

# Putting Serious Games in Context: The Energy Efficiency of Buildings Case

## The promise

As reported by many field trials, a systematic change in a building's occupants behaviour has the potential to bring about a 3-6% decrease of energy consumption records (in very exceptional cases reaching up to 10%) - irrespective of the building's energy efficiency class. If permanently realized, this outcome may help procure fresh financial resources to the building's owner for the structural investments in energy retrofiting required to further enhance the energy efficiency performance of the building itself.

## The challenge

Especially in the US, but also in Europe, public utilities have funded a number of experimental programmes - based on serious games - to promote changes in energy consumption styles of the buildings occupants. In this sense, energy efficiency games can be considered as an integral part of the persuasive technology systems that the literature on service design has explored with growing attention and intention. However, most of them do not seem to have managed to materialize the expected outcomes in terms of energy performance with the required size and persistence over time. In addition, most experimental programmes have stayed confined to private homes rather than extending to the functional buildings owned by public administration (e.g. schools, gyms, museums, offices etc.). This because of the heterogeneous and in many respects random composition of the public buildings users, made of a great deal of occasional and/or anonymous visitors, temporary occupants (such as students and teachers), and more generally users who don't pay for the energy bills themselves, nor do they care about who is in charge of doing that.

## Our proposed approach

To promote effective gamification of future programmes of behavioural change for energy saving we introduce here a pragmatic approach based on three context based design goals:

- Promoting the Acceptance of proposed measures,
- Understanding the Potential of a large-scale deployment of demand side measures, and
- Monitoring the Results of behavioural change in terms of improved energy efficiency of the buildings.

We see these as mutually reinforcing aspects, as the following graph displays:



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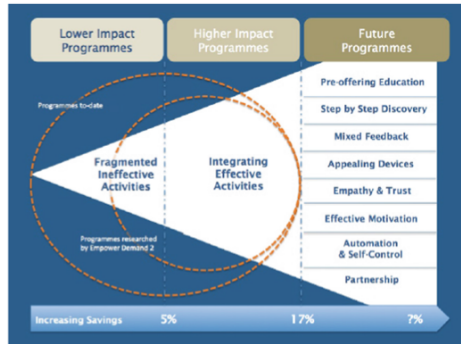
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## Why is this important

Buildings are responsible for 40% of energy consumption and 36% of CO<sub>2</sub> emissions in the EU. While new buildings generally need 3 to 5 litres of heating oil per sq.m per year, older buildings consume about 25 litres on average and some even require up to 60 litres. Currently, about 35% of the EU's buildings are over 50 years old. By improving the energy efficiency of these buildings, we could reduce total EU energy consumption by 5-6% and lower CO<sub>2</sub> emissions by about 5%.

(Source: <https://ec.europa.eu/energy/en/topics/energy-efficiency/buildings>)



One possible research avenue suggested by the diagram, is to overcome the current disintegration (of activities, methods and tools) and lack of time consistency that most of the low impact programmes exhibit.

(Source: P.E. Lewis et al., 2012: Energy Efficiency through Information and Communication Technology - Best Practice Examples and Guidance. VaasaETT Global Energy Think Tank)

To understand the contribution that gamification could bring to integration, the above list of elements of future programmes can be compared with the 8-items typology of persuasive strategies displayed in the following table: (Source: S. Halko and J.A. Kientz, 2010: Personality and persuasive technology: An exploratory study on health-promoting mobile applications. In: T. Ploug et al. (eds) Persuasive Technology. LNCS vol. 6137. Springer, 150-161.)

Programme elements	Persuasive strategies	Gamification added value
Pre-offering Education	<i>Instruction style:</i> Authoritative	<i>Instruction style:</i> Non-Authoritative
Appealing Devices		
Mixed Feedback	<i>Social Feedback:</i> Cooperative	<i>Social Feedback:</i> Competitive
Partnership		
Effective Motivation	<i>Motivation Type:</i> Extrinsic	<i>Motivation Type:</i> Intrinsic
Empathy and Trust		
Automation and Self-Control	<i>Reinforcement Type:</i> Negative	<i>Reinforcement Type:</i> Positive
Step-by-step Discovery		

Intuitively, offering the possibility to monitor the results of their engagement (e.g. via smart metering systems or the unravelling of the electricity bills) enables more users to understand the potential of behavioural change for an improved energy efficiency of existing buildings. In turn, a wider and deeper knowledge of the mechanisms by which DSM can determine a sensible improvement of the current situation favours a broader acceptance of the behavioural prescriptions to be implemented. Finally, with the full and convinced engagement of all the building occupants (including occasional visitors and the people in charge of e.g. cleaning or periodic maintenance services or dairy supplies), the chances become much higher to reach the most ambitious targets of improvement and to keep them stable across time. To highlight the value of this approach, we adopt the simple formula first introduced by IEA (the International Energy Agency) when elaborating on energy efficiency programmes and how to increase DSM measures' uptake and impacts:

$$\text{Potential}^* \text{Acceptance} = \text{Result}$$

What the formula says is that potential per se is not the only target. Another is how to get sufficient acceptance of energy efficiency measures by the building users. Any huge number multiplied by zero will be zero!

## Why is this sustainable

Art. 5 of the Energy Efficiency Directive (2012/27/EU) requires Member States to ensure that 3% of the total floor area of central government buildings above 250 sq.m is renovated each year. As an alternative option to retrofiting, the national governments can take other cost effective measures that achieve at least equivalent savings to those that the default approach would have delivered. Such alternative measures may include the promotion of energy efficiency through achieving changes in the public building occupants energy consumption behaviours.

## Our project goals

The 3 main objectives of the 36 months' project TOGETHER are to:

1. Increase public buildings' energy efficiency and secure investments, through improved multidisciplinary in-house staff **capacity building of Public Administration** and the establishment of a **system of alliances with the more engaged and motivated building users**;
2. Produce and pilot test the most appropriate combinations of **technical, financial and Demand Side Management tools** for the improvement of the energy performance of public infrastructures, currently across 8 regional pilot actions involving a total of 85 buildings;
3. Codify the project outcomes into a **comprehensive policy package for a large-scale implementation**, bringing local buildings governance practices to the centre of ambitious energy saving policies.