

IntUBE – Intelligent Use of Buildings’ Energy Information: Energy Challenge Concept

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1. Introduction

Energy efficiency of buildings may be improved using information provided by smart meters. They enable new services aiming at making the end-user aware of its energy consumption. Our vision is a neighbourhood of independent but co-operating buildings, with common aim to maximise their energy efficiency. Smart meters are the link between the buildings and the Neighbourhood Management System (NMS) which will control the community. The NMS will analyse the measurements, loads and available power in buildings and use simulation to forecast their behaviour to provide e.g. failure detection and load management.

In this context a new concept has been developed.

2. The Building Energy Challenge Concept

The concept illustrates an intelligent use of building energy information through a contest between several office buildings within a company. The idea is to combine both “energy awareness” and “energy information benchmarking” to create an incentive scheme for energy reduction in a tertiary environment. The contest should raise a high stimulation level by rewarding good energy behaviour.

The concept principle is the following:

1. Select (at least) 2 candidates buildings belonging to the same company.
2. Equip the buildings with energy monitoring systems (smart meters and sub-meters, wireless sensors for behaviour monitoring, dashboards) for energy awareness in all office rooms.
3. Perform an energy audit to establish the (current average) reference consumption of selected buildings.
4. Explain the rules to the participants (contest duration, user guides for the dashboards...) and present the reward for the winner:
 - *Different buildings (or even teams within the buildings) will be confronted. To win the building challenge, employees must improve energy*

systems and desktop applications uses. Environment-friendly acts will be rewarded with a bonus and heavy consumption behaviours with a penalty to improve their understanding of and interest in energy savings.

- *The building (or team) that receives the smallest penalty (or the highest bonus) and which decreases its consumption the most (by at least 10%) will win the building challenge.*
5. Launch the contest, and plan regular intermediate progress reviews.
 6. Elect the winner “greenest” building of the company
 7. Evaluate actual energy savings, quality of user involvement in the experiment, and impact on behaviours:
 - *The overall aim of the building challenge is to reduce energy consumption by at least 10% for one whole year. The second aim is to change employees’ behaviours and habits through environment-friendly acts and consumption information awareness.*
 - *It is expected that environment-friendly behaviours will become habits and have long-lasting impact: indeed it will encourage them to cut energy consumption at work and then at home.*

After the end of the competition, it has to be ensured the infrastructure could be used for further services in the building. Acting on the assumption that during the contest an as-is performance profile of the building could be identified, continuous monitoring of sensor information will enable facility managers for instance to identify necessary repair works or possible retrofit activities

Service sector is usually very wasteful with energy, having both high total energy use and low level of efficiency. In addition, personnel rarely have a good understanding or interest in energy efficiency. Through the IntUBE-concept, it is expected that information about consumption and environment-friendly acts should change employees’ behaviours, and thus contribute to energy savings. Both the participants and the company are winners because, on the one hand, the first will receive a reward for their eco-friendly behaviour and, on

the other hand, the company will save money thanks to energy savings.

Considering the possibility to demonstrate this concept as a real pilot case, we drafted below the typical

needed equipment in a building office room for the challenge:

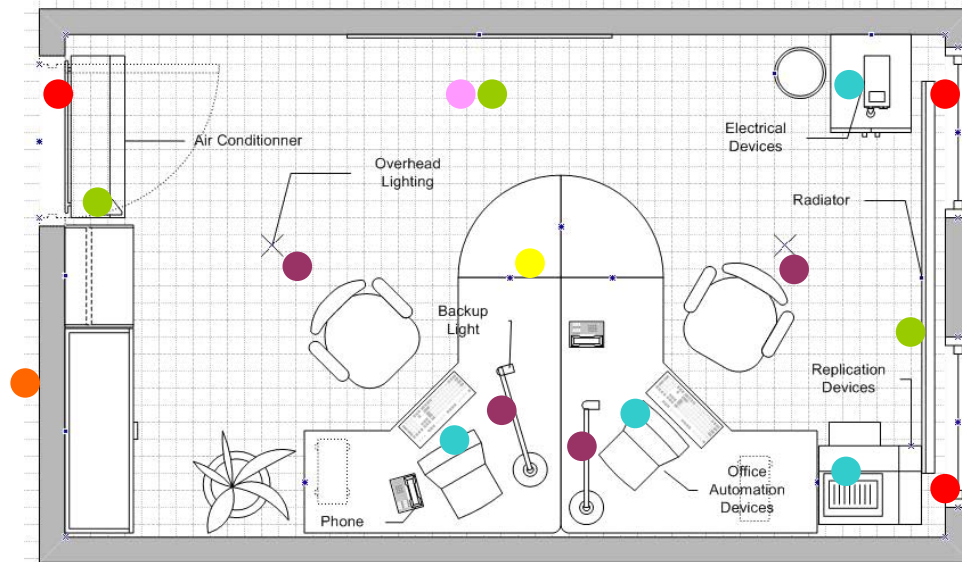


Figure 1. Needed metering equipment for a typical office room

Sensors	
●	4 temperature sensors
●	4 light sensors
●	3 contact sensors
●	1 electricity meter
●	2 brightness sensors
●	1 presence sensor
●	4 power-detector plugs

Table 1. Examples of penalty or bonus that will be monitored during the challenge:

Penalties	Bonus
<ul style="list-style-type: none"> - having a window open while the heating system is on - leaving the office at the end of the day with the computer switched on - switch on the artificial light while day light is sufficient - Having a temperature lower than 26 °C with the air-conditioning on [1] 	<ul style="list-style-type: none"> - Switch off the light each time when leaving the office - Switch off the computer when leaving the office for more than one hour - ...

The building challenge technical system uses energy submeters for detailed individual and real-time energy consumption data collection, wireless sensors for detecting “energy-impacting” behaviours, ICT based displays for energy awareness, and finally an ICT OSGi platform for consumption data storage and benchmarking. [2]

Communication between the submeters, sensors and the platform is based on radio-frequency and using the ZigBee protocol [3]. The sensors measure data about

building consumption and participants’ uses, so as to detect behaviours and allocate penalty or bonus, as illustrated in the Table 1.

Expected impact is at the economic level through energy savings and therefore money savings, at the technical level by enabling a building dynamic energy monitoring and by improving the knowledge on actual consumptions, but also at the social level since employees become actors of energy efficiency. The concept should furthermore stimulate long-lasting environmental-friendly behaviours.

3. Demonstration in a Real Office Building

The concept will be demonstrated in full-scale and real conditions through a new project called ECOFFICES (Energy Challenge within OFFICES), co-funded by the French region PACA and the European Regional Development Fund. The challenge will take place in a CSTB Building located in Sophia-Antipolis, and will start in September 2010.

4. Acknowledgement

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References

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