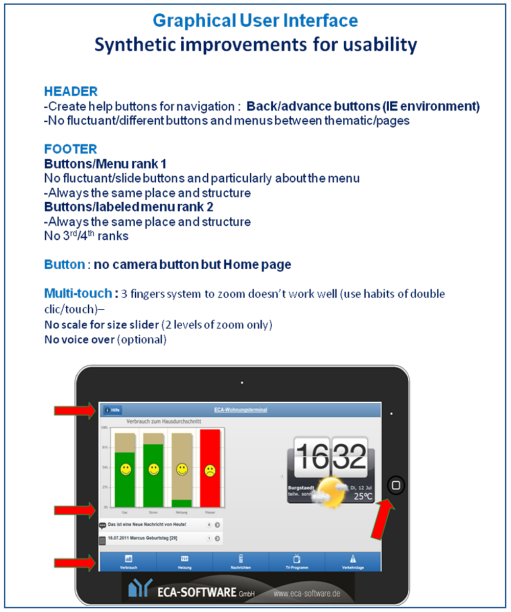
Quantitative survey

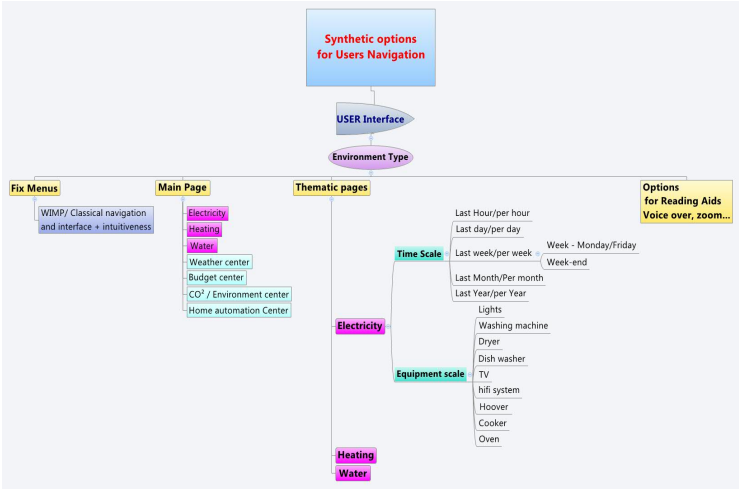
Data tracking / statistics about the uses and the connexions of final users with the interface

Ref: Sociological public results 2014- PhD Cifre K.Zoonnekindt Mines/GDF SUEZ in the SHOWE-IT project

Step 3: invest in UX researches & methodologies

⇒Research on perceived affordances of hardware & software
⇒Testing individual/collective





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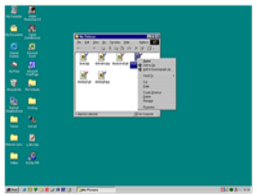
Step 4: co-designing solutions with users

⇒Qualitative sociological interviews
⇒ Incremental process with various prototypes
⇒ Follow-up tests before/after until final version

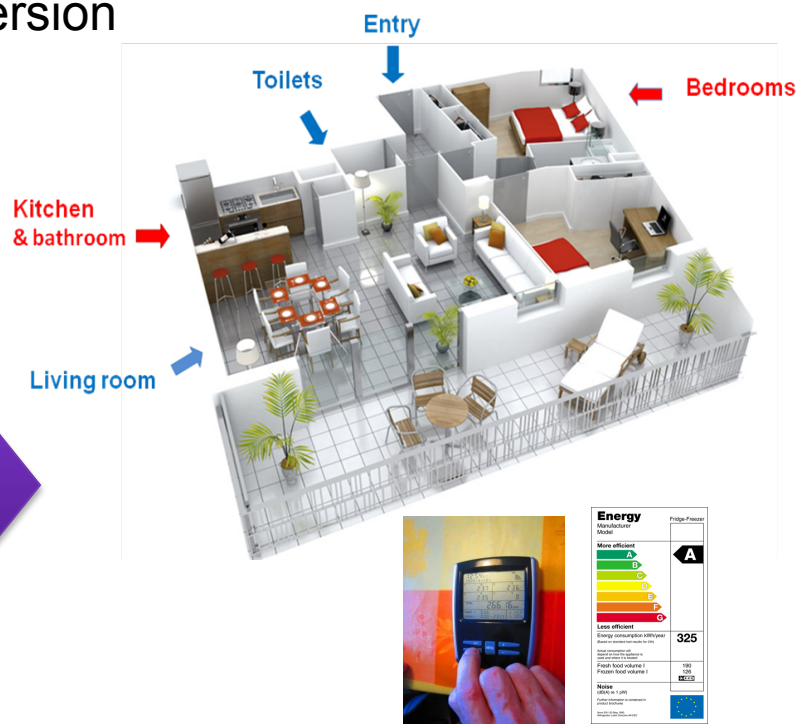
The 3 types of SUPPORTS :

1. MAIN INTERFACE : TABLET
   NUI (Natural User Interface) with tactile technology
   - A majority of positive reactions
   - Especially for elderly people who don't like the pointer system +kids
   - Instinctive interaction human/tablet
   Option : the voice over (elderly people + alerts)

2. OPTIONNAL INTERFACE : COMPUTER
   Classic WIMP Interface (windows, icons, menus pointers) where the finger is replaced by a pointer
   - Some tenants want to have both tablet + computer interface



3. CROSS MEDIA : TABLET + COMPUTER
   A positive option for motivational factors and human/device interaction
   - Pro-activity for home and self management



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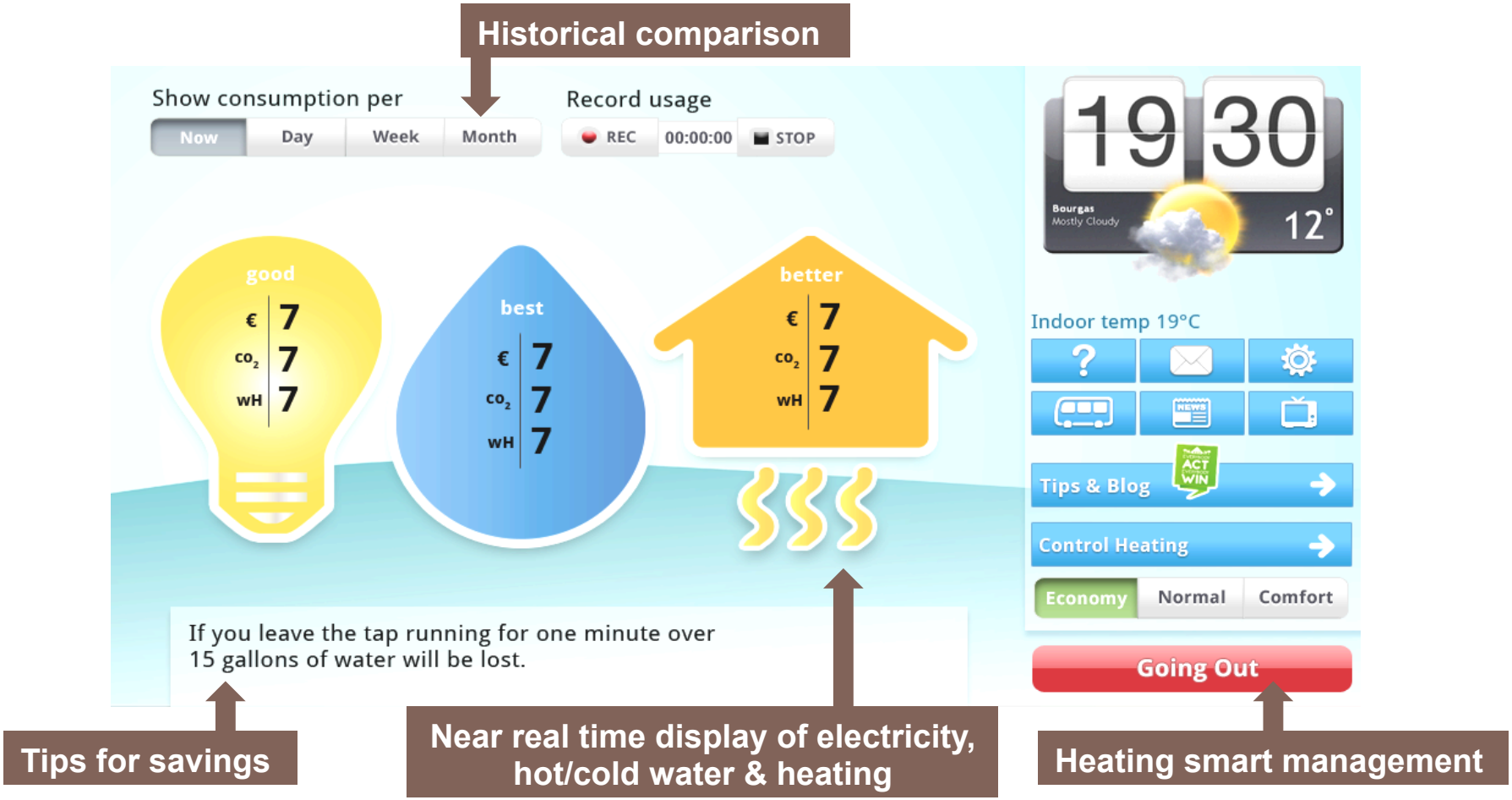
Step 5 : learn from users tests: what tenants expect with ICT-based smart energy services ?



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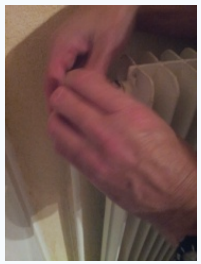
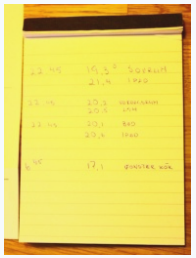
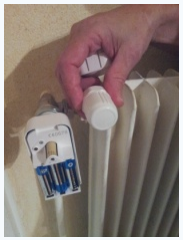
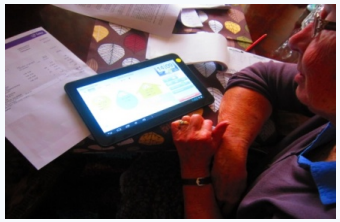
Step 6 : Engagement Program and transparent communication from other stakeholders



OBJECTIVES

- Integrate tenants as referents
- Analyze the origin of resistances and potential controversies
- Establish margins of actions and new threats (double fuel poverty)
- Measure potential rebound effect
- Answer to anti-reflexive behaviors, poaching actions
- Improve users' satisfaction

To conclude on SHOWE-IT project

SAVINGS (estimated by pilot sites)

- → Heating : 0% to 15%
- → Electricity : 0% to 8%
- → Hot Water : 0 to 12%
- → Cold Water : 0 to 15%

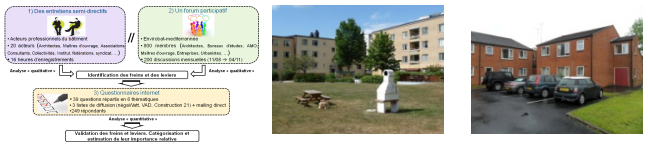
+

POSITIVE APPROACH mixing Sociology & Design

Positive assessment of user interface by tenants & engagement program

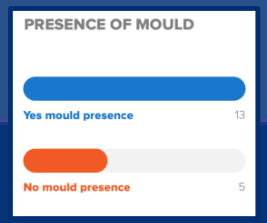
76% expressed an interest for the smart services proposed and 70% wanted to continue using the SHOWE-IT tablet;

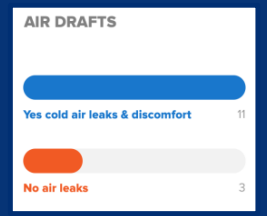
84% assessed that the interface was easy to use,



The sociological and UX researches continue in DREEAM project 2015/2019 in UK, Sweden, Italy

dreeam
scaling energy renovation





INDICATORS
- ✓ Household occupancy profile
- ✓ Thermal comfort perceptions summer & winter
- ✓ Equipment /devices
- ✓ Radiators used & set point
- ✓ Damp/mold & humidity perceptions
- ✓ Air drafts & ventilation habits
- ✓ Renovations expected & relevant quotations

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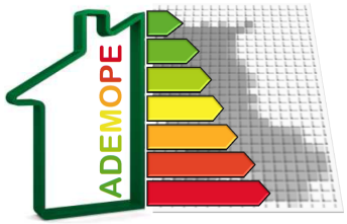
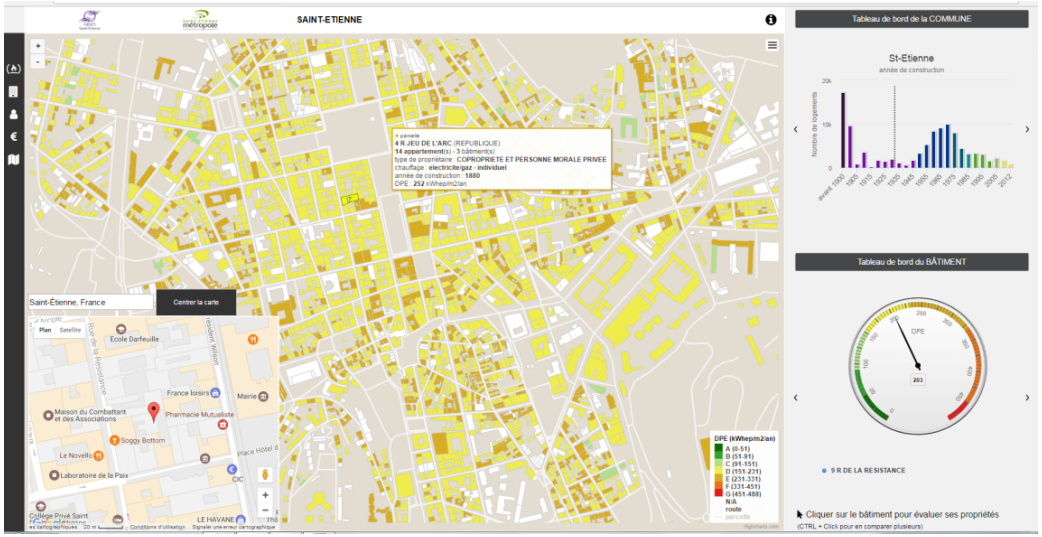
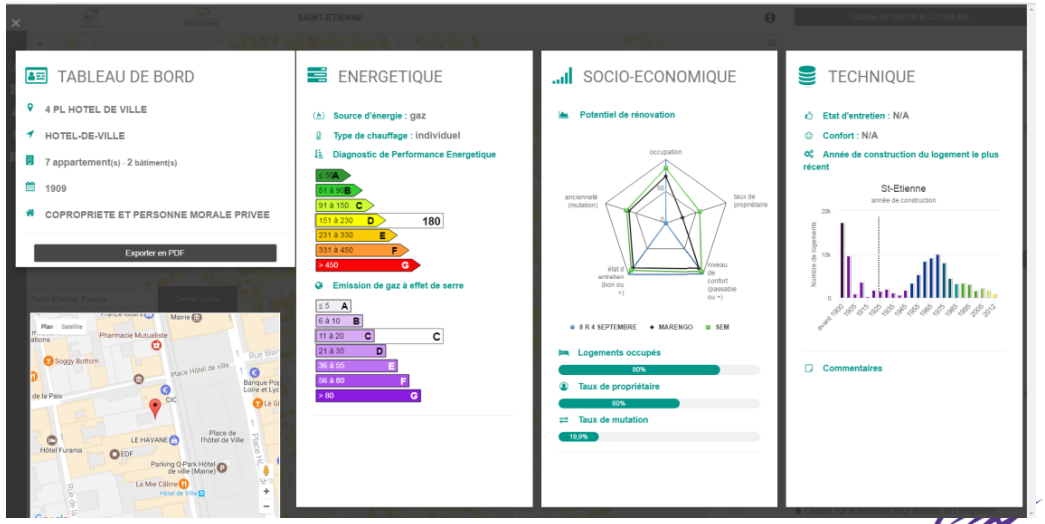
The technical researches continues in ADEMOPE project 2016/2021 in France







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