e3soho

Energy Efficiency in European Social Housing

E3SoHo:
ICT Services for Energy Efficiency in European Social Housing

CIP-ICT-PSP-2009.4.1

Margherita Scotto D'Appolonia S.p.A. (It)
Nicolas Salmon Nobatek (Fr)

ICT for sustainable homes: 17-18-19 November 2010 Nice
Energy efficiency measurements and validation methodology for pilot

ICTPSP

Agenda

- E3SoHo Project Overview
- Methodology
  - Project Methodology
  - Methodology to Validate the Performance of ICT
- How we do it from the monitoring expert: NOBATEK
- Conclusion and challenges

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E3SoHo in a few words

The overall objective of E3SoHo project is to implement and demonstrate in 3 Social Housing pilots an integrated and replicable ICT-based solution which aims to bring about a significant reduction of 25% of energy consumption in European social housing by:

-providing tenants with feedback on consumption and offering personalised advice for improving their energy efficiency

-reducing the energy consumption and increasing the share of RES by informing and supporting the user to decide for the most appropriate behaviour in terms of energy efficiency, cost, comfort and environmental impact.

-monitoring and transmitting consumption data to Energy Services Companies which could enable real time energy audits in order to perform more accurate refurbishment activities as well as maintenance operations

E3SoHo in a few words

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The proposed ICT based system offers a holistic solution that provides advice to the different stakeholders on how to :

- reduce energy consumption
- install the system
- monitor and tune energy consumption
- improve management of energy production systems

E3SoHo service is built up of sub-services that can be provided separately:

- Perform an audit in the building to identify the energy saving potential.
- Provide the owner with an ICT detailed plan
- Implement the system according to the blue-print
- Tuning of energy consumption by monitoring
- Maintenance of the installed system
    - ❖ dissemination to the open market

E3SoHo Consortium

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- Partners

1. Acciona Infraestructuras S.A., ES **Coordinator**
2. City of Warsaw, PL
3. Cecodhas, BE
4. Centre Scientifique et Technique du Bâtiment, FR
5. D'Appolonia, IT
6. ISA – Intelligent Sensing Anywhere, PT
7. Institute of Control and Industrial Electronics, PL
8. Mostostal, PL
9. Nobatek, FR
10. Telenor, NO
11. Sociedad Municipal Zaragoza Vivienda, ES
12. ICF, FR

acciona

D'APPOLONIA

CSTB
le futur en construction

ISA

CECODHAS

nobatek

Mostostal
WARSZAWA

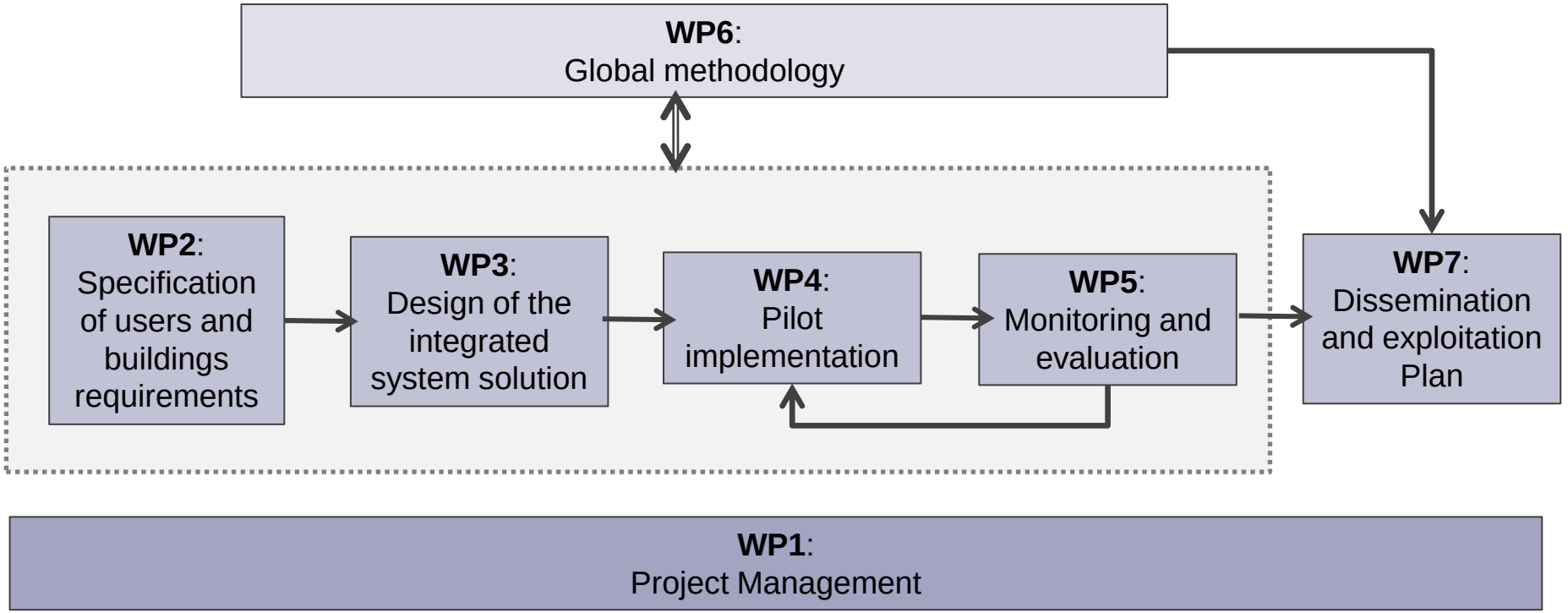
Zaragoza Vivienda

WARSAW UNIVERSITY OF TECHNOLOGY

icf NOVEDIS

telenor group

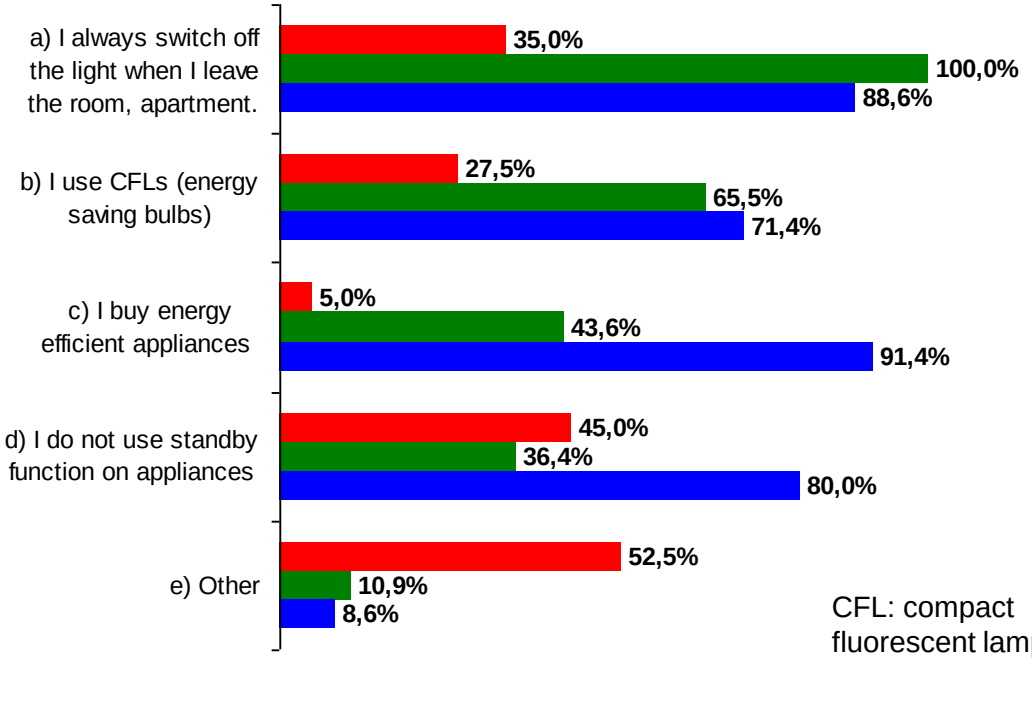
E3SoHo Work package flow



User Requirements

The E3SoHo partners involved in WP 2 set up a 45 questions survey addressed to dwellings' tenants. It deals with the tenants' relationship to environmental issues and aims at collecting information about their behaviors towards energy consumptions and savings

Q5: In what way do you limit your energy consumption?*



CFL: compact fluorescent lamp

- People are interested
- Training and awareness are needed
- People want different things

Building Requirements

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Analysis of building requirements has been performed. In particular with reference to the different European Countries (Belgium, France, Germany, Italy, Spain, Norway, Portugal and Poland) similarities and differences in the approach took on by the authorities have been analysed.

Moreover for the pilots the following aspects have been considered;

- Characteristic features of SH:
- Overview of the social, co-operative and public housing system
- Technical requirements of SH construction
- Estimate of rents and exploitation costs in SH
- Technical equipment and installations in a modern-day social housing
  - Heating ,Gas,Ventilation,Electrical installation and low-voltage installations, Water, Fire protection installations ,Sun protection.

Energy audit (with ICT considerations)

Analysis of ICT Technologies

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The analysis of ICT technologies available on the market has been based on:

- Overview of the ICT space related to Energy Efficiency with special emphasis on the residential sector. Trends, initiatives, platforms, providers, protocols, processes, and projects are identified.
- Examples of ICT solutions appropriate for social housing.
- Development of the first draft of the E3SoHo system architecture(s).
- Technological offerings of the project ICT providers Nobatek, ISA, and Telenor to bring the system architecture to reality.
- Identification of most suitable ICT solutions from within and outside of the project that will be utilized in E3SoHo.

(Justification for these choices will be provided and the integration activities necessary to ensure the interoperability of these ICT solutions will be detailed) .

Pre-Deployment Data Collection

GOAL ⇨ For each pilot building: establish a reference for buildings and users energetic behavior, without ICT and without awareness campaign:
Usual response of the building to external conditions (Climate)
Usual energy consumption
Usual comfort level in the dwellings

RESULTS ⇨ Energy/comfort typical response of the building related to:
dwellings typologies (size, exposition, systems) and climate conditions
users typologies (families, singles, etc.) and behavior

⇨ To be used for later comparison (WP5) with ICT equipped buildings and after awareness campaign

Pre-Deployment Data Collection

METHOD

1. Identification of the dwellings to be monitored in each building (representative sample of the whole building)
   - *Number of dwellings in the building*
   - *Size of the apartments*
   - *Exposition*
   - *HVAC implemented systems*
   - *Typology of users*

2. "Transparent" monitoring system implementation in each pilot (metering and sensors)
   - *No interface*
   - *Wireless / small sensors*

3. Data acquisition during a representative period
   - *Data consolidation and verification* (coherence of the results)
   - *Maintenance of the monitoring system*

4. Definition of a reference behavior for the building
   - Results analysis
     > Energy/comfort typical response of the building

E3SoHo services and solutions

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"In E3SoHo ICT services and solutions include and are being coupled with"

Smart metering

Control Actions

Pure ICT

Tenant questionairres and educational initiatives

Awareness and training campaigns

Management Methodology

Partially ICT (ICT Enabled)

Building retrofit actions

Not ICT

Monitoring and evaluation of the system's performance

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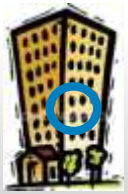
For each pilot building:

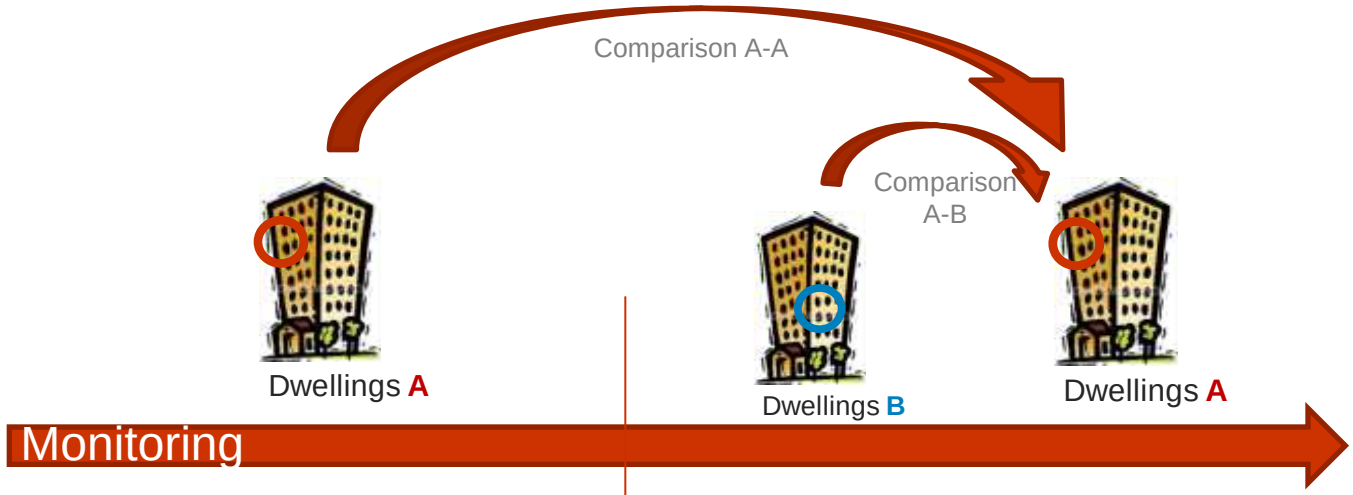


Dwellings **B**

= reference dwellings (no ICT equipement, no awareness campaign)

Dwellings **A**

= pilot dwellings (ICT equiped, aware users)



Energy efficiency evaluation

(=energy consumption related to comfort level and external conditions: *Pilot vs. References*)

Monitoring and evaluation of the system's performance

-Evaluation of ICT impact

-Evaluation of awareness programs

Methodology

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Methodology: Framework information

Energy Efficiency in European Social Housing

Under the ICT PSP Work Programme 2009, Theme/Objective identifier: CIP-ICT-PSP-2009.4.1 – ICT the European commission selected three projects for funding**: 3E Houses, E3SoHo, and eSESH**

Each of the three consortia awarded a grant by the EC, was asked to work on the development of a **methodology for efficiency measurement**. And subsequent to that, a workshop to discuss, exchange experience and, if possible, use it, to identify good practices, potential difficulties and ways of avoiding/solving, etc, took place in Brussels, on June 1st, 2010, in which, the three consortia participated and agreed a cooperation strategy for the development of the methodology based on three versions where:

- Version 1 is developed by 3E Houses
- Based on that E3Soho will develop version 2
- Finally based on Version 2 E SESH will develop version 3

E3SoHo global methodology

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Assessing ICT Performance: IPMVP

The Step	What is it?	What's Involved?
Initial Assessment	*Looking at where you are today and where you would like to go?*	Building Diagnosis (EPBD...) User Needs Owner Needs
Developing your ICT Solution	*A proven methodology + consulting expertise = your ICT solution.*	Monitoring and evaluation Selection of Performance Indicators Technical Design Installation
Using your ICT Solution	*Interpreting your results, benchmarking, and assessing solution performance.*	Your reports on consumption Energy Saving Recommendations

E3SoHo methodology: initial assessment

The initial assessment is based on the following:

- Building Diagnosis
- User Needs
- Owner Needs

Buildings diagnosis are done based on the indication reported at European level within the EPBD

In order to evaluate the users' needs a survey has to be carried out. It deals with the tenants' relationship to environmental issues and aims at collecting information about their behaviors towards energy consumptions and savings

The need of the pilot site owners is related to the ways available to save energy, water, and heat among the tenants, getting to know users opinions and attitudes towards subjects related to environmental protection and eco-minded behaviors

E3SoHo methodology: Developing your ICT solution

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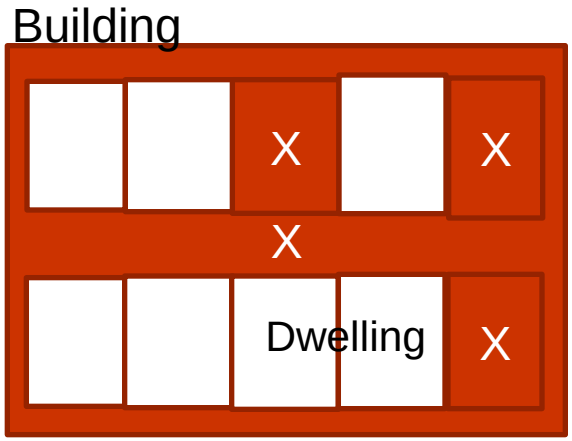
Measurements:

- Electricity
- Gas
- Hot Water
- Temperature
- Air quality
- Humidity
- Luminence
- Occupancy
- Weather Conditions



Levels: Measurements can be taken at different levels (building level, individual flat level, room level, appliance level) depending on the analysis desired.

Performance Indicators: allow the analysis and comparison of these measurements in different useful ways (e.g. energy consumption/dwelling, return on investment, carbon footprint, etc.). It is useful to group performance indicators in line with the four pillars of sustainable development: Technical, Economic, Environmental, and Social

E3SoHo methodology: selection of performance indicators

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Technical Energy

- Total Energy Consumption
- Energy Consumptiom by Source (Elec, Gas)
- Energy Consumption by Application:
  - Heating
  - Cooling
  - Cooking/Kitchen
  - Ventilation
  - Lighting
  - Domestic Hot Water (DHW)
  - Laundry
  - Other uses of electricity

Economic

- Return on Investment
- % Bill / Income
- % Bill / Rent

Environmental

- % Renewable Energy
- CO2 Emissions

Social

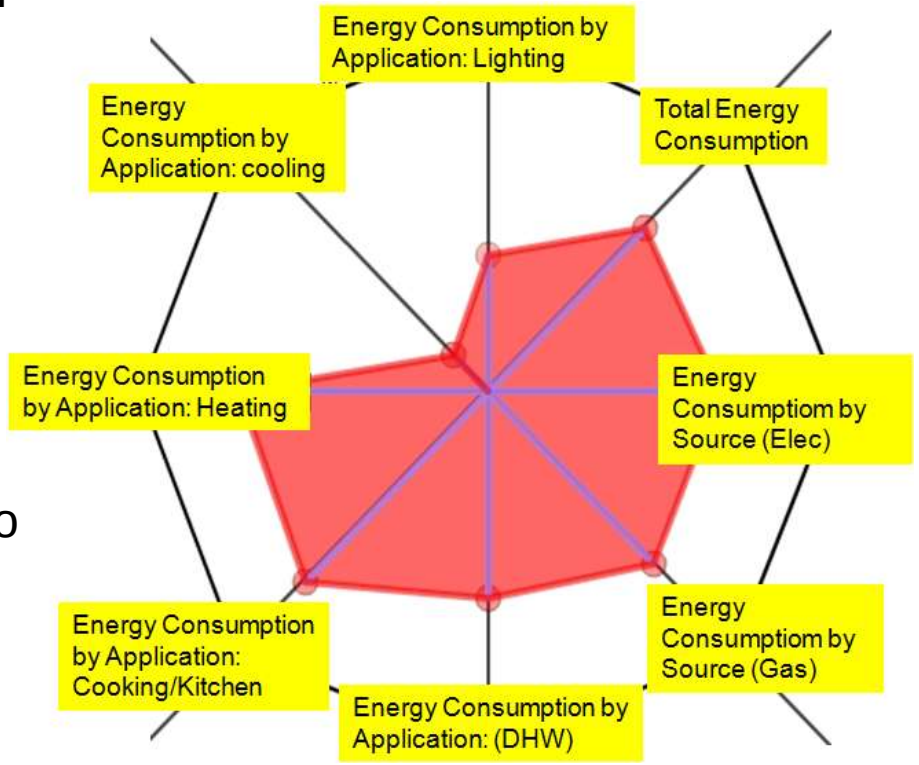
- Comfort
  - Temperature
  - Humidity
  - Air Quality
  - Illuminance
- Satisfaction

Using your ICT solution

For each pillar the parameter identified will allow to give an evaluation of the ICT solution implemented. In order to display in a single way the multivariate data estimated the intent is to use a star pilot.

The star plot consists of a sequence of equi-angular spokes, with each spoke representing one of the variables. The data length of a spoke is proportional to the value of the variable. The center of the star represents the most desirable results

For each pilot a final plot star representing the 4 pillars will be develop



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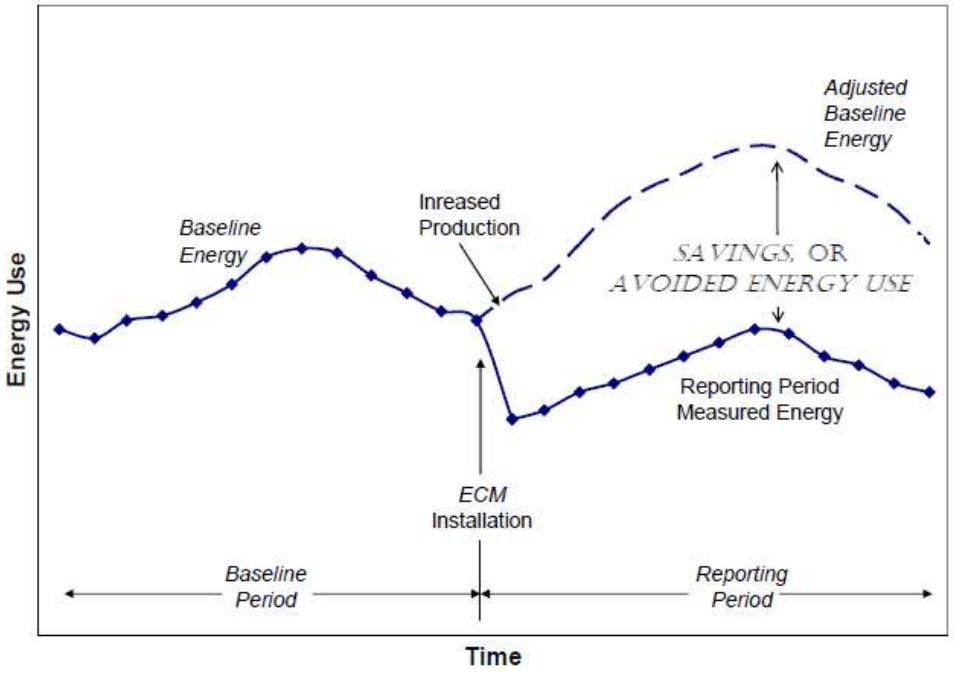
Measuring the performance

At this point the ICT solution will allow to:

- Measure the parameters considered prior
- Verify the performance achieved

In order to compare the result with the situation before the ICT implementation is necessary to define an M&V plan. IPMVP will be the base.



Measuring performance

To link the goals, the equipments and the data:

Goal **25% energy savings** *(+ comfort improvement)*

Measures

ICT : metering -> display -> control… *to be defined*
+
Awareness campaign *to be defined*

Indicators/Ratio

-Energy consumption, Energy savings (KWh electricity, KWh gaz)
-Energy produced
-GHG emissions reduction
-Energy consumption peak reduction -> Load factor (demand response)
- cost
-…..
- *xx/m^2; xx/person; xx/building; etc….*
-*Xx/heating; xx/ cooking; xx/lighting; etc….*

Measuring performance

International Performance Measurement & Verification Protocol – IPMVP

M&V Plan

1.	Energy Conservation Measures (ECM) intent	Goal
2.	IPMVP option and measurement boundary	
3.	Baseline :Period, energy and conditions	Context
4.	Reporting Period	
5.	Basis for adjustment	Data
6.	Analysis procedure	
7.	Energy prices	
8.	Meter specifications	Means
9.	Monitoring responsibilities	
10.	Expected accuracy	
11.	Budget	
12.	Report format	Quality
13.	Quality Assurance	

Measuring performance

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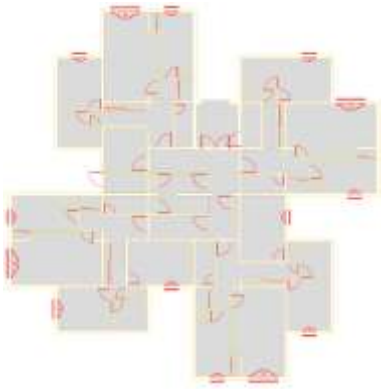
Each pilot is unique:

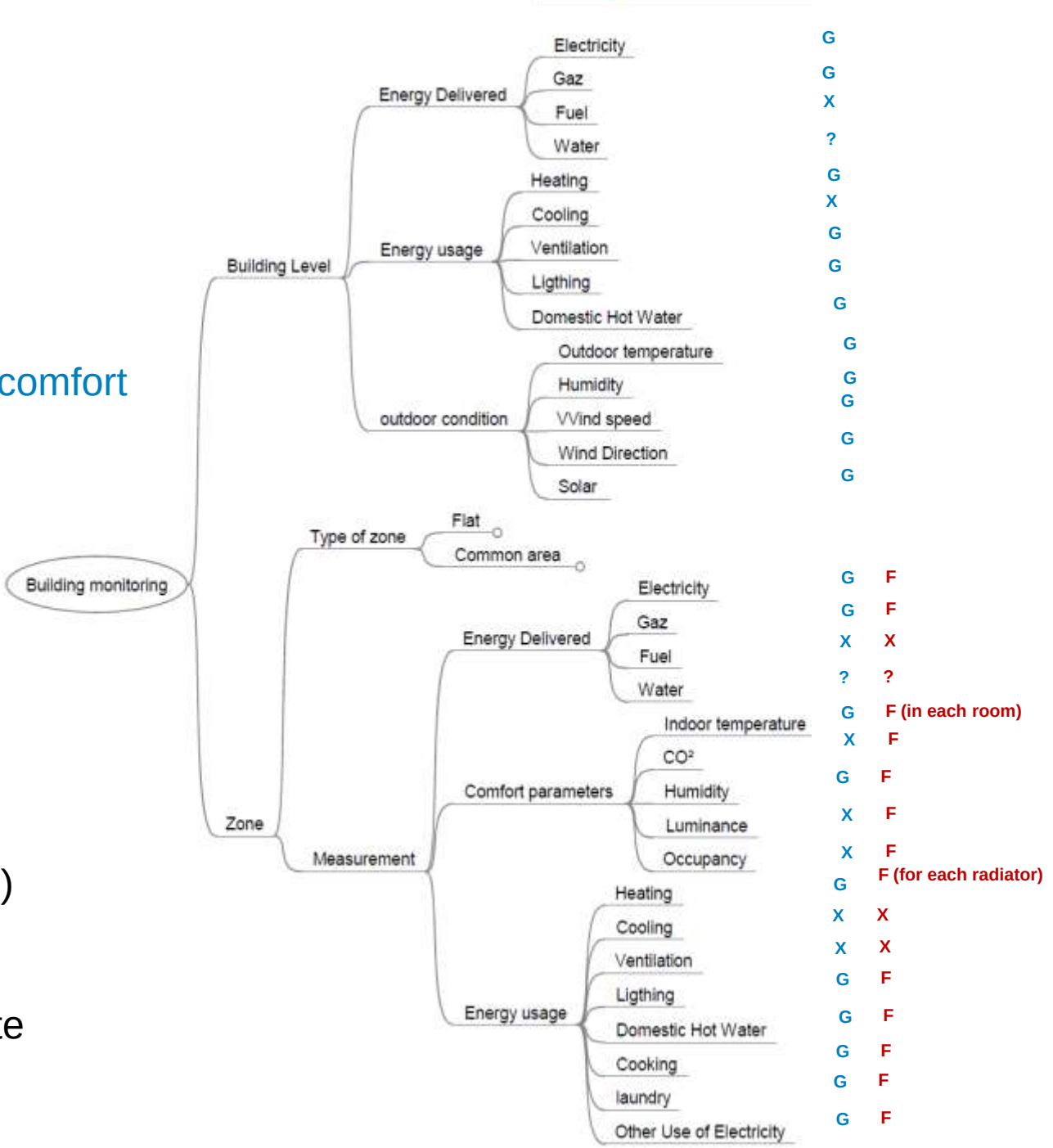
Presentation of *Lievin* pilot and ICT solution



Monitoring and Evaluation Procedure

Reporting period:
measurements>energy+comfort

Type of monitoring:
Fine: **F** (only some dwellings)
Basic: **G**



+ windows openings (**F**)

+ initial measurements:
- ventilation flowrate
- IR scan

Monitoring and Evaluation
Pilot sites: Liévin

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Dwelling selection

Technical analysis

- Buildings B and C : located close to the technical room (easy signal transmission), buildings representative of the 4 buildings
- Floors : 1st floor, 1 intermediate floor, and last floor
- Building B facing north, building C facing south
- Representative sample of dwellings types : T1, T2, T3

Social analysis

- Age
- Family
- Activity
- Earnings

Monitoring and Evaluation
Pilot sites: Liévin

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> Dwelling

Heating
+
Hot Water
+
Lightings
+
Specific electricity

Metering

- I and V
- amperemetric holder + current sensor
- in the store room with the electric table
- Heating on 3 circuits
- Lighting on 2 circuits
- Specific electricity on 4 circuits

Monitoring and Evaluation
Pilot sites: Liévin

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> Dwelling

Indoor environment
(thermal comfort, luminance, air quality)

Metering

- Thermal comfort :
  - T + h%, wireless sensor
  - 1 sensor/apartment or 1 sensor/room
  - Initial Infrared analysis
- Luminance
- Air quality:
  - CO2 sensor plugged on T
  - 1sensor/apartment
  - Initial measure of ventilation flow rate

Monitoring and Evaluation
Pilot sites: Liévin

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> Dwelling

Occupancy
+
Windows openings

- **Metering**
  - Occupancy
  - Windows openings: contact sensor plugged on a data node

Monitoring and Evaluation
Pilot sites: Liévin

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> Common area

Light
+
Ventilation (energy consumption)
+
Plug

- **Metering**
  - Holders + current sensors (if safe enough)
  - In the corridor in each floor

Monitoring and Evaluation
Pilot sites: Liévin

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> Building

Global consumption (?)
+
Climatic conditions

- **Metering**
  - Weather station:
    - T + h%,
    - wind force and direction
    - Luminance

Monitoring and Evaluation
Pilot sites: Liévin

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Communication and data acquisition

- Serveur = PC
- located in the technical room (loge du gardien) between buildings B and C
- Internet connexion

Monitoring and Evaluation
Pilot sites: Liévin

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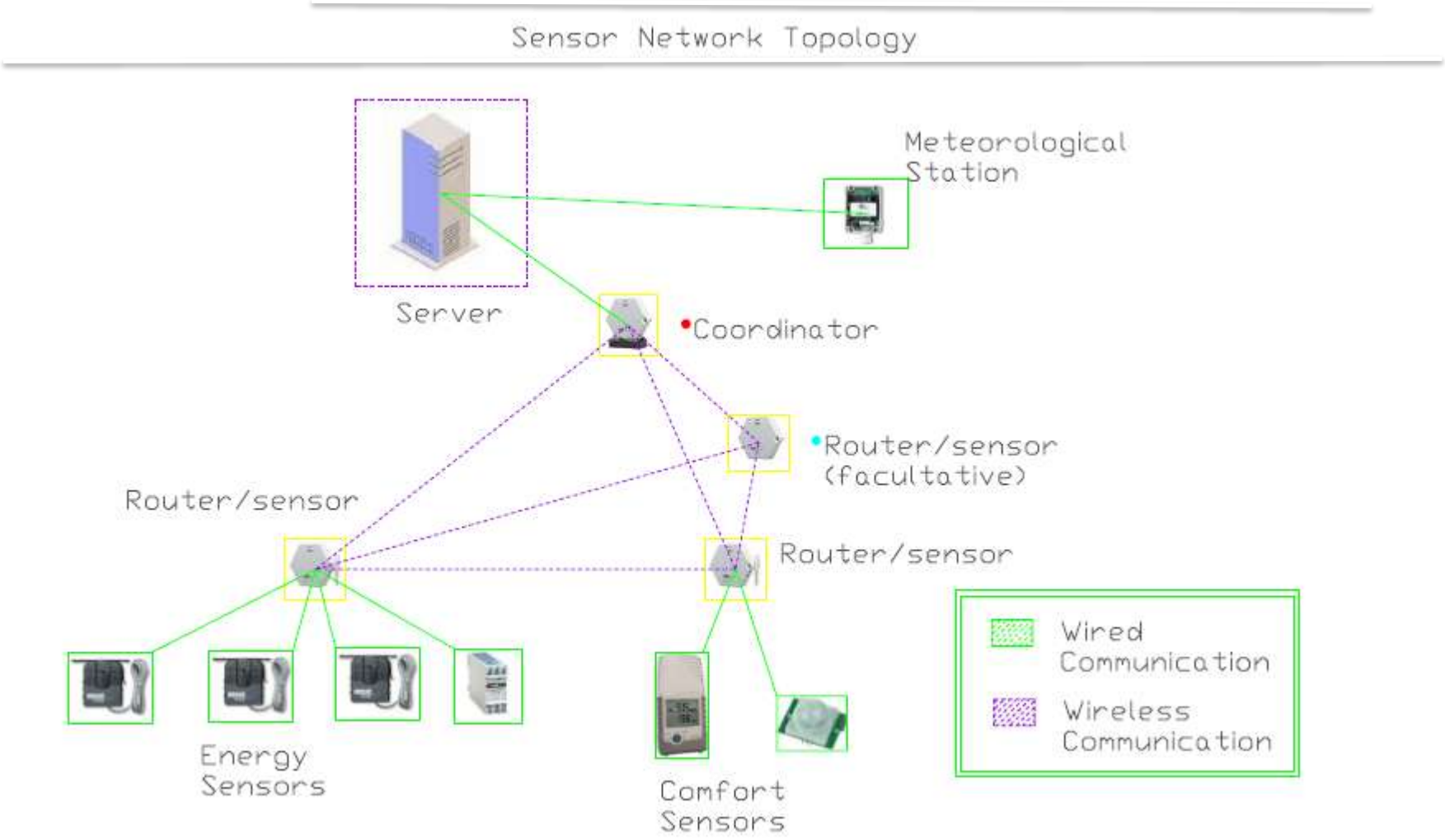

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Conclusion- challenges

The challenges that E3Soho is going to face in order to maximize the project results are:

- Create a methodology sustainable and replicable in the different countries with national regulation on Social housing
- Efficiently identified the priorities that need to be addressed based on energy reduction needs and users behaviors
- Identification of refurbishment and maintenance activities based on real time energy audits
- Crete awareness among end users by providing direct feedback
- Disseminate among stakeholders project results and the global methodology

Thank you for your kind attention

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