# *SAVE ENERGY GREEN PAPER*

***Annex to***

***Deliverable D 1.1***

## SAVE ENERGY Vision

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# GREEN PAPER

## 1. Motivation

Cities play a crucial role in sustainable development. According to UN, global population will reach 9 billion in 2050, of which majority will live in cities. The majority of European cities have already been acting to increase their energy efficiency. Continuing improvements will require strong actions, in particular through improving the existing building stock.

According to Eurostat, the annual energy consumption in EU-27 –countries is about 3 400 TWh electricity and 2 600 000 TJ heat. Of this, about 25% of electricity and 10% of heat is consumed in the Commercial and Public Services sector, mostly in the buildings. Buildings in general (households and commercial, mainly heating and lighting) account for almost 40% of the total primary energy use in Europe.

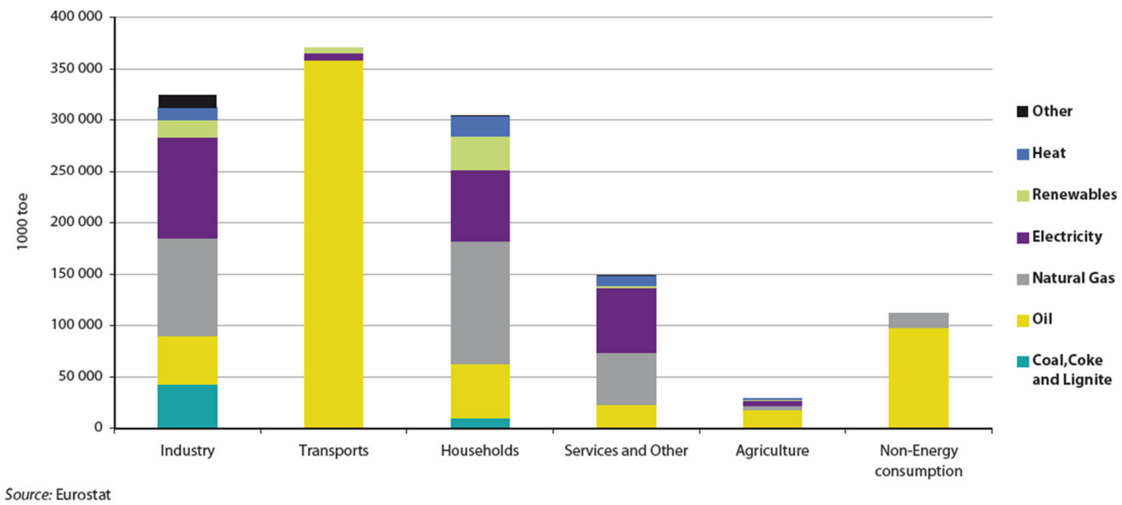


Figure 1 Europe's energy consumption by fuel and end-use sector (Eurostat)

A saving potential equating to approximately 28% of Europe's total energy consumption has been identified as being available through improvements in building energy efficiency. The European Union has stated that public buildings should lead the way in improving energy efficiency of buildings. Such savings in building sector could reduce total EU final energy use by around 11%.[1]

Municipalities have an incontrovertible role in driving these savings – as there is a large energy savings potential that remains untapped in public buildings and due to the crucial role of municipalities in providing the necessary conditions to drive the required activities.

[1] Commission of the European Communities, Action Plan for Energy Efficiency: Realising the Potential (19.10.2006)

### 1.1 Introduction to Behaviour Change

Behaviour transformation as a concept is based on the use of empirically demonstrated techniques as a means to impact on the behaviour of individuals, and thus achieve an identified objective.

The methods that can lead individuals and groups changing their behaviours have been interpreted differently through time – with the creation of several theories and models.

Despite the differences between theories, two main concepts are consistently referred to as essential: motivation and education.

The project has utilized the five sub-conscious questions to categorise the actions most useful to change user behaviour in public buildings scenarios. Behaviour is partly driven by our beliefs and values, through our education and by social norms. However individual actions are most frequently based on sub-conscious thought processes, where we are constantly asking ourselves these five questions.[2]

- Do you perceive there to be an issue with energy use in the building? This question can be further categorized into whether the issue is business-related (e.g. related to the financial and operational sustainability of the organization) or more generally related to the impact of energy use on the environment.
- Do you know what can be done to solve such an issue?
- Do you think that this solution will impact energy use in a positive manner?
- Are you concerned about the identified issue, and believe the solution is important?
- What will your peers think of your behaviour?

So what motivates people to change their behaviour? The key motivational questions are "do I care" and "what will others think of my behaviour". In any team-based scenario, it is the alignment of the aims of individuals toward a common objective that will yield the greatest change.

Key variables have been identified as potential behaviour determinants (based on studies provided on health area)[3]: Environmental constraints; Skill or ability; Attitude or anticipated outcomes of a given behaviour; Social norms; Self standards; Emotional reaction; and Self-efficacy.

And how can people do it?

Education is acquiring new "knowledge" that, according to Benjamin Bloom from Bloom's taxonomy-learning domains, can be classified in three domains: Cognitive, Psychomotor and

[2] Questions based on Ajzen and Fishbein, 1980, After the Theory of Reasoned Behaviour.
[3] Fishbein M, Bandura A, Triandis HC, et al. (1991) Factors influencing behaviour and behaviour change. Final report— Theorists workshop. Washington, DC: National Institute of Mental Health.

Affective. In the Save Energy project, three relevant education questions can be determined: Is there a problem? Do I know what to do? Will it work?

The way you learn – the education process – can be formal, non-formal and informal. The European Commission uses the following definitions:

- Formal learning - provided by education or training institutions, with structured learning objectives, learning time and learning support. It is intentional on the part of the learner and leads to certification.
- Non-formal learning - is not provided by an education or training institution and typically does not lead to certification. However, it is intentional on the part of the learner and has structured objectives, times and support.
- Informal learning - results from daily activities related to work, family life or leisure. It is not structured and usually does not lead to certification. In most cases, it is unintentional on the part of the learner.

These different types of learning conditions the instruments used in the learning process. The use of Information and Communication Technologies (ICT), and particularly the internet, is now an essential and integral part of our daily lives. ICT has thus become an important means for providing access to the most detailed information in the learning process.

## 1.2 Central Message

Cities and public buildings use a significant amount of energy and the SAVE ENERGY project argues that the best energy efficiency savings can only be achieved through physical solutions in combination with changes in user behaviour. There has been much investigation and analysis of the physical solutions. The Save Energy project focuses on the behavioural solutions required to work in combination with such physical solutions.

Municipalities and other city decision-makers have a unique opportunity to improve the operation of public buildings and at the same time influence citizens to apply similar behaviour in their homes/industries and through networks of cities.

It is thus argued by the SAVE ENERGY project that new policy options are required to help municipalities and cities implement this strategic role to impact on user energy behaviour in public buildings.

## 2. SAVE ENERGY Project

SAVE ENERGY is a European Project that addresses the challenge of behaviour transformation through the use of ICT (including ICT-based games and real time information) as an enabler of energy efficiency improvement in five public pilot buildings in five European cities – Helsinki, Leiden, Lisbon, Luleå and Manchester. The project ran from March 2009 to August 2011.

ICT is recognized as an enabler of higher energy efficiency. The main objective of the SAVE ENERGY project is to make use of ICT to transform the behaviour of users of public buildings regarding energy efficiency through serious games and real time information from energy meters. SAVE ENERGY builds upon the Living Labs methodology to provide an engaging environment for users, citizens and policy makers to gain awareness, understanding and experience associated with energy saving behaviours.

The Living Lab systemic approach in the context of the SAVE ENERGY project involves all the relevant stakeholders from the very beginning of a new idea, creating the motivation to share and discuss their experiences and expectations. This provides a collaborative environment, where users are expected to co-create the solutions. The Living Lab methodology ensures that the transformed behaviours and the recommended policies are accepted by informed, motivated and empowered users.

The five pilot buildings are fitted with real time energy data collection systems that feed engaging local display of consumption information. The hypothesis was that profound behaviour transformation and significant energy savings could be made in each of the pilots, including through the impact of real time information display on the users' energy consumption patterns would lead to

Through SAVE ENERGY, the project stakeholders are becoming aware of the consequences of living in a world of ever more expensive energy and the potential impact (economic, environment and political) of current trends. They are encouraged to co-create and validate innovative policies and energy saving solutions within the context of the Living Labs methodology.

## 3. Current Policy and Regulations

The European Commission has adopted an Action Plan aimed at reducing greenhouse gas emissions by at least 20% compared to 1990 levels (or by 30% if the conditions are right), increase the share of renewable energy in final energy consumption to 20%, and achieve a 20% increase in energy efficiency. This is the 20-20-20 strategy. The role of buildings in reducing greenhouse gas emissions is emphasized, as they represent around 40% of all energy use, through introducing minimum requirements for the energy performance of buildings.

In 2002, the European Union adopted the Energy Performance of Buildings Directive (EPBD), which set common energy measurement standards for both residential and commercial buildings. The EPBD was designed to slash emissions and help the region meet its targets under the Kyoto Protocol. The most visible change of the implementation of the Directive, which impacts nearly all European Union citizens, is the mandatory Energy Performance Certificate that is required, in practice, every time buildings are sold or rented. The certificate must also be issued when a new building is constructed.

In November 2009, European Union lawmakers agreed that all new buildings would have to comply with energy-performance standards, and supply a significant share of their energy requirements from renewable sources by 2020. The public sector must lead the way through buildings with "nearly zero" energy standards by the end of 2018. Nevertheless, the concept of "nearly zero" was left somewhat vague and critics regret that no standards were laid down for the energy performance of existing buildings.

The EN 16001 Energy Management standard defines standardized EU-wide criteria for energy management systems. It came into force in June 2009. It aims to support all types of organizations in the implementation of energy management systems. The standard specifies the requirements for an energy management system to enable organizations to develop and implement a policy, identify significant areas of energy consumption and target energy reductions.

In addition to technological and building management aspects, EN 16001 does include a section on developing awareness through training and information dissemination to staff members. However, the SAVE ENERGY project believes that the standard can be extended in terms of driving changes in user behaviour in public buildings – including the non-staff users.

## 4. Strategic Role of Cities:

According to IEA's World Energy Outlook 2008, 67% of global energy is used in urban areas, and cities are responsible for 76% of energy related $CO_2$ emissions.

Further the average annual growth rate is predicted to be around 2% during the period 2006-2030. The energy infrastructure that every city and town depends on will need to be continually adapted and upgraded if it is to meet the ever-increasing demands for energy services. This provides the opportunity and demand for city and local government leaders to encourage increased deployment and use of energy efficient systems and behaviour.

| | **Cities as % of world primary energy demand** | | | **Average annual growth rate 2006-2030** |
|---|---|---|---|---|
| | **2006** | **2015** | **2030** | |
| Coal | 76 % | 78 % | 81 % | 2,2 % |
| Oil | 63 % | 63 % | 66 % | 1,2 % |
| Gas | 82 % | 83 % | 87 % | 2,0 % |
| Nuclear | 76 % | 77 % | 81 % | 1,2 % |
| Hydro | 75 % | 76 % | 79 % | 2,2 % |
| Biomass & Waste | 24 % | 26 % | 31 % | 2,6 % |
| Other Renewables | 72 % | 73 % | 75 % | 7,4 % |
| **Total** | **67 %** | **69 %** | **73 %** | **1,9 %** |
| **Electricity** | **76 %** | **77 %** | **79 %** | **2,7 %** |

**Table 1 World primary energy demand in cities by fuel according to IEA's World Energy Outlook 2008**

Local authorities and city decision makers, being the closest administration to the citizens are ideally positioned to understand their concerns and to influence the energy behaviour of their citizens. Moreover, local authorities can address the challenges in a comprehensive way, facilitating the conciliation between the public and private interest and the integration of sustainable energy into overall local development goals, be it development of alternative energy more efficient energy use or changes in behaviour.

There are several advantages for addressing local policy-makers in coping with energy and environmental issues:

- A significant share of the world population is found in urban areas
- An urban orientation of energy and environmental policy may also encourage a direct involvement of citizens, as such policy initiatives are usually resource-based, effect-oriented and visible so that sufficient local support base may be generated

- Urban areas are a suitable spatial scale for systematic data collection, monitoring and analysis of energy/environmental indicators

Further, at a local level there is a wealth of practical insights and ideas that can be developed to cope and improve inefficiencies in energy supply, energy use and environmental issues.

According to IEA's report "Cities, Towns and Renewable Energy: Yes In My Front Yard"[4] many local governments tend to follow early innovators rather than lead. However there are advantages for cities that lead in the design, investment and monitoring of renewable energy and energy efficiency demonstration projects that can be scaled up and replicated. Local authorities can serve as a vehicle to implement top-down policies from national governments, deliver meaningful results, and ensure national mandates are carried out. They can design solutions to climate change that are adapted to the needs of local constituents and are consistent with local policy priorities. This process can help build resilience to climate change in the urban infrastructure. Experimentation on new forms of policy at the local level can provide learning and experience and, when successful and where appropriate, can lead to bottom-up diffusion of approaches between cities, as well as at the national and international levels.

Local governments therefore have an important role of becoming leading actors for implementing sustainable energy policies, and must be recognized and supported in their effort. Leaders and officials of local governments have started to become more involved in climate change policy-making by undertaking strategic planning; formulating, approving and implementing appropriate policies; evaluating their effectiveness; and disseminating successful actions that might be replicated elsewhere.

While there are many examples of cities that have already acted upon climate change and energy security issues by developing support policies to stimulate renewable energy and energy efficiency activities (like Covenant of Mayors)[5], there is still strong requirement for cities to increase the actions. The combination of high and growing energy use in cities and the ability to have a direct impact on the citizens means that cities role in increasing energy efficiency and clean energy technologies is inevitable.

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[4] Report "Cities, Towns and Renewable Energy: Yes In My Front Yard", IEA, 8 December 2009

[5] http://www.eumayors.eu/home_en.htm

## 5. Combination of Technology and Behaviour:

As described above, there has been significant progress in the development and implementation of policy and regulations to enhance energy efficiency through improvements to building fabric and services. The next challenge is to transform the behaviour of building users to improve day to day energy-efficiency operation of facilities.

Public building users generally do not have a personal financial incentive to act in an energy efficient manner. This is the case for all type of users – including facilities managers, public servants and those who directly use the public buildings for leisure and other activities, such as for commercial purposes, where there is the case of external companies, renting public premises, who have fixed rate contracts, not taking into account the amount, nature and daily period of energy consumed. This financial incentive gap between public building users and those that receive the direct monetary benefits of energy efficient behaviour is a key factor in the selection of behaviour transformation methods that were used by the SAVE ENERGY project.

Practical examples of this issue were found on many occasions in the SAVE ENERGY project. For instance, catering providers that are hired to provide services to schools or other public buildings often were not financially benefitting from any reductions in energy use, as they were paid through fixed price contracts with the building owners. Instead the benefits passed straight to the public building owner, who paid the energy bill.

Effectively, there are two methods to improve the energy efficiency of a building:

(i) to improve the asset, i.e. insulation / lighting / HVAC / controls.
(ii) to improve the operation of the building. These improvements can be split into two elements: (a) activities that can be done by a facilities manager e.g. change the set point temperatures; and (b) activities that can be done by everyone else who interacts with energy consuming devices in the building.

The SAVE ENERGY project focuses on method (ii)(b), and contends that European Union policy should now focus on this method of improving the energy operation of the building.

It is the SAVE ENERGY project's contention that operational energy efficiency policy should be developed and implemented at the European Union level.

The issues around energy efficient behaviour change are truly trans-national in character, and so the appropriate body for developing such policy is the same as the body that defines European energy efficient building construction policy – the European Parliament.

The choice of entities to be directly targeted by such policy is more contentious. The range and variety of public buildings and user types make it very difficult to design a policy that can directly influence behaviour change. It would be more effective to target the policy towards organizations that can then implement specific programmes and regulations at a local (e.g. municipality/city) level that conform to the policy goals.

The SAVE ENERGY project believes that municipality leaders and other city decision-makers are well-placed to define and implement such local programmes and regulations. They have a unique opportunity to combine the investment in physical improvement to buildings (fabric and services), operation of the services by facilities management and use of the buildings by staff and citizens)in public buildings throughout their urban areas as well as putting in place specific programmes that directly impact the behaviour of the users of these public buildings. Further, the effects from public buildings can be multiplied through citizens applying similar behaviour in their homes/industries and through networks of cities.

## 6. Multiplier Effects

Policy aimed at municipality and other city decision makers will lead to two multiplier effects that will help to ensure the maximum policy impact on behaviour change of public building users.

Firstly, the large range of existing networks of cities throughout Europe, such as *Eurocities, the Covenant of Mayors or Connected Smart Cities Network*[6], can be used to exchange experiences of the specific programmes undertaken by the city decision makers in line with the policy set by the European Parliament. Implementation of public programmes that aim to influence beneficial behaviour change are somewhat of a new practice. These networks can thus be used to disseminate and multiply the impact of the European-level policy at the city-level.

Secondly, whilst the proposed policy focuses on user behaviour in public buildings, it is expected that the behaviour changes in individuals that are created will spill-over into citizens' behaviour in their homes and also potentially in private industries. This multiplier effect is predicted to increase the impact of the policy.

[6] Created on the 18th of November 2010 in the context of FIREBALL (FP7-ICT-2009-5), an initiative driven by Helsinki City.

# 7. Practical User Behaviour Process and Toolbox

As a practical method to encourage a change in behaviour, the SAVE ENERGY project has developed a User Behaviour Transformation process that includes a Toolbox of actions to positively influence behaviour. This methodology is based on the concept that for behaviour change is most strongly influenced by a combined programme of education and motivation.

The User Behaviour Transformation process describes, in a stepwise approach, how to develop and implement a pilot for the purpose of saving energy through a user behaviour change. The process can be divided into three phases – Preparation, Execution and Checking.

The Toolbox then describes the different tools that can be used to facilitate a user behaviour change through this process.

The project has utilized five sub-conscious questions to categorise the Toolbox actions most useful to change user behaviour in public buildings scenarios.

- Do you perceive there to be an issue with energy use in the building? This question can be further categorized into whether the issue is business-related (e.g. related to the financial and operational sustainability of the organization) or more generally related to the impact of energy use on the environment.
- Do you know what can be done to solve such an issue?
- Do you think that this solution will impact energy use in a positive manner?
- Are you concerned about the identified issue, and believe the solution is important?
- What will your peers think of your behaviour?

The pilots involved in the SAVE ENERGY project attempted to answer these questions in the minds of building users through use of selected actions from the Toolbox. The pilot results show that the provision of real-time information, regular (e.g. monthly analysis) and frequent informal meetings can be used, along with technical solutions and equipment, to successfully drive user behaviour change.

Further, results from testing of the ICT-based games developed and implemented in the SAVE ENERGY project point towards a positive impact of targeted game-playing on understanding and awareness of energy saving methods.

Arising from these initial results, the project developed an initial User Behaviour Toolbox which has been further developed through the project. The idea behind the Toolbox is to identify the key actions (tools) that can be used to influence user behaviour. The impact of each selected tool is considered in regard to each of the five questions.

The diagram below provides an overview of the toolbox.

| Behaviour Change Tool | Educate | | | Motivate | | Prompt |
|---|---|---|---|---|---|---|
| | *Is there a problem?* | *Do I know what to do?* | *Will the solution work?* | *Do I care?* | *What will others think?* | |
| Informal Meeting | Green | Green | Green | Green | Green | Green |
| Formal Meeting | Yellow | Yellow | Yellow | Red | Red | Red |
| Energy Audit | Yellow | Yellow | Yellow | Red | Red | Red |
| Actions Checklist | Yellow | Green | Green | Yellow | Yellow | Green |
| Energy Helpdesk | Red | Green | Green | Yellow | Red | Red |
| Corporate Policy | Yellow | Red | Red | Yellow | Yellow | Red |
| Metered Billing | Yellow | Red | Red | Green | Yellow | Yellow |
| Personal Objectives | Green | Red | Red | Green | Green | Yellow |
| Set Examples | Red | Yellow | Red | Yellow | Green | Green |
| Suggestions Box | Red | Yellow | Red | Red | Yellow | Yellow |
| web / tv / radio | Green | Green | Yellow | Yellow | Green | Green |
| Serious Game (with real data) | Green | Yellow | Yellow | Red | Red | Green |
| Serious Game (no real data) | Yellow | Yellow | Yellow | Red | Red | Green |
| Social Network - share experience | Yellow | Green | Green | Green | Green | Green |
| Social Network with data | Yellow | Green | Green | Green | Green | Green |
| Leaflet (information) | Green | Yellow | Yellow | Red | Red | Red |
| Poster / Signage | Red | Green | Green | Red | Yellow | Green |
| Newsletter (stories) | Red | Green | Green | Red | Yellow | Yellow |
| Report (with real data) | Yellow | Yellow | Yellow | Red | Red | Yellow |
| Real Time Energy / Cost | Green | Green | Green | Yellow | Yellow | Green |
| Performance vs Baseline | Green | Yellow | Yellow | Yellow | Yellow | Green |
| Historic Information (graphical) | Green | Yellow | Yellow | Yellow | Yellow | Green |
| Energy Saving Tips | Green | Green | Green | Yellow | Yellow | Green |
| Competition / Incentives | Yellow | Red | Red | Green | Green | Green |

**Table 2 Overview of the user behaviour toolbox**

The tools themselves are shown in the first column. The further columns show the SAVE ENERGY team's opinion on the extent to which implementing each tool can answer each of the sub-conscious questions. A dark green cell implies that the tool can have a significant impact on user behaviour. A yellow indicates that the tool can have some impact on user behaviour, whilst a red cell indicates either little or no impact or a lack of current relevant evidence from the project.

A specific example can be seen with the implementation of information on real time energy/cost at key parts of the building where people must decide to utilize an energy using equipment or not (e.g. in a catering concession). The provision of such real-time information in the Lulea Pilot is currently estimated to have accounted for 40% of all the energy savings achieved in this pilot during the SAVE ENERGY project.

The SAVE ENERGY experience highlights a further, very important point. The implementation of the tools can be costly. This is particularly relevant for tools that include a requirement for equipment, for instance with the implementation of specific energy use monitoring equipment and the provision of real-time information to users. An example can be seen in the Helsinki Pilot, in which energy meters in the kitchen area were around Euro 500 to purchase. Further, their installation can also be very costly.

## 8. Next Generation Business Architectures

The SAVE ENERGY project has highlighted the importance of business architecture in ensuring that changes in user behaviour have the maximum impact on energy use in public buildings.

Business architecture relates the organizational mission, structures and operations to the information technology infrastructure. Conceptually this is done in models and diagrams. The technical bridge is called “middleware platform”.

The SAVE ENERGY project has developed such middleware platform was and validated it in the pilots. The SAVE ENERGY project has demonstrated that its middleware platform can be provided with an open source business model that allows free access to the technical specifications and free use of the software.

The SAVE ENERGY project has demonstrated that such open source platform does increase innovation rate through advanced research-based applications such as the serious games, intelligent management system, or mobile applications that have been developed in short time frames within the project.

With the technical feasibility of such open source platform proven, the sustainability of this or similar solutions will be dependent upon combined R&D and industry policy activities to create an even-level playing field for rapid growth of new European ventures. If such policy is not implemented, then non-European ventures may leapfrog their European counterparts.

# 9. Moving from User Behaviour and the Toolbox to Policy

The Toolbox has been developed to identify and assess specific actions through which user behaviour can be changed in public buildings. It is clear however that the implementation of the tools should be done at a building management level. Public buildings are too diverse – in terms of purpose, staff employed, public involvement to name but a few elements – for general policy to be able to effectively impact the selection and implementation of the tools.

A further issue occurs when there are several departments with relevant responsibilities in one public building. For example, in Helsinki there are often four such departments – (i) one department pays the energy bills, makes investments and owns the building; (ii) one department rents it for activities; (iii) one takes care of maintenance; and (iv) one is responsible for monitoring energy consumption and making energy efficiency studies. Usually it takes the effort of all these four to save energy in the example.

The role of policy is essential in providing the incentives framework under which public building managers (which may include the four departments described above) have the incentive and/or requirement to select and implement the most applicable tools.

These issues and the results from the SAVE ENERGY project results in the following policy recommendations. Given the complexity and heterogeneity of energy use in public buildings, the SAVE ENERGY project believes that the recommendations should be implemented through a voluntary code of practice rather than through a legally binding directive.

## 9.1. Include objective to implement a User Behaviour Toolbox in every public building

As previously discussed, regulations such as EN 16001 focuses on the physical implementation, management and operation of energy saving equipment. This is key to improving the energy efficiency of public buildings. **However, the SAVE ENERGY project believes that such regulations should be updated to include the design and implementation of a User Behaviour Toolbox by the building management in each public building.**

The SAVE ENERGY experiences have been used to define a generic User Behaviour Toolbox. It is not advised that any of the specific methods included in the Toolbox would be mandatory to implement. Instead, the SAVE ENERGY project recommends that a generic User Behaviour Toolbox be defined, and the building managers given the responsibility to ensure that a logical process is undertaken to identify, select and implement the most relevant methods for their building.

The relevant regulatory authority, including the city/municipality, would then play a role in ensuring that this process is correctly undertaken during the energy audit of the public building.

**The practical implementation of this recommendation could be provided through the following two-part strategy:**

- **Update of EN 16001 and/or the addition of an equivalent voluntary code of practice that has best practice user behaviour transformation methodology (i.e. the use of the SAVE ENERGY process and Toolbox).**
- **Extension of the EPBD to mandate that the operational energy efficiency of all public buildings is improved to a minimum threshold. In such a method, there would be no need to identify the implementation methodology.**

## 9.2. Estimate energy savings that have been achieved due to user behaviour

It is often difficult to provide specific information about energy use under the scale of the whole building. In many situations it is not possible to separately meter energy consumption because as a result of complicated and often old circuitry. Further complications can arise if the public building is listed with related restrictions on the manner in which the building manager can change the structure. This was clearly demonstrated in the SAVE ENERGY project, in which one of the Pilots (Manchester) was required to change the pilot building from the original choice which was a listed building with strict regulations concerning updates of infrastructure and very old circuitry.

**It is recommended that the regulations be updated to incentivize each building manager to develop and implement a methodology to best estimate the amount of energy savings that result from user behaviour. Again, the role of policy and regulations would not be to define how this is done. Instead, rather their role is to help building managers to implement an estimation procedure.**

It could be the case that such regulations are implemented differently in new-build and existing structures. In new-build, the regulations could be strengthened to ensure that the method (and required measurement facilities) are identified and agreed at the building design stage, thus ensuring the most accurate possible estimates of user-behaviour driven energy savings. In existing structures, especially older and protected buildings, the regulations would be more limited.

## 9.3. Accounting for Costs as well as Benefits

One important aspect in regard to analysis of the estimated energy savings from user behaviour is the cost/benefit aspect. Each element of the User Behaviour Toolbox has associated implementation costs – including direct costs of equipment implementation/ maintenance or indirect costs of staff time and training. This is clearly shown in the SAVE ENERGY project, under which the five pilots had extensive ICT costs to implement the required equipment.

**Hence, the regulations that drive the implementation of user behaviour plans and estimates of associated savings should allow the building manager to include assessment of the costs when selecting the user behaviour tools to implement. Again, the regulations themselves should not seek to identify and describe the level of the costs involved, rather they should define the broad methodology that building managers can use to identify and assess these costs.**

## 9.4. Focus on Information Provision and Monitors

The SAVE ENERGY project generally contends that the role of policy is to provide the options for user behaviour transformation in public buildings and drive the requirement for building managers to implement the methods that are most effective for their circumstances. However, the SAVE ENERGY results point towards the provision of real-time information to public building users (backed up by an ability to impact energy use) can have a material and immediate impact on their energy use. For instance, in the Helsinki Pilot, between 17-27% of the energy savings from the pilot in the kitchen areas are estimated to be due to the display of real time information.

**It is thus recommended that the specific aspect of providing real-time information to users at the key points in a building when they make decisions on which energy use decisions be an important aspect of the Toolbox.**

Further, as is the case in a selection of SAVE ENERGY Pilots, the city education has a range of eco-mentors in public buildings. For instance, in Helsinki these eco-mentors mainly work on user behaviour issues, often helping to implement the range of annual campaigns on energy saving that are implemented by the city authorities.

## 9.5. Enhancing the Green Culture of Citizens

Many of the most effective methods implemented in the SAVE ENERGY project of transforming user behaviour included a focus on enhancing the green culture of the public building users. This was especially seen in the Helsinki Pilot which focused on schoolchildren with the introduction of sessions on the environmental benefits of energy efficiency and energy saving, and with employee sessions in the public buildings of other pilots which were able to increase employee awareness of energy efficiency.

**It is thus recommended that sessions and other techniques to increase the environmental understanding of energy use of public building users (especially those which use the buildings frequently, especially schoolchildren and public employees) should be a further mandated element of the implementation of the toolbox.**

## 9.6. Maximizing the role of ICT as enabler of Energy Efficiency

The SAVE ENERGY project focused on the implementation of ICT solutions that would assist to enhance the transformation of user behaviour in public buildings. It is the SAVE ENERGY project's conjecture that such ICT solutions must be used in conjunction with other user behaviour techniques to maximize the impact on energy use in public buildings.

**The SAVE ENERGY project thus recommends that the role of ICT be maximized through aspects such as (i) Enhancing the role of social networking as a form of ensuring peer commitment; (ii) Use of future internet and web 2.0 as catalysts for energy efficiency and user behaviour transformation and, as previously defined (iii) Maximizing the role of Real Time Metering and displays of energy consumption as a means of increasing efficiency in energy use.**

## 9.7. Aligning Incentives and Benefits

Among the recurring obstacles to good energy management that have been identified in the SAVE ENERGY project are that there are many people/departments involved in energy management and that the responsible persons are not necessarily the same as those which benefit financially from a reduction in energy use. **Internalizing these financial benefits and allocating them to the users would be an important step towards incentivizing building managers and users to save energy**.

However, the complications that arise from having different city authorities and departments responsible for different aspects of the process (e.g. investment, maintenance, operation and monitoring) means that this in practice can be difficult to accomplish. In such cases the need for the implementation of non-financial method to change user behaviour become even more relevant.

## 9.8. Implementing the Living Labs Methodology

The SAVE ENERGY project has substantially benefited from the use of the Living Labs Methodology. This was a key methodology that allowed for successful user behaviour transformation through the use of a co-creative, user driven ecosystem that involved all stakeholders and enabled the achievement of the projects objectives in a sustainable way and led to higher awareness and dissemination of best practices through users. The Living Lab Methodology has thus shown itself to be an overall framework under which user behaviour in energy use can be transformed.

This methodology can be replicated in all public buildings and regions. **Hence, it is recommended that the city decision-makers and public building managers implement a methodology based on the Living Labs concept to motivate and enhance energy saving measures in their public buildings.**

## 9.9. Develop industrial policy to ensure horizontal market structure

The SAVE ENERGY project has developed an open-source middleware platform through which different building automation systems, sensors, databases and the Internet can inter-operate. Even within the short time period of the project, this platform has been validated by the SAVE ENERGY Pilots. The SAVE ENERGY project thus believes that it is possible to develop a middleware platform that can be accessed by all market players, thus ensuring a horizontal market structure where applications and services can access data of any building automation systems through open standard interfaces, and to this end can choose any available telecom operator.

This requires both, technical development and standardization of the interfaces and the middleware platform and industry policy activity to overcome the current vertical market structures, in which each vendor has its own specific systems without external interfaces so that users are locked into long-term arrangements with specific providers. Lock-in creates monopoly situations, which defer users from investing. Further, the innovation rate is often lower because inventors do not have open access to installed systems.

**It is thus recommended that industrial policy is developed to enhance the probability that the a horizontal market structure is created around an open-source middleware platform that will allow public building operators to most effectively implement the ICT required to drive user behaviour change.**