PLEEC
PLANNING FOR ENERGY EFFICIENT CITIES

Planning behaviour-driven energy efficiency interventions in a city context

Katariina Kiviluoto, Annika Kunnasvirta & Timo Mieskonen (eds.)

SEVENTH FRAMEWORK PROGRAMME

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SYMBOLS


Renovation


Public transport


Waste, water and sewage management


Industry and commerce


Fossil and nuclear energy


Building technologies


Motorized private transport


Electrical power grids


Private and public services


Renewable energy


Pedestrian traffic and cycling


Private households


Spatial structures and land-use


Transport of goods


Heating and cooling grids


Public lighting

CONTENTS

ABSTRACT

Main aim of the report

The purpose of Work Package 5 Deliverable 5.5, "Planning behaviour-driven energy efficiency interventions in a city context", is to showcase the methodological framework of conducting successful behavioural energy efficiency interventions in urban areas. This is the final report of PLEEC Work Package 5 and it also includes conclusions about the state of behavioural energy efficiency work in six participating cities (Jyväskylä, Eskilstuna, Santiago de Compostela, Turku, Tartu, and Stoke-on-Trent).

Target group

The main addressees of D5.5. are city officials of partner cities, NGO representatives, private sector actors and any other relevant actors who plan and realize behavioural energy efficiency interventions in European cities. This report will also provide valuable information for the WP6 general model for an Energy-Smart City.

Main findings/conclusions

Changing behaviour in the context of energy efficiency is a complex equation of the target's knowledge, awareness, norms, values and motivation. When planning energy efficient interventions, all of these have to be taken into consideration, not forgetting the possible rebound effects. To achieve the desired goals, specified nudges are also needed.

By analysing the PLEEC case studies and reviewing existing literature it was found that the best practises in behaviour-driven interventions are based on social influence, feedback, communication, rewarding and overcoming the behavioural barriers. Also the importance of economic data in planning and evaluating an energy-efficiency intervention was recognised. Guidelines for planning a behaviour-driven intervention were drawn from the findings of the report.

The PLEEC project

Energy efficiency is high on the European agenda. One of the goals of the European Union's 20-20-20 plan is to improve energy efficiency by 20% by 2020. However, holistic knowledge about energy efficiency potentials in cities is far from complete. Currently, a variety of individual strategies and approaches by different stakeholders tackling separate key aspects hinders strategic energy efficiency planning.

For this reason, the PLEEC project – "Planning for Energy Efficient Cities" – funded by the EU Seventh Framework Programme uses an integrative approach to achieve a sustainable, energy-efficient, smart city. By coordinating strategies and combining best practices, PLEEC will develop a general model for energy efficiency and sustainable city planning.

By connecting scientific excellence and innovative enterprises in the energy sector with ambitious and well-organized cities, the project aims to reduce energy use in Europe in the near future and will therefore be an important tool for contributing to the EU's 20-20-20 targets.

FOREWORD

Urban areas account for two-thirds of global energy requirements while housing approximately half of the world's population. Energy is an intrinsic determinant of all urban settlements. It interconnects the built environment with socioeconomic activities, transport, industry and the individual citizens in their everyday lives. Unabated though it may seem, energy reductions are in dire need as cities tackle to reduce global greenhouse gas emissions.

In the face of an ever-growing energy demand but finite resources, efficiency is imperative. Technological solutions abound and some cities excel in energy efficient spatial planning. Great efforts are still needed, however, to get all the citizens, officials and private companies on board to better capture the vast potential for energy savings in each and every community, industry, workplace or household. In addition to the technological and structural changes that together set the needed transformation processes into motion, human behaviour is the element which helps sustain all the efforts to save energy.

In most cities, energy efficiency programmes with a strong behavioural aspect have most likely been implemented with varying success. It has been found, however, that within these projects, efforts and programmes there is a serious lack of assessment tools and genuine understanding of intervention effectiveness. The report at hand, along with PLEEC Deliverables 5.1. and 5.2., presents concrete examples, tools and methods for conducting behavioural energy efficiency interventions in city contexts. It has been found that behaviour conforms to distinct patterns and is guided by general principles. However, unfortunately, when it comes to human behaviour, there are no one-size-fits-all, infallible solutions for solving these issues. Behaviour is complex in any case, and especially in relation to energy efficiency, where so many different actors and interests abound. Despite these constraints, this report is meant to serve as an introduction into the realm of behavioural energy efficiency interventions, their planning, realization and evaluation.

1. INTRODUCTION

Behaviour plays a huge role in promoting energy efficient practices on a city level. It has been acknowledged that technical improvements carried out in isolation tend to have a lower impact on saving energy than ones combined with measures intended to encourage behaviour change (EEA 2013, 9). While energy efficiency is considered a logical approach by professionals working within the field of energy consumption, (Heiskanen et al. 2009), the benefits of energy efficiency may be obscure and difficult to grasp from the perspective of the end user. Energy is a consequence of action, and energy use is rarely consciously contemplated (Stern 2000; Sütterlin et al. 2011).

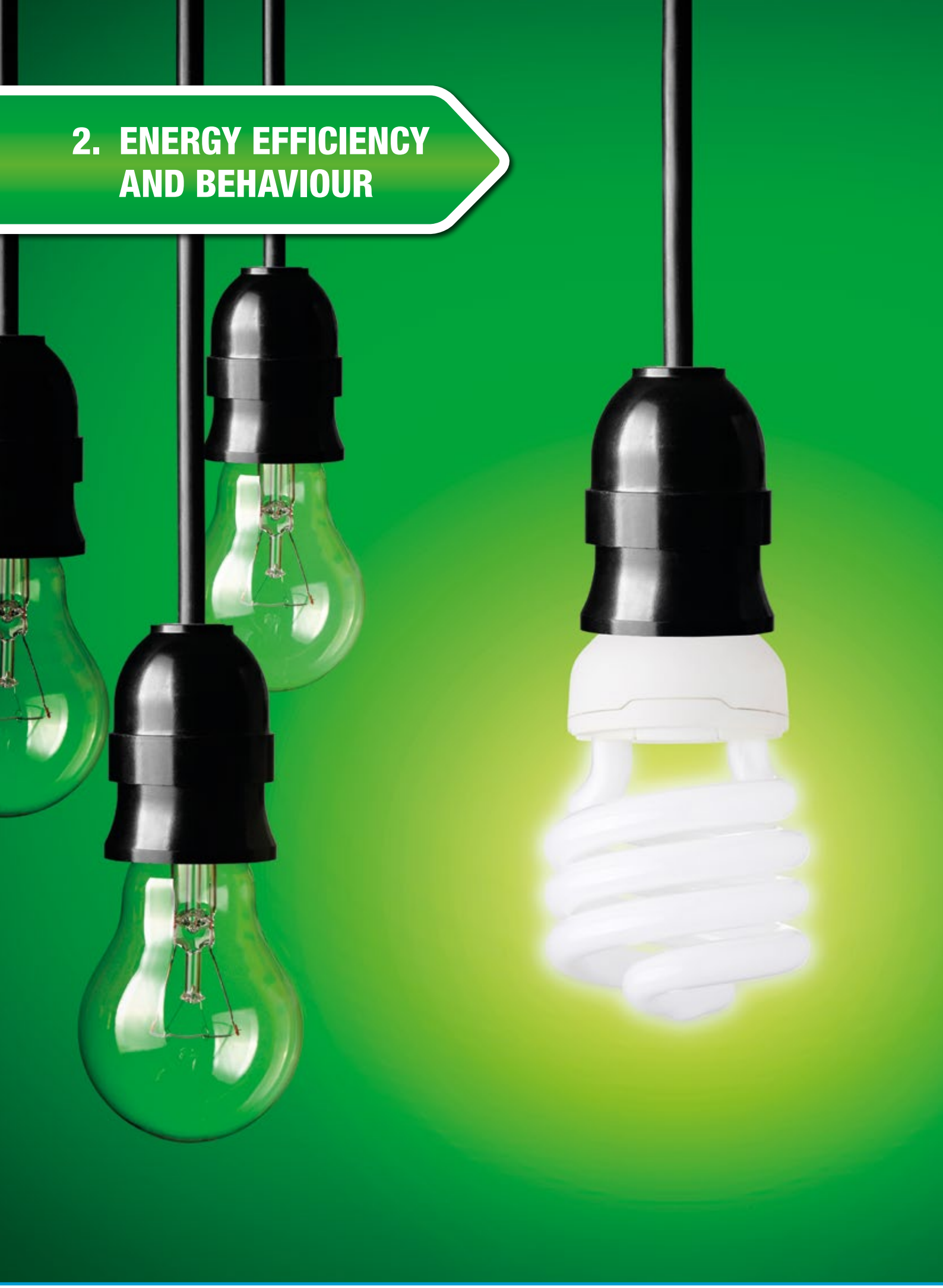
Governments and officials apply many instruments with the aim of obtaining the desired behavioural changes as defined by policies. Economic measures, such as taxes, fees and subsidies as well as legal regulations are commonly used and often effective methods to induce these required behaviour changes. For many reasons, however, such structural measures are met by public or political resistance, which may severely hamper the implementation of these measures (Ölander & Thøgersen 2014, 342). The use of soft measures, such as information provision and organization of choice settings, so-called nudges, is thereby common amongst the heavier and often politically more challenging regulations.

In essence, this report aims to review what type of measures are worthwhile for cities to take in order to promote energy efficiency via behavioural means. Households, for example, have a direct connection between the energy use and behaviour, portrayed by monthly energy bills. However, different norms govern energy saving in non-residential settings. As opposed to residential settings, energy efficiency in non-residential settings has no direct link to the personal wealth of the employee. Therefore also the design of behaviour change programmes can (and should) differ remarkably once applied to non-domestic consumers, with the emphasis on corporate and social responsibility objectives. (EEA 2013,10.) Cross-overs between these two types of interventions do however exist. Behaviour change interventions at the workplace, for example, may indeed inspire the employee to act differently at home.

Changing behaviour in the context of energy efficiency is a complex equation of many different things – first and foremost the knowledge, awareness, norms, values and motivation of the target group. When planning energy efficient interventions, all of these have to be taken into consideration. In addition, the importance of social influence and peer pressure, as well as varied barriers or rebound effects to energy saving should not be ignored. And, when it comes to energy use in cities, partially different norms govern energy saving efforts than in rural settings. Also, given ever-tightening budgetary restrictions, the economic benefits of behavioural interventions should not be overlooked.

With these aspects in mind, the WP5 final report was divided into two sections – one focusing on general guidelines on energy saving behaviour and their possible cost-benefit ratio, and the city-specific one focusing on the specific challenges of the six PLEEC model cities: Eskilstuna, Jyväskylä, Tarto, Stoke-on-Trent, Santiago de Compostela and Turku. Both sections aim to offer policy insights for cities to help them address behaviour-driven energy efficiency in a more structured manner, integrated into city-level planning strategies.

2. ENERGY EFFICIENCY AND BEHAVIOUR



Many different approaches can be taken to ameliorate environmental problems – government policies, national and international agreements, technical innovations, educational measures, to name but a few alternatives. One option is also to try and influence people's behaviour directly with varied sticks and carrots. All people, however, consume materials and energy in their everyday lives and are thus in the position to choose to adapt their behaviours and consumption habits to more environmentally friendly ones. Even small-scale or low cost efforts to influence people's behaviour should thus not be overlooked. Improved energy efficiency is the desired goal, however achieving it may often prove less straightforward.

Understanding energy behaviours requires knowledge on behavioural drivers, as well as the skills to transfer them into succesfull interventions. This chapter aims to assist in understanding the factors that influence energy saving behaviour. The chapter introduces different aspects of pro-environmental behaviour in general and behaviour-driven energy efficiency in particular. These include the complex norms, motivations and values that guide behaviour, as well as the habits, barriers, rebound effects and many other issues which may inhibit the success of these energy saving efforts.

2.1.

WHAT LIES BEHIND PRO-ENVIRONMENTAL BEHAVIOUR?

A persisting emphasis in awareness-raising and education of citizens is based on the "information deficit model" – resting on the assumption that environmental education will lead people to act in order to meet the policy objectives intended for a given environmental cause (Owens & Driffil 2008, 4413). It has been observed, however, that providing information may somewhat influence attitudes but alone will rarely have an impact on behaviour. Attitudes are influenced by a complex mix of social, political and cultural factors in addition to the information provided. It has also been acknowledged that expressed pro-environmental attitudes are not necessarily reflected in behaviour (ibid). This is to some extent explained by the complexity of attitudes that guide the behaviour and the interplay between values, norms and attitudes and behaviour. Explicit change in attitudes is not even always needed to change behaviour, as behaviour can be changed through economic instruments and regulation.

It has been observed, however, that providing information may somewhat influence attitudes but alone will rarely have an impact on behaviour.

Pro-environmental behaviours (PEBs) are not solely guided by environmental values but are also affected by other factors. Many PEB's are not driven at all by environmental values (Mirosa et al. 2013; Stern 2000; Whitmarsh 2009). A PEB can be driven by personal determinants (e.g. knowledge, values, skills, age, education etc.) as well as external or contextual determinants (e.g. support, pricing, regulations) (Uitdenbogerd et al. 2007).

When considering the complexities of PEB's it is important to understand that PEB's are not single actions, but more like an aggregate of different kinds of behaviours (Karlin et al. 2014). Uitdenbogerd et al. (2007) argue that there is also no actual proof, when it comes to PEB's, but only strong suspicions. There's no single answer either which kind of PEB is most linked with energy use (Uitdenbogerd et al. 2007). However, for example Whitmarsh (2009) has noted that PEB's tend to be linked with the little things, i.e. environmental concern is not a major driving force when making bigger investments. •

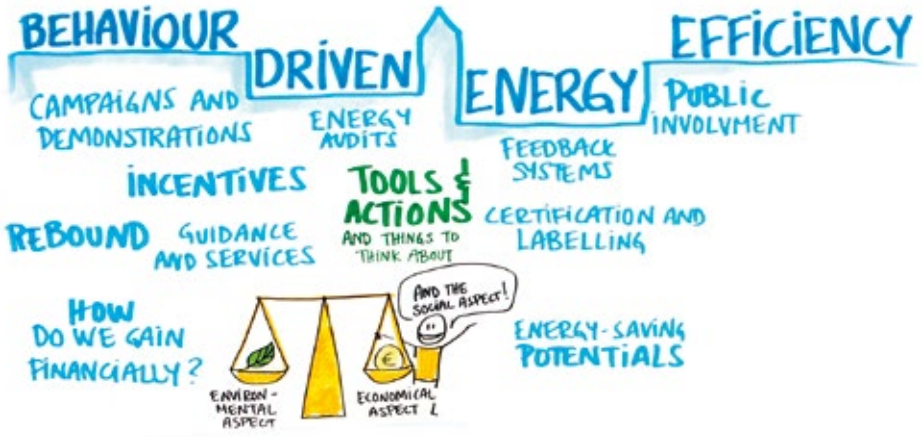
BEHAVIOUR-DRIVEN ENERGY EFFICIENCY

As has been established, awareness and knowledge alone don't explain energy use (Sweeney et al. 2013.) According to Steg et al. (2014), energy efficient behaviour is governed by three **goals**: hedonic, gain and normative. Normative goals should be strengthened and the other two goals weakened or all three should be integrated. **Values** are strongly related to consuming energy efficient goods such as bulbs. Not-consuming and bigger purchases are guided by non-environmental rationales and these are considered non-environmental actions (Jensen, 2008).

In addition, not all energy efficiency behaviour is guided by the same principles. For instance, **curtailment** behaviour (non-financial) and efficiency behaviour (investments needed) are driven by different values. Curtailment behaviour refers to actions that require a change in the consumer's everyday life via the adoption of new habits of energy use, as well as possible lifestyle changes. Reducing the temperature at one's house or apartment, using public transport instead of a private car or buying seasonal food all entail curtailment behaviour. (Karlin et al. 2014; Sütterlin et al. 2011; Sweeney et al. 2013)

Energy saving behaviour may also be based on energy efficient actions. Energy efficient technology, on the other hand, requires the mere act of for example buying a more energy efficient appliance for the home. These actions normally have a long-term effect on energy consumed without actually entailing a change in everyday energy use behaviour. (Sütterlin et al. 2011, 8138.)

From a psychological point of view, these two actions are fundamentally different. While investing in technical solutions offers the same benefits as before but in a more energy efficient way, curtailment is essentially about reducing benefits via the decreased use of energy. Curtailment thus involves giving up on something. This difference is reflected in the general acceptance of specific energy-saving measures. It has been observed that the average consumer is more likely to be receptive to energy-saving measures based on energy efficiency than based on curtailment. (Sütterlin et al. 2011, 8138.) Based on the above, when planning measures to influence different types of consumers it is important to separate between energy efficiency and curtailment behaviour. Research on the different profiles of energy consumers is, however, somewhat lacking. Segmentation of different energy user groups could be helpful when planning intervention strategies.



Also intent-orientated or symbolic actions (such as switching off the lights) tend to have an environmental background whereas impact-orientated actions (such as energy renovations) seem to be guided by other driving forces such as comfort and money-savings (Whitmarsh 2009; Stern 2000; Jensen 2008). Lillemo argues that **procrastination** seems to have a big effect on energy efficiency behaviour. The potential gains from energy savings seem too abstract and people tend to postpone decisions and falsely think they will take care of these things later (Lillemo 2014).

The **contextual** constraints of behaviour-driven energy efficiency have often been overlooked. The physical and social structures of modern life may hinder behavioural change, especially when price provides a strong counter-incentive. •

Key findings regarding behaviour-driven energy efficiency

The information deficit model has been proven inaccurate or severely lacking in many respects.

The context of energy use affects energy saving possibilities to a large extent. Therefore, when planning energy saving measures the possible contextual constraints should always be considered.

2.3.

NORMS, VALUES AND MOTIVATION AT THE CORE

Energy efficient behaviour is guided by a wide array of different values.

Awareness and knowledge don't alone explain energy use (Sweeney et al. 2013). As Sütterlin et al. (2011, 8138–8139) have pointed out, the acceptance of incentives and disincentives on energy saving behaviours is very much dependent on individual factors. Values, for example, influence awareness of problems and to what extent individual responsibility is assigned to these problems, which then affect the extent of the perceived moral obligation to take action to correct the problem. **Values** are hard to change and somewhat stabile, and they are linked with behaviours in unpredictable ways (Mirosa et al. 2013; van der Bergh 2008). **A deep understanding of values is needed to make interventions and it should be borne in mind that pro-environmental behaviour (and energy-related purchases) are not solely guided by environmental values** (Mirosa et al. 2013; Stern 2000).

Energy efficient behaviour is guided by a wide array of different values. Mirosa et al. argue (2013) that values drive behaviour in complex ways and the same value can have contradictory effects on energy efficient behaviour (e.g. the value of pleasure drives people to insulate their houses, but might also result in taking longer showers). It also seems that energy efficient behaviour is guided by value combinations consisting of e.g. values of achievement, being capable, intelligent and doing what is sensible. Thus people might seek to do what they believe is sensible, but can simultaneously be driven by other values, too. (Mirosa et al. 2013). Energy efficient behaviour can also be guided biospheric, biocentric, self-transcendent and altruistic values as well as egoistic values (Stern 2000, de Groot & Steg 2010).

However, having environmental or altruistic values does not necessarily result in energy efficient behaviour. That is, we do not make energy efficient choices only out of environmental concerns, but are guided by other values, such as comfort, economy and practical sense. According to Mirosa et al. (2013) people do not always act according to their values and need to rationalize this kind of behaviour. Value-action gap or discrepancy between values and action has been studied at length by various researchers (e.g. Mirosa et al. 2013; Jensen 2008).

Behaviour is also influenced by different **goals** which that steer attention and influence which information is detected most easily, which alternative actions are perceived and how people will act. More often than not, these goals are subconscious as goal-directed behaviour is not necessarily intentional. Pro-environmental behaviour in general often involves a conflict between hedonic and gain goals versus normative goals. In lay terms, this means that in order to promote the normative goals, acting in a pro-environmental manner often involves sacrificing personal benefits (steered by hedonic gain goals) such as time, money or convenience to the benefit of the environment. (Steg at al. 2014.) By reducing the conflict between normative and hedonic or gain goals, the actual or perceived outcomes of pro-environmental behaviour can, however, be changed. Also, the normative goals can be strengthened, thereby weakening the relative strength of hedonic or gain goals. By so doing, people will focus more on the environmental consequences of behavioural options, encouraging pro-environmental actions even if such actions may entail some personal costs.

Motivations, values or goals don't solely explain pro-environmental behaviour, but contextual factors and habits should always be considered as well.

Attitudes can be described as partly unconscious predispositions to react to things in a certain manner, negative or positive. Attitudes consist of three components: affect, behaviour and cognition. These three components should not be internally conflictive. Attitudes towards climate change and energy saving have often been targeted with cognitive (CO2 emissions contribute to global warming) and emotive ("forlorn polar bears on sinking ice") reasoning. No matter how powerful messages, both cognitively and affectively associated, authorities come out with on energy saving, results cannot be achieved if sufficient opportunities for energy saving are not provided (better public transport networks, smart grids etc.). Cognitive dissonance will occur if behaviour does not match with the other components. (Stoknes 2014, 163.) In other words, realistic opportunities to save energy need to be provided in addition to providing rational or emotive reasoning for why energy needs to be saved.

In the end, however, motivations, values or goals don't solely explain pro-environmental behaviour, but contextual factors and habits should always be considered as well (Steg & Vlek 2009).

Habits are a key driving force in PEB's and habitual behaviour should be examined more closely (Steg & Vlek 2009; van der Bergh 2008; Maréchal 2010). van der Bergh (2008) argues that values and habits are closely linked. According to Maréchal (2010), energy-related policies and interventions should aim at habits, which guide our daily lives to a great degree. Steg & Vlek (2009) argue that PEB is not solely driven by elaborate reasoning, but habits and automated processes affect it considerably. Habits are triggered by cognitive processes which are learned, sorted in and retrieved when a particular situation connected with the habit arises. More studies should be conducted on how habits are formed, reinforced and sustained. (Steg & Vlek 2009.)

Energy efficient behaviour is motivated by different factors. People tend to be motivated by for example potential money savings and rewards, but it is quite clear that this is not a straightforward process (see e.g. Nygren et al. 2014; Abrahamse et al. 2005; Grantham 2011; Steg & Vlek 2009; Whitmarsh 2009; Hori et al. 2013; Strohm 2011). Whitmarsh (2009) argues that financial incentives should be combined with e.g. infrastructure improvements, and money savings should be addressed together with other tangible benefits such as health. Accroding to Strohm (2011), financial incentives are especially motivating when people are not that interested in saving energy. Grantham (2011) argues that incentives can also be helpful, when the proposed action is costly or difficult. People are also less likely to adopt energy efficient behaviour, if it's costly and unpleasant, even if they are environmentally aware and concerned (Hori et al. 2013). There seems to be some consensus that rewards are more effective than punishments, but research indicates that strong rewards and incentives can result in short term results as people do not actually change their behaviour, but revert to their old behaviour soon after (Steg & Vlek 2009; Abrahamse et al. 2005; Grantham 2011).

Thøgersen & Grønhøj (2010) argue that self-efficacy (i.e. sense of self-worth) and personal and social norms seem to increase motivation. Saving intentions seem to be related to especially social and self-evaluative outcome expectations making social-normative approaches potentially useful. However, these social-normative approaches should be used together with empowerment to avoid provoking feelings of guilt, which may result in potentially negative responses. (Thøgersen & Grønhøj 2010.) •

2.4.

WATCHING OUT FOR REBOUND

A term often used in relation to energy efficiency measures, rebound effect refers to the "extent to which energy saved via energy efficiency measures is taken back by consumers in the form of higher consumption" (EEA 2012). Also known as the "Jevon's Paradox" or the "takeback effect", the rebound effect was first presented by Jevons in 1865. It has become clear that active energy conservation measures do not always result in energy use reduction despite good intentions, and may even negate energy savings already accomplished. Sometimes there may even be an increase in energy consumption due to this effect.

Some different types of rebound effect can be identified. **Direct rebound** effect refers to the situation when the increased efficiency of a product or service and the associated cost reduction leads to increased use due to lower costs. Increased energy use is therefore a by-product of greater efficiency.

Indirect rebound effect, on the other hand, occurs when there is a reduction in the cost of energy services. Households, for example, may have more funds to spare on other goods and services due to reduced energy costs.

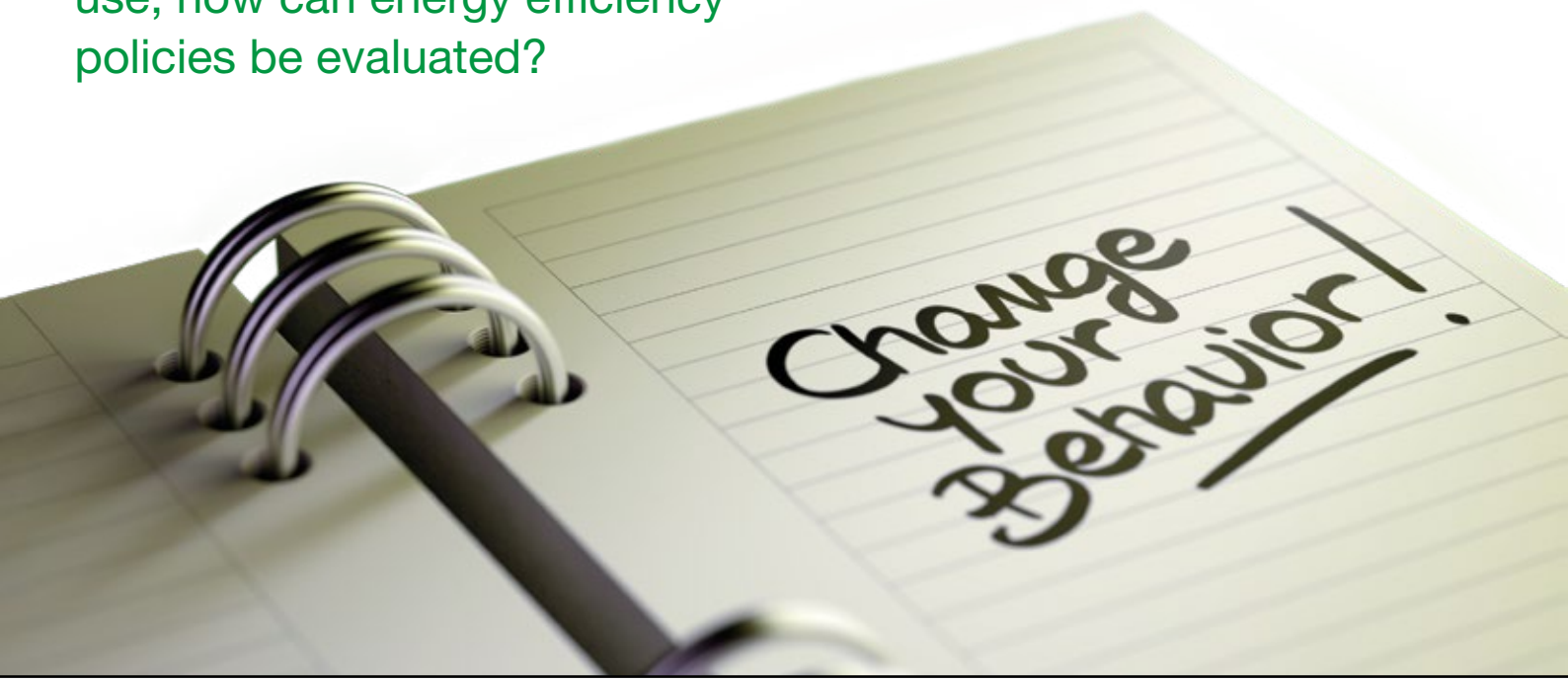
The basic mechanisms of rebound effects are widely accepted. However, the magnitude of the rebound effect is under dispute in the field of energy economics. Some researchers argue that rebound effects have only minor significance for energy services, whereas others conclude that economy-wide rebound effects may offset the savings from improved energy efficiency to a large extent. (Sorrell & Dimitropoulos 2008; UK Energy Research Centre 2007.)

The rebound effect has potential consequences also for policy planning. If increased energy efficiency does not lead to decreased energy use, how can energy efficiency policies be evaluated? Is the energy efficiency intervention thereby unsuccessful?

The rebound effect may even prove so large that it undermines the rationale for policy measures that aim to promote energy efficiency (Sorrell & Dimitropoulos 2008). Some might argue that the policy implication of rebound effects is that regulations to improve energy efficiency may not actually reduce energy demand. Failure to take into account the potential rebound effects of any energy efficiency policy could therefore have a significant negative effect on the achievement of energy policy goals.

The potential contribution of energy efficiency policies needs to be re-evaluated, taking rebound into consideration. Whether promoted through policies that raise energy prices or non-price policies, such as building regulations, rebound effects may reduce their apparent effectiveness. Still, many energy efficiency measures are very cost-effective even with rebound effects, and care should be taken to ensure that energy efficiency policies in general are not questioned. (International Risk Governance Council 2013; Sorrell & Dimitropoulos 2008.) •

If increased energy efficiency does not lead into decreased energy use, how can energy efficiency policies be evaluated?



STRATEGIES FOR CHANGING BEHAVIOUR

Information provision has not been proven too successful a means to promote voluntary behaviour change. Human decision-making is a complex process, influenced by a range of factors from norms, attitudes and motivations to peer influence. In recent years, behaviour economics has paid increasing attention to facilitating decision making into the desired direction. Researchers talk about **choice architecture** (Ölander & Thøgersen 2014; Mont et al. 2014) – the subtle cues, or **nudges**, in the context that can unconsciously influence human decision-making. Choice architecture reflects upon the notion that behaviour is not only governed by rational and conscious processes but also automatic and unconscious ones. Quite simply, nudges can be applied to promote virtually anything from road safety to dieting, or, in the energy efficiency context, the purchase of energy efficient appliances. All of these are methods that neither apply the carrot or the stick.

So, when exactly is a nudge needed? According to Thaler and Sunstein (2008), what a decision-maker chooses and – more importantly – how that choice is implemented and realized, often depends on how the choice is presented – the choice architecture. By choosing the right choice architecture and designing the context carefully, it is possible to indirectly influence the choice, sometimes to a considerable degree. Nudges, in short, steer people in particular directions while at the same time allowing them to go their own way (Sunstein 2014, 583). Nudging is thereby at the other end of the intervention intrusiveness spectrum as described by Mont et al. (2014). While laws and regulations eliminate and restrict choice, incentives, information and nudging guide and enable choice. Nudges are needed especially when choices have a delayed effect, they are difficult or when they are infrequent, feedback on the choice is poor or the relation between the choice and its outcome is ambiguous (Thaler & Sunstein 2008).

Message type has been found to be an important feature that can shape households' response to conservation nudges. Utility companies, for example, have stepped up in recent years to test information campaigns that seek to provide feedback to consumers with the intention to positively influence how households think about energy and how they use it. Evidence from these trials has been mixed. Some reviews have shown that normative statements have had no effect on energy use. This failure has been most likely due to the boomerang effect – descriptive norms having unintended consequences when people below the norm have actually ended up using more energy to conform to typical peer behaviour. To counteract this effect, normative feedback is often supported by messages which buffer against rebound behaviour. It has been found, for instance, that adding **an injunctive message**, such as a smiley face emoticon for those who consume less than average, will counteract the rebound effect. (Rasul & Hollywood 2012.)

Different design features of a nudge, such as frequency or duration, may effect its success. Even the **mode of presentation** of information can make a difference. Ayers et al. (2009) and Alcott (2009) both found that envelope size affected treatment response. In delivering Home Energy Reports, business-style envelopes were significantly more effective at lowering energy use than other modes of presentation. Authors suggest that this effect was likely due to the fact that the envelopes resembled the format of energy bills, making people more inclined to open and read them. •

Key findings regarding strategies for changing behaviour:

- **Nudging can be a useful strategy for inducing changes in human behaviour. Nudging is particularly helpful when choices are difficult and feedback is poor or delayed, or when the relation between a choice and outcome is ambiguous.**
- **Nudges can be used to guide behaviour and decisions in the desired direction – or to reduce undesired behaviour. Nudge tools include defaults, various warnings, changing the layouts of of different environments, drawing attention to social norms and using framing of information.**
- **Message type and mode of presentation can have a significant effect on the success of a particular message.**

3. BEST PRACTICES FOR PROMOTING ENERGY EFFICIENCY VIA BEHAVIOUR-DRIVEN INTERVENTIONS

In this report behavioural interventions are defined as campaigns, projects, initiatives or undertakings, which somehow target energy efficient behaviour in a city setting. All of the over 40 cases gathered during the PLEEC project have been classified as behavioural interventions, even if these cases have been very different with regard to their design, set-up, methods and objectives. Although different in many ways, the cases have all included elements targeting people's behaviour either directly or indirectly. For more information regarding the case gathering methodology and case analysis, please see the Case Study Report on Energy Efficient Behaviour (D5.1.).

The best practices introduced in this section are a result of an extensive literature review presented in paragraph 2 and the analysis made based on the over 40 behavioural intervention cases gathered by the PLEEC partners. As a conclusion, five core themes have surfaced, all of which cover several sub-themes. These include the power of social influence, the importance of feedback, the need for balanced communication, the preference for immediate rewards and the importance of acknowledging various barriers.

These core themes together with their sub-themes make up the best practices, which will be introduced in the following chapter. Some practical case examples drawn from the gathered case studies have been included under each core theme. **The idea has been to illustrate the complex world of pro-environmental behaviour and energy efficiency and to build a bridge between practical behavioural interventions and the science behind changing behaviour.** In addition, some concrete examples in the form of city tips have been included in this chapter to be used as a reference point for city officials planning behaviour-driven interventions.

3.1.

SOCIAL INFLUENCE AND PEER PRESSURE

The power of social influence and social norms are well documented in research literature (for further research see e.g. Abrahamse & Steg 2013; Abrahamse et al. 2007; Lucas et al. 2008; Allcot 2011; Frederiks 2015; EEA 2013; Shove 2003; Schelly 2014; Thunström et al. 2014). The tendency of people to conform to the opinions and behaviours of others has been shown to have an effect in the outcome of energy efficiency measures. People adhere to social norms and do what is considered acceptable and what is expected of them. People also closely follow what other people do and make decisions based on the behaviour of others as well as based on what is the general norm and the accepted way of behaving.

Research literature distinguishes between two different sets of norms: **descriptive and injunctive norms** (see e.g. Cialdini 2003). Injunctive norms tell us what people typically disapprove or approve of (e.g. littering in public places is generally disapproved of). Descriptive norms usually involve perceptions of what people do in a given situation (e.g. people are more likely to litter, if others have littered, even if it's not generally accepted behaviour). What people approve of and actually do are thus not always the same thing. In order to encourage pro-environmental behaviour, both injunctive and descriptive norms should be addressed so that they do not contradict one another. (Cialdini 2003). People also seem to make decisions based on their own sense of what is the right thing to do as well as what is socially acceptable behaviour. Research indicates (see Thurnström et al. 2014) that if a certain pro-environmental behaviour (such as saving energy) is generally accepted and the majority of people are known to engage in it, people are more likely to conform, because not conforming will lead to social disapproval, which people tend to avoid.

People frequently utilize the resources available in their **social networks** when making decisions (for social networks and pro-environmental behaviour, see e.g. Abrahamse & Steg 2013). The opinions of friends, families, colleagues and neighbours more often than not complement the information gathered from other sources and have an influence on decision-making. Social ties influence people's beliefs, values, preferences and choices. The examples set by those who are a part of your social network can encourage or discourage pro-environmental behaviour. Utilizing existing social networks seems to be instrumental in achieving behaviour change. Face-to-face interaction is likely to be more effective especially if a person's existing social networks or otherwise relatable people are utilized by the intervention. Encouraging examples set by role models, trusted messengers or the like seem to encourage people to engage in energy-saving.

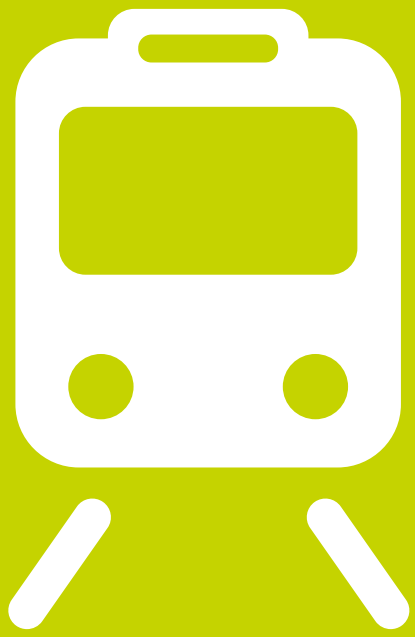
Public pro energy-saving commitments seem to be effective and should be utilized more also in interventions. People tend to respect publicly made announcements. This builds upon **social pressure** (i.e. people conform to avoid social disapproval) and normative behaviour (i.e. people tend to conform to what is generally regarded as accepted behaviour). For further reading regarding public commitments making see e.g. Abrahamse & Steg (2013).

Introducing **game-like elements** into pro-environmental behavioural interventions is not well-documented in research literature (for gamification and behaviour change see e.g. Schoech et al. 2013). However, adding game-like elements into services and other non-game-like environments is becoming more common due to the increased prevalence of smart phones, tablets, web-based solutions and other new technologies. Although the results are inconclusive, combining game-like elements with other methods such as social pressure and information seems to be a good option, especially if target groups are positively inclined to games and gadgets. Game-like elements can be used for example in turning an abstract notion such as energy use into something more concrete and recognizable. Social games, where a group of people work together towards achieving a common goal could also encourage people in energy saving, as well as having a group of people compete against each other in a positive setting. Game-like elements combined with social pressure, information and competitive elements have been used in some of the case-studies gathered in PLEEC WP5 with promising results.

For further reading about social aspects of pro-environmental behaviour see e.g. Behavioural insights team 2011; EEA 2013; Frederiks et al. 2015; Lucas et al. 2008; McMichael & Shipworth 2013; Corner & Randall 2011; Allcot 2011; Abrahamse & Steg 2013; Abrahamse et al. 2007; Thunström et al. 2014.

The social aspects of behaviour have been targeted in some form or another in a number of the over 40 cases gathered by WP5. At least various forms of social and peer pressure, game-like elements, group and collective efforts as well as the trusted messenger / block leader approach have been used in the cases. Social influence in its many forms combined with other means of behaviour changing efforts have produced promising results in a number of cases. People are naturally social and interventions targeting energy efficiency should most definitely utilize this tendency in future undertakings. •

The key findings regarding the use of social influence in city-level behavioural interventions are:



MAKE IT NORMAL

Underlining energy efficiency and energy saving as the normal way of doing things might increase people's interest towards energy efficiency measures. If people are aware that everybody else in their neighbourhood is saving energy or taking up energy efficiency measures, they are more likely to do the same.

City tip: If city-owned buildings are saving both energy and money, why not try to make it into a norm by making it public knowledge. This might encourage citizens and companies to save energy, too.

MAKE IT COLLECTIVE

Targeting groups of people (communities, neighbourhoods and workplaces) could be a way to increase the uptake of energy efficiency measures. Working together towards a common goal with a group that shares your interests seems to be effective. Peer pressure and the tendency to avoid social disapproval ensures that people work together towards achieving the common group goal.

City tip: Create communities for likeminded energy-saving citizens. Open up the decision-making process, so that these communities are included and heard when planning new energy-saving measures.

MAKE IT PUBLIC

Making public pledges seems to be effective also in achieving energy efficiency. People tend to respect pledges made in public more than privately made promises. The fear of publicly losing face makes people to keep up with their pledges.

City tip: Consider having for example a web-based application on your city webpages, where citizens can make public pledges regarding energy use. Adding a link to this pledge application to your city's front page ensures wider participation.

- ### MAKE IT THE CORRECT OPINION

  Local opinion leaders, block leaders, role models or trusted messengers could significantly increase the adoption of energy efficiency measures. Opinion leaders could be used to spread the word about energy efficiency effectively in their social networks. Influencing these people could be an effective way to reach others.

  City tip: Find out potential block leaders or role models, which you could use for promoting energy efficiency in your city. Adopt a citywide curb sticker, which can be granted for high energy saving households.

- ### MAKE USE OF SOCIAL NETWORKS

  People turn to their friends, family members, colleagues and other members of their social networks for information, when making decisions. Having someone you either personally know or can otherwise identify with as a source of information regarding energy efficiency seems to be more effective than receiving the information from a total stranger, even if this stranger would be an expert.

  City tip: Introduce a web-based platform for citizens, where they can promote energy-efficient practices and give tips to others.

- ### MAKE IT INTO A SOCIAL GAME

  Utilizing game-like elements together with social influence might help to make energy efficiency more appealing to people, especially if the target audience is tuned into gaming. Having teams compete against each other in a playful way has been used quite widely with promising results and people seem to respond to social games.

  City tip: Why not make a competition, where your city competes with another city of similar size, or create a game, where different neighbourhoods try to outrun each other in saving energy.

- ### MAKE IT INTO A STORY

  People are motivated and inspired by the positive experiences of others, especially if these others are well-known to them or otherwise identifiable.

  City tip: Create an online citywide storybook with inspiring stories of saving energy in real life settings.

CASE EXAMPLES:

MOBI **Fun and games encouraging sustainable commuting**

MOBI is an award-winning online game targeting daily commuting practices of people around Europe. It encourages employees to choose smart modes of transport by offering **timely information** on work-related travel. In addition to offering information, MOBI users can form teams, which compete against each other by making as many sustainable daily commutes as possible. Sustainable travel modes are favoured and receive higher scores than private vehicle use. MOBI users can keep online commuting diaries and receive information on their energy saving. The online game platform also shows how many calories the participants have burned and how much money they have saved during their sustainable commutes.

MOBI **offers tips and advice** on how the participant can optimize their daily commutes while saving both energy and money. Participants and highest scoring teams can also win different kinds of prizes. MOBI uses positive **social pressure** and **game-like elements** to encourage individuals and groups of people to change their unsustainable commuting habits. Engaging examples, competitive elements and targeted feedback makes the generally dull daily commuting process into an exciting and fun experience.

Walk and cycle to school

Schoolchildren and parents as advocates of sustainable transport

The walk and cycle to school campaign aimed at reducing GHG emissions, noise and congestion generated by school commuting done by private vehicles. The campaign focused on raising awareness of schoolchildren, their parents and school staff by organizing information evenings on the health and environmental benefits of cycling and walking. It also increased road safety along school routes and thus made walking and cycling a safer option for daily commuting. The case is a good example on the innovative use of **social pressure** in campaigning: commuting becomes a **collective** matter when communities built around a local school are addressed and engaged in working towards safer and environmentally friendlier commuting. Using **schoolchildren as advocates** of sustainable commuting is also an effective way to reach parents, who might not otherwise be interested in changing their commuting habits.

Kilometre race **Teams competing against each other in a playful cycling competition**

The Finnish Kilometre Race campaign has been arranged since 2007. The idea of the competition is to cycle as much as possible. Participants can compete against each other either individually or as teams. In 2014 the cities of Turku and Tampere were competing against each other. The competition is organized twice a year during summer (May–September) and winter (January–March). The participants can win raffled prizes each campaign month and the winners and runners-up of the team competitions win bigger prizes at the end of each competition season.

CO2 savings are calculated for each team and various health and other benefits generated by cycling are stressed during the campaign. Since its start in 2007, the competition has seen a steady rise in participants, cycled kilometres and CO2 savings with a relatively modest annual budget. The Kilometre Race uses positive **social pressure** in the form of a **playful competition** aiming to engage all kinds of people into cycling during the work week and in their free time.

Eco Support Training

Colleagues learning from colleagues

Eco Support Training promotes sustainable development, resource and energy efficiency and environmental awareness in workplaces.

Initiated in 2006 in by the City of Helsinki, the programme has spread to 10 Finnish cities and also to Estonia. Workplaces have appointed eco-supporters, who after receiving training give **peer advice** to colleagues on various environmental matters and enhance the implementation of previously produced action plans. Eco-supporters also raise environmental issues in meetings and see that unsound practices are uprooted and more sustainable practices are adopted in workplaces.

The Eco-Support Training programme utilizes both **peer pressure** and **trusted messengers** or **block leaders** by using colleagues as the initiators of sustainable practices. People are more likely to listen to their peers or trusted colleagues for advice instead of this advice coming from management level or outside experts.

Energy Neighbourhoods Project

Saving energy together

The Energy Neighbourhoods project is about the organization of a climate bet between the public authorities and their citizens. Groups of households, the “Energy Neighbourhoods”, have to save as much heat and electricity as they can by changing their behaviour. If they save at least 8% of energy compared to the previous heating period, the municipality awards them a prize. Energy Neighbourhoods are made up of 8–12 households with common interests. They can be neighbours or members of tenant associations, sports clubs, trade unions, NGOs etc.

By taking part in an Energy Neighbourhood the residents become “energy soulmates”, a unit that saves energy together. The case utilizes **peer pressure** by bringing together a group of people, who not only save energy together, but also share other common interests. Making energy saving a **group effort** makes it harder for participants not to do their part. Disrespecting the group goal results in **social disapproval**, which people tend to avoid.

3.2.

COMMUNICATION, AWARENESS RAISING AND TARGET GROUPS – GETTING YOUR MESSAGES RIGHT

Communication, in some form or another, is an essential element in promoting pro-environmental behaviour. Communication efforts typically include mass media campaigns, information events, promotional materials, saving tips and other awareness raising strategies. However, providing people with more information on energy efficiency takes us only so far. In other words people rarely change their behaviour, if they are just given more information. Before and after comparisons done in connection with bigger awareness campaigns indicate that awareness raising as such does not result in significant behaviour change. Increased awareness does not lead to action, if social, cultural and structural factors are not equally addressed and if information is not combined with other efforts. People need to be engaged and encouraged and the structural and technical factors need to support a change in behaviour. (see e.g. Strohm 2011; Abrahamse et al. 2005; Owens & Driffil 2008; EEA 2013; Delmas et al. 2013; Bachus & Van Ootegem 2013; Steg & Vlek 2009).

Providing people with information might increase awareness, but rarely results in actual behaviour change or energy savings. In addition, information campaigns are generally relatively expensive to be used as the sole strategy for changing behaviour especially as they rarely result in actual behaviour change. However, when communication and awareness raising are combined with other methods, the results are more promising. (See e.g. Steg & Vlek 2009; Abrahamse et al. 2005; Strohm 2011). Through **combined efforts** people become not only aware, but are also likelier to engage in actions resulting energy saving. Information combined with for example concrete and personal guidance, goal setting, tailored messages, feedback and social support seem to be more effective than just pouring information into inattentive ears. **Meaningful, engaging, encouraging and personalized information** also seems to work better than creating generalized mass media campaigns trying to convince as many people as possible.

Communication activities should be carefully **segmented and tailored** to reach those whose behaviour the intervention is targeting. If the issue does not resonate with the target group or does not address the barriers hindering a particular behaviour, people are not likely to change their behaviour. According to Mourik et al. (2009), conducting prior research (surveys, interviews, pilots etc.) on the target groups is essential. Intervention planners should know their target groups prior to carrying out the actual intervention to be able to tailor messages effectively and use correct channels. Big mass media campaigns with no specific target group tend to fail, as the messages remain too generic and seldom address specifically the things people find important in terms of the behaviour the campaign is trying to change. In addition, it is of no use for a city to carry out massive campaigns on for example public transport promotion if at the same time the public transport infrastructure does not support these changes. **The social context of any intended behaviour change must always be carefully considered.**

According to e.g. James (2010) and Service et al. (2014) there are a few guidelines in formulating **engaging and empowering messages**. Messages should include an element of surprise, which makes you look at the issue from a different angle. Messages should also be as simple as possible by breaking down a complicated concept like energy saving into smaller tasks, which can be both easily understood and are achievable by following simple steps. Keeping it simple includes also the idea of tangibility: an abstract and invisible concept like energy should turned into something concrete by using clear and concrete phrases and by avoiding scientific or expert jargon. Messages should be personally targeted, i.e. individuals (the "yous") should be addressed directly and for example any potential personal benefits should be emphasized in the message. Messages should utilize only one core idea, which captures the essence of the targeted behaviour. It is better to tackle one issue at a time instead of trying to address too many.

Owens & Driffill (2008) describe the way in which mixed messages can lead to confusion and resentment towards energy saving policies. This may happen, for instance, if people are urged to do one thing but price signals and the constraints of everyday life present obstacles for its completion. Coherence and consistency in policy promotion is essential. In other words, the combination of incentives, regulation and information as well as policies of public engagement should take into consideration the context-specific factors which may inhibit behavioural change.

Different kinds of informational and awareness raising elements have been used in some way in almost all of the case studies gathered by WP5. Informational activities have mostly been used together with social pressure, incentives, infrastructure improvements and other types of measures. Even though communication activities rarely work wonders by themselves, some provision of information should be included in all types of interventions which target behaviour. The main thing is to make messages **simple, concrete and tailored**. Adding some human interest into abstract and technical issues such as energy use helps also in getting the message across to people. •

The key findings regarding communication and information activities in city-level behavioural interventions are:

- **MAKE IT TAILORED**

  Tailoring the information according to your target audience is important to induce behaviour change. Having personalized information is more effective than using generic messages, which try to appeal to a larger audience.

  City tip: Introduce energy experts in your city. An energy expert can guide in energy saving and give personalised information according to the specific needs of the resident.

- **MAKE IT TARGETED**

  Mass-media campaigns can be effective in making an issue known to a bigger audience, but these types of campaigns rarely result in actual behaviour change. Addressing target groups, which are instrumental for certain key behaviours, is usually more effective. Getting to know your target groups beforehand helps with finding out the needs and interests of your target audience. By clearly defining your target groups you can create appealing messages, which meet the specific interests and needs of the people you are trying to reach. This will result in a better response.

  City tip: Why not make an energy saving campaign for a specific neighbourhood. This way you can really focus on the needs of people living in a specific place. Or make a campaign, which is specifically targeted to the elderly and their energy use. Or why not make a campaign combining both and target the energy use of the elderly in a specific neighbourhood.

- **MAKE IT CONCRETE**

  Energy is an abstract concept, which is not an easy thing to grasp. Making your messages more concrete is one of the key issues in creating successful campaigns. Using e.g. smiley faces to indicate energy use has been shown to be more effective than using numbers or kWh's.

  City tip: Let the citizens know how much energy their city is using on the city webpage, but instead of showing just the numbers and kWh's, indicate energy use also with a smiley face or with some other concrete example.

- **MAKE IT SIMPLE**

  Campaigns tend to target too many issues at the same time, which often creates confusion among the target audience. People tend to get easily distracted, if they need to focus on many issues at the same time. Concentrating on just one or two things and using a simple step-by-step approach is usually more effective. So, make it simple and create campaigns, which introduce only one simple message at a time and remember to introduce simple steps to help people to reach the target.

  City tip: Why not ask your citizens to generate messages for you? Create a competition, where people need to sum up their energy-saving practices in just one simple sentence containing up to five, six words. Use these sentences to create a pool of energy-related slogans, which can be used in energy-related campaigning.

- **MAKE IT INTO A STORY**

  People are naturally drawn to other people's experiences. Giving a voice to those, who have successfully decreased their energy use or switched into more sustainable transport modes helps to render these abstract issues into something anyone can relate to. Energy-related success stories not only make energy issues more concrete, but also create positive social pressure. If the Joneses were able to cut their energy bills, what's stopping us?

  City tip: Create a youtube channel, where people can tell their energy-related success stories. Give a small prize to the video of the month.

CASE EXAMPLES:

Spring Vacation for the Car

Getting to know your target group (Helsinki, Finland)

The Finnish Spring Vacation for the Car campaign targeted the challenging target group of private car owners. As a part of the planning process, the **target group** was thoroughly researched and their **specific** needs and opinions were mapped. The gathered background information was then successfully utilized in the campaign design. The general campaign strategy and **simple**, yet powerful **messages** were created based on the findings made in the background research. This resulted in a very successfully **targeted** campaign, which reached its aims and objectives manifold. The Spring Vacation for the Car campaign clearly indicates that knowing your target group and segmenting the campaign carefully is one of the key things in making successful and cost-effective campaigns, which hit the mark.

Ecohome

Tailoring and personalized information helps to save energy (Turku, Finland)

The EcoHome project addressed the challenges in household energy consumption and sustainable consumption choices. The aim of the EcoHome project was to monitor consumption practices of households in the South-West of Finland in 16 pilot homes, and to map out in detail the environmental impacts of daily household activities.

The pilot homes were offered **tailored and personalized information** on various aspects of their household energy practices. The participants were guided with the help of for example e-mail prompts, personal visits, online data linked with smart meters, joint meetings, a Facebook group and monthly newsletters. Being able to **perceive one's own consumption more clearly** was considered the best result of the project by many participants. This can only be achieved if the information is clearly targeted and personalized.

Senate Governmental Properties User Electricity Saving Project

Making energy use more concrete

Senate Properties is a government owned enterprise managing 11 500 buildings owned by the Finnish government. Every year Senate Properties implements electricity saving projects that seek to engage people to save electricity in their workplaces. Central methods in this are communication affecting people's conceptions and attitudes, and stimulating **personal involvement** so that people can see the **effects of their behaviour**, receive energy saving tips and discuss on issues related to energy use. The information offered is **timely** and comparisons between different buildings are available, making energy use more **concrete, positive and relatable**. A comic figure has also been introduced to inspire and encourage people to save energy in their workplaces.

Take the Bus to work

Giving a voice to passengers (Turku, Finland)

The Take the Bus to Work campaign aimed at making bus commuting a fun and positive experience by both issuing commuters free travel cards and by offering public transport related information to the citizens. The campaign was carried out in 2013 and 2014, first in the city of Turku and then in the Turku region. Both campaigns utilized **social media** and participating commuters were asked to discuss their experiences on the campaign Facebook page.

The participants were eager to **share and discuss** their travels with other fellow participants. Participants also gave valuable improvement suggestions related to public transport, which were then directly utilized by the people working with the city public transport issues. The campaign nicely shows that if people are given an opportunity to share their experiences, they will. These experiences can be used when making improvements into the public transport system, but also in public transport promotion to bring public transport closer to the people.

3.3

PROVIDING FEEDBACK FOR BETTER RESULTS

As stated, energy use is not visible as such. With no appropriate frame of reference, the consumer has no means of determining whether their use of energy is excessive or not. In order to make a conscious effort to reduce one's energy consumption, the energy end user needs to receive **timely and accurate** information on how much energy is consumed by different functions. Feedback is an integral element of effective learning, raising energy awareness and changing consumer's attitudes to energy consumption. (EEA 2012.) The mode of feedback, however, to a large extent determines its success.

The most successful feedback measures typically involve both direct and indirect elements.

Direct feedback measures cover a variety of systems with access to real-time energy consumption information, either on a frequent or continual basis. This could include direct in-home displays, smart meters, trigger devices or consumption limiters, for instance.

Indirect feedback refers to measures which promote energy saving via learning, for example more frequent and more informative bills based on meter readings. Indirect feedback has been proven more effective when combined with normative feedback, e.g. comparison with similar households' consumption figures.

A comprehensive review of different feedback projects by Darby (2006) between 1975 and 2000 covered a range of feedback measures. The review showed that the most promising single type of intervention is direct feedback, either by itself or combined with other measures. The highest energy savings were achieved by using a table-top interactive display unit; a smartcard meter for prepayment of electricity; and an indicator that showed the cumulative cost of operating an electrical cooker. According to a 2010 meta-review by Erhardt-Martinez and Donnelly, energy savings in the household sector due to direct feedback tend to fall within the range of 5%–15%. With indirect feedback, indirect measures can reach 10%, with the success being largely susceptible on the context and quality of information. All in all, **the most successful feedback measures typically involve both direct and indirect elements.** •

Key findings regarding feedback – recipes for good feedback:

- **MAKE IT TIMELY, EFFECTIVE, CONVENIENT AND RELEVANT.**

  City tip: Offer citizens Feedback with cost information + historical comparison + appliance-specific breakdown

- **MAKE IT SIMPLE AND DESCRIPTIVE.**

  City tip: Apply injunctive messages that portray the energy use of city buildings on an emoticon scale for a sad face to a smiley one. Send city officials prompts, which are noticeable, self-explanatory (graphic) and frequent.

- **MAKE IT PERSONALIZED.**

  City tip: Offer citizens personalized information and recommendations. Tailored information and feedback is essential.

- **MAKE IT FREQUENT, CONSISTENT AND REPEATED.**

  City tip: Combine feedback with information and advice.

- **MAKE IT COMPARATIVE.**

  Comparative energy feedback helps individuals put their energy use habits into context and may encourage individuals to stay within the "norm" or to improve their energy consumption relative to their neighbours or peers.

  City tip: Create a web-based service, where citizens can compare their energy use with their neighbour or somebody living in similar settings.

- **MAKE IT ACCESSIBLE.**

  Good feedback brings future benefits closer and makes energy more tangible.

  City tip: Offer easily accessible energy data to your citizens.

ECOHOME PROJECT – PROVIDING FEEDBACK ON HOUSEHOLD ENERGY CONSUMPTION AND SUSTAINABLE CHOICES

The EcoHome project addressed the challenges in household energy consumption and sustainable consumption choices. The aim of the EcoHome project was to monitor consumption practices of households in the South-West of Finland in 16 pilot homes, and to map out in detail the environmental impacts of daily household activities. Selected methods, such as monitoring consumption and versatile advisory services were used to guide the households to reduce these impacts. With measurements, information and follow-up, the households were able to assess their environmental impacts and the needed improvements.

In EcoHome project the pilot households received **real-time, online smart meter data** on household electricity use throughout the project. It was found that monitoring the households' energy and water consumption was a succesful means of changing consumption habits when **combined with personal advice**.

According to a 2010 meta-review by Erhardt-Martinez and Donnelly

Energy savings in the household sector due to direct feedback tend to fall within the range of 5%–15%.

3.4

IMMEDIATE REWARDS VERSUS LONG-TERM PAYBACKS

Many energy conservation efforts are characterized by immediate upfront costs and long-term benefits. As people in general are often inclined to prefer immediate rewards instead of future ones, **upfront costs from energy conservation measures might not be appealing despite future savings**. The appeal of longer term improvements to properties can be increased by including an **upfront incentive** as part of the installation of the energy efficiency measure.

Purchasing more energy efficient appliances is one of the main choices people can make in terms of household energy saving. Energy efficient appliances are often more expensive than normal appliances with the same features. However, the higher retail price is made up for through savings in electricity over the appliances' life-time. In most cases, energy efficient appliances are remarkably cheaper than the less efficient ones in the long run. The costs, however, need to be paid upfront with benefits being achieved in the future, something that economists call time discounting. Discount rates, or "the magnitude of consumer's preference for present over future value" (Stern 1986), is a useful economic concept that can be used to analyze decisions involving inter-temporal choices and can have important policy implications as they can be used to predict consumers' decisions, thus helping to evaluate the impact of policies. Judging from the lower market penetration of energy efficient appliances, it has been found that implicit discount rates can often be quite high when consumers make energy efficiency investments. (Newell & Siikamäki 2013; Chunekar & Singh Rathi 2012.)

Purchasing more energy efficient appliances is one of the main choices people can make in terms of household energy saving.

In Britain, the Green Deal, the Government's flagship policy has helped people introduce energy efficiency measures in their homes at no upfront cost. This is facilitated by a financing mechanism that allows private companies, charities and local authorities to cover the upfront costs of installing energy efficiency measures. The cost of the measures is paid back through the savings made in the property's energy bills. The Green Deal intends to make energy investments more appealing to individuals as the costs of the installation are deferred. (Cabinet office & Behavioural Insights Team 2011.)

Newell and Siikamäki (2013) evaluated the effectiveness of energy efficiency labeling in guiding household appliance choices. They found that **simple information on the economic value of saving energy** was the most important element guiding more cost-efficient investments. Other information on physical energy use and carbon dioxide emissions proved to have lesser importance. Information programmes on household energy efficiency should therefore seek to provide understandable information by assisting the consumer in weighing the higher capital costs against the savings made in energy costs during the appliance life span. •

Key findings regarding incentives:

- **MAKE IT LUCRATIVE AND EASY**
  People tend to discount future energy savings and instead focus on short term gains. Combined with the aversion to engage in seemingly arduous installing of energy efficiency measures, people's willingness to take action may be hindered.

  City tip: Introduce a web-based application, where citizens can compare future energy savings and short term gains of simple installations.

- **MAKE IT CONCRETE**
  There's a strong tendency to target attitudes and behaviours with education and awareness raising. However, mere information provision is unlikely to bring about permanent changes in behaviour if the information runs counter to other strong influences, such as social norms or prices.

  City tip: Create pop-up events, where families or companies share their real-life energy-saving examples and best practices.

- **MAKE IT INTO A SHARED INTEREST**
  Information provision should be part of a wider strategy of deliberative communication between different stakeholders: decision-makers, technical experts and the public about energy saving.

  City tip: Create a network for different stakeholders, where they can meet, discuss and create common plans for promoting energy efficiency.

FUND KRED-EX

Financial support for apartment building renovation has been provided by Fund KredEX in Estonia since 2010. It is estimated that as a result of the renovation works the apartment buildings have managed to save 43% of energy. Feedback on the financial support was largely positive. Many occasions showed that the grant was a tipping point in deciding whether to renovate or not. The case also goes to show that **education of apartment owners** is crucial for achieving energy efficiency goals.

The project is a good example of how funding possibilities for energy efficient actions are crucial but also of the importance of having well defined goals for achieving the grants which impacts the quality of the renovation itself and of the users' behaviour changes afterwards.

3.5

OVERCOMING BARRIERS TO BEHAVIOUR CHANGE

Apart from the many institutional, market-related and organizational barriers to energy conservation, the behavioural ones are a significant reason behind the non-exploitation of energy saving measures. Actions have been taken to make energy conservation technically feasible and economically viable. Nevertheless, these actions are not always implemented.

It has become clear that energy is an intangible concept, invisible to the consumer but for the monthly bills on electricity and heat. Very much in the same way as the outcome of using energy, carbon dioxide emissions, is invisible, energy consumption might be a difficult concept to grasp in every-day life. The somewhat abstract terms, such as kilowatt hours, used to describe this consumption do not really help in understanding what energy is or how much of it is consumed in certain activities. **What are the barriers that might inhibit effective communication on energy saving?**

Various methods and instruments are applied by governments and other actors to obtain the goals set for energy saving. Policies can be utilized to change behaviour by offering new technologies, providing material incentives, providing education and information appealing to fundamental values, or by modifying institutional structures which may drive behaviour change – to name but a few options (Stern 1999, 461).

Well-designed energy efficiency policies have the potential for substantial energy savings. At best, these policies address the various barriers that exist for increasing energy efficiency in different sectors. A variety of constraints may, however, inhibit pro-environmental behaviour. An individual may, for instance, prefer using one's private car for commuting due to the fact that public transport is slow, the weather often unfavorable for cycling and cycling paths poor or nonexistent. For another individual, constraints may apply to private car use – lack of money or parking places near the workplace – and thus drive to use public transport. Different individuals are constrained in different ways. Therefore **changing behaviour requires that the particular constraints are addressed in a given situation**. (Stern 1999, 465–466.)

Removing the particular constraints in a given context via incentives may significantly improve the success of energy efficiency measures. Incentives in the energy efficiency context refer to such measures from energy efficiency programme that aim to encourage or motivate their target group (e.g. households, energy company customers) to reduce their energy consumption per a given service without reducing the quality of the said service. These incentives may range from simple cash rebates on purchase of energy efficient products to technical assistance in planning and implementing energy efficient building retrofitting. Incentives can be targeted at specific customer segments or purchase transactions, or they can be directed further up the market supply chain to encourage manufacturers or retailers to influence their customers to choose more energy efficient products or services. (National Action Plan for Energy Efficiency 2010, 1–2.)

Direct incentives refer to direct payments or subsidies to individual customers for the purchase or installation of an energy efficiency measure. These include the following (National Action Plan for Energy Efficiency 2010):

- **Rebates.** A rebate is a fixed amount or custom payment from the intervention sponsor to an individual customer which is typically made after a qualified item is purchased.
- **Discounts.** Discounts are upfront rebates taken off the price of the product at the point of purchase. However, discounts can also be structured as reductions or credits on energy bills.
- **Financing.** Loans offered to customers to implement energy efficiency measures. Financing instruments may be crucial especially to groups who may not qualify for conventional financing.

Direct or indirect incentives are often combined with non-financial incentives. Depending on the intervention type, a non-financial can also be used on a stand-alone basis.

- **Technical services.** For the layman, identifying, installing and paying for energy efficiency improvements may be a daunting task and thus create unwanted transaction-cost barriers. The lack of expertise can be compensated by services that assist consumers with this process.
- **Information services.** Many individuals lack information of their energy use habits as well as their actual effects. Various education and training services can reduce this lack of information and provide guidance in choosing and implementing energy efficiency measures.

It is important to remember that when talking about voluntary behaviour change, information provision alone rarely leads to desired effects. Information is an intervention in the personal domain. When making decisions which entail significant barriers external to the individual – upfront financial costs or inconvenience – little effect has been achieved via informational efforts. Financial or technical incentives can be applied to overcome these barriers. (Stern 1999, 468).

In other words, **intervention effectiveness can be improved by combining monetary incentives with nonfinancial ones**. Also, incentives can be backed up by informational interventions, which has been found to increase their effectiveness significantly. In essence, the effectiveness of an incentive is very much dependent on the way it is explained to people (National Action Plan for Energy Efficiency 2010). •

TYPES OF INCENTIVES

GOAL

FINANCIAL INCENTIVES

FINANCING

DISCOUNTS

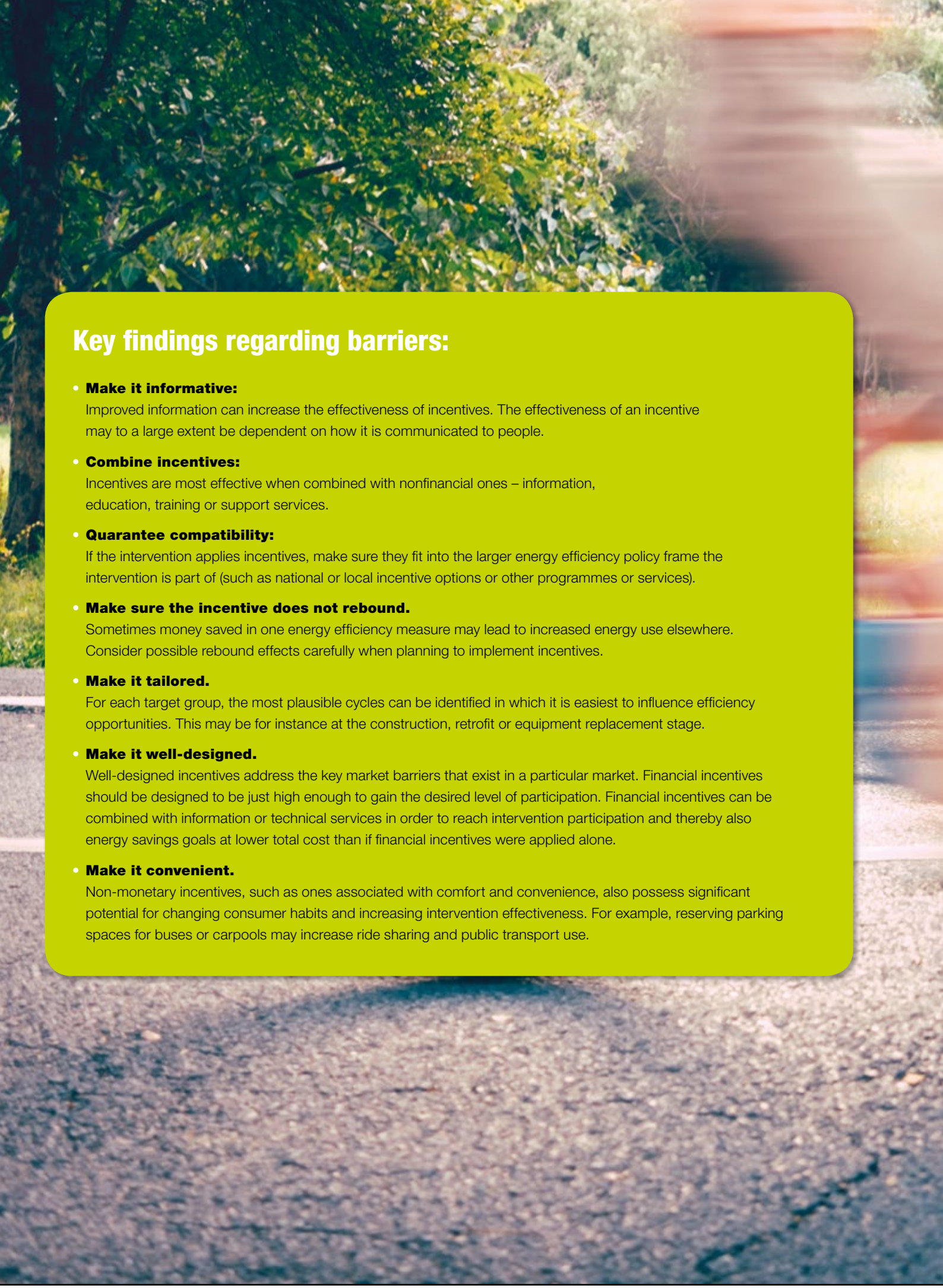
REBATES

NON-FINANCIAL INCENTIVES

EDUCATION AND TRAINING

SUPPORT SERVICES

INFORMATION SHARING



Key findings regarding barriers:

- **Make it informative:**
  Improved information can increase the effectiveness of incentives. The effectiveness of an incentive may to a large extent be dependent on how it is communicated to people.
- **Combine incentives:**
  Incentives are most effective when combined with nonfinancial ones – information, education, training or support services.
- **Quarantee compatibility:**
  If the intervention applies incentives, make sure they fit into the larger energy efficiency policy frame the intervention is part of (such as national or local incentive options or other programmes or services).
- **Make sure the incentive does not rebound.**
  Sometimes money saved in one energy efficiency measure may lead to increased energy use elsewhere. Consider possible rebound effects carefully when planning to implement incentives.
- **Make it tailored.**
  For each target group, the most plausible cycles can be identified in which it is easiest to influence efficiency opportunities. This may be for instance at the construction, retrofit or equipment replacement stage.
- **Make it well-designed.**
  Well-designed incentives address the key market barriers that exist in a particular market. Financial incentives should be designed to be just high enough to gain the desired level of participation. Financial incentives can be combined with information or technical services in order to reach intervention participation and thereby also energy savings goals at lower total cost than if financial incentives were applied alone.
- **Make it convenient.**
  Non-monetary incentives, such as ones associated with comfort and convenience, also possess significant potential for changing consumer habits and increasing intervention effectiveness. For example, reserving parking spaces for buses or carpools may increase ride sharing and public transport use.

4. EVALUATING THE ECONOMIC ASPECTS OF BEHAVIOUR-DRIVEN INTERVENTIONS

THE IMPORTANCE OF ECONOMIC EVALUATION

The purpose of economic evaluation is to facilitate cost-effective allocation of resources and demonstrate the benefits of a particular intervention for a city or municipality. Information about cost-effectiveness is crucial for decision-makers and organizations, because resources for energy efficiency promotion are scarce in municipalities, communities and organizations. Therefore, concentrating on the most cost-effective options is vital.

Economic evaluation can be used to examine investment decisions (e.g. different projects, policy actions, promotional campaigns, etc.) in order to assess the positive changes (e.g. financial, environmental, behavioural) attributable to them. One of the tasks of WP5 was to evaluate different behaviour-related interventions in Deliverable 5.2. The objective was to examine how to conduct an economic evaluation of behaviour-driven energy efficiency interventions by using the PLEEC case studies as examples (see D5.1.). The impact of these interventions was assessed against predetermined objectives. Deliverable 5.2 is not only a guide for economic analysis, but serves also as a reminder of the importance of collecting relevant economic data when formulating different policy actions. For more detailed guidance about the method and procedure, see PLEEC Deliverabe 5.2.

There are two principal types of financial and economic evaluation: cost-benefit analysis (CBA) and cost-effectiveness analysis (CEA). **The cost-benefit analysis (CBA)** was chosen as the basis for the analysis for making the assessments in D5.2. CBA quantifies and compares the economic advantages (benefits) and disadvantages (costs) associated with a particular project or policy for the society as a whole. In principle, all impacts should be assessed and if possibly monetised: financial, economic, social, environmental, etc. In the field of energy efficiency, special attention should be paid to cost savings, associated with proposed interventions.

For example, the costs and benefits of investment projects can be assessed by using the so called incremental approach which considers the difference between a scenario "with the intervention" and an alternative scenario "without the intervention" (EC 2008). CBA usually recommends choosing interventions with the largest net benefits, where net benefits are defined as the benefits minus the costs. The analysis results identify net benefits and conclusions can be drawn on whether the action or project is desirable and worth implementing from a societal point of view. A positive net benefit indicates that an intervention is worthwhile from an economic (social) perspective. To be more cost-effective, ranking the alternatives is necessary to be able to choose those interventions that have the highest return on investment and/or bring the greatest benefit to the target populations. •

4.1.

A SIX-STEP APPROACH FOR MAKING ECONOMIC EVALUATIONS

1. Crystallize the objective of the intervention

The analysis can be made from a local, regional or national perspective. The appropriate level of analysis should be defined in reference to the size and scope of the intervention. The level of analysis should thus be adjusted accordingly. Some interventions may have minimal national impacts, yet the impacts at the local level can be considerable. A clear statement of the intervention's objectives is needed in order to understand if the investment has social value. The objectives should be logically connected to the investment.

2. Identify the intervention

The main characteristics of the proposed intervention should be clearly identified. This step includes a demand analysis (market study, traffic forecasts and energy consumption statistics) on the basis of which the assessment of revenues and costs has been based and the projections performed.

3. Timing is everything

It is crucial to determine the time horizon, i.e. the timing of costs and impacts. The time horizon refers to the maximum number of months (or years) for which forecasts are provided (period of both investment and operation). The time horizon of CBA can be central to the outcome of the analysis. For example, a CBA with a short time horizon tends to reduce the benefit-cost ratio of the intervention.

4. Collect and analyse financial data

The financial analysis of an intervention estimates its financial impact on the implementing party, or those otherwise financially affected. The emphasis is on the assessment of monetised income, expenditure, cash flows, profit and end-of period balance. As a general rule, including monetised aspects is not essential in terms of decision-making as energy efficiency interventions can lead to many benefits which are most often not monetary and thus cannot be included directly in the financial analysis. However, gathering financial data is a major step towards estimating the overall benefits and costs

5. Define the economic benefits of the intervention

This step includes the identification and monetary quantification of various intervention benefits, correction of intervention costs with economic prices and calculation of the ENPV, ERR and B/C ratio.

6. Draw conclusions

Finally, the chosen indicators give us information about the cost-effectiveness of the intervention. This helps decision-makers to examine and draw conclusions on the actual cost-effectiveness of the intervention. These results can be used in assessing the level of success of the intervention.

4.2.

WHAT KIND OF DATA IS NEEDED?

Intervention planners should know how large the **total investment costs** of the intervention will be and what the **revenues** of the intervention will be. In addition to this, a decision on the most relevant costs in the cost estimation must be made. Investments include all start-up costs needed for the intervention. Revenues of an intervention can consist for example of the sale of goods and services. These revenues are determined by the forecasts of quantities of services provided and by their prices throughout the established time horizon. •

Examples of investment costs on the basis of analyzed case studies

- Installation of LED lightning;
- Organization of promotional campaigns and events;
- Organization of trainings;
- Organization of energy audits;
- Development and promoting a new cycling strategy;
- Reconstruction of energy inefficient buildings.

Examples of recurrent revenues (cost-savings) on the basis of analyzed case studies

- Fuel savings due to shifting transport preferences from personal to public transportation;
- Electricity savings due to improvements and reconstruction of properties;
- Electricity savings due to increased awareness about energy efficiency;
- Electricity / heat savings due to encouraging construction beyond existing energy efficiency regulations;
- Electricity savings via promoting and implementing LED in-house lightning.

4.3.

REMEMBER THE NON-MONETARY BENEFITS

After the data for costs and revenues have been collected, it is time to calculate the indicators. For more information on the financial indicators used in the analysis, please see Deliverable 5.2. Despite the usefulness of financial indicators in standard investment situations, they can only be used as a starting point in the evaluation of energy efficiency interventions. Energy efficiency interventions mostly result in benefits that are not necessarily financial in their nature, e.g. environmental benefits, improvement in the quality of life, etc. These **non-monetary benefits should be taken into account as well**. For example cities will most likely profit from energy efficiency interventions in many ways although no clear financial value can be estimated. However, the pressure to capture and quantify (monetize) non-monetary benefits by economic evaluation is clear. •

4.4.

CONFIRM THE POSITIVE EFFECTS

Economic benefits and economic costs are different from the financial ones. Interventions may have many relevant impacts which have no set market value (e.g. environmental benefits). These positive or negative effects or externalities need to be identified, quantified and given a realistic monetary value. In addition, appropriate conversion factors are needed for the values of the financial analysis. These put together will capture the most relevant economic benefits a project / policy action may generate.

The assessment of economic benefits and costs results in the calculation of economic performance indicators. Possible indicators are the **economic internal rate of return** (EIRR), the **benefit-cost ratio** (B/C ratio) and the **economic net present value** (ENPV).

ENPV is the most important and most reliable indicator according to the analysis made in Deliverable 5.2. It describes the difference between the discounted total social benefits and costs. A positive value of this indicator shows that the society benefits from the intervention and therefore the intervention is worth carrying out. The ENPV indicator is independent from the scale of investment, so it can be used to directly compare different interventions. Other possible indicators are described in the D5.2 report.

Benefits of an intervention can take the form of societal benefits that are not properly taken into account in the financial analysis because, even if they are an intended outcome of the project, they are not fully captured by the financial prices due to the lack of a market value. A typical example of these kinds of benefits is improvements in the quality of life of the people taking part in an energy efficiency intervention.

The general recommendation is to limit the assessment of externalities in the economic analysis to those for which a solid economic argument can be presented and for which estimates are realistically possible. Measuring and quantifying for example electricity savings as a result of a specific intervention is challenging since it requires comparisons of electricity consumption made in both intervention and non-intervention settings. •


COST
BENEFIT

4.5.

ECONOMIC ANALYSIS OF SELECTED PLEEC CASE STUDIES

As a part of the work done in WP5, some of the cases presented in D5.1. were analysed using the CAB method. In the D5.2. analysis, the economic net present value (ENPV) was chosen as the most important indicator for energy efficiency interventions. To examine the results with other indicators, please see D5.2.

CASE examples:

MOBI – promoting sustainable transport for employees

Short description: Using sustainable modes of transportation for employees.

Investments: 500 euro for the pilot (services). Investments are made to promote the use of sustainable modes of transport among a limited number of people in a company (50 for the case study – 10 euro/person).

Savings: Reduced use of fuel from 8 400 to 6 300 litres. The resulting savings from the case study are limited to the reduced fuel usage and these are the only savings used in the economic evaluation.

ENPV (based on CO2 emissions only): 10 325 euro. The economic net present value of the case study is positive which is an indication that the project is beneficial for the society as a whole, justified by the decrease of harmful air emissions.

Living labs

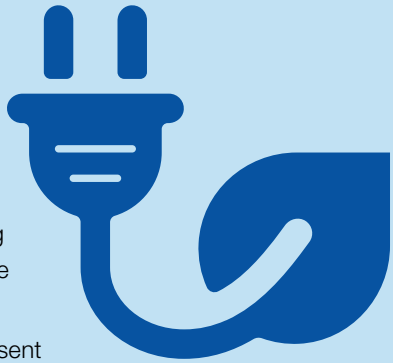
Short description: Real time information for energy performance and recommendations for households

Investments: 12 000 euro for the pilot (services). Investments are made for a relatively small target group of 150 people (80 euro per person)

Savings: reduced use of energy from 1 000 000 to 840 000 kWh. The resulting savings from the case study are limited to the reduced energy usage and these are the only savings used in the economic evaluation.

ENPV (based on CO2 emissions only): 93 761 euro. The economic net present value of the case study is positive which is an indication that the project is beneficial for the society as a whole, justified by the decrease of harmful air emissions.

Energy neighbourhoods



Short description: Organization of a climate network between public authorities and citizens.

Investments: 35 000 euro for the pilot (services). Investments are made for a relatively small target group of 240 people (146 euro per person)

Savings: reduced use of energy from 1 600 000 to 1 472 000 kWh. The resulting savings from the case study are limited to the reduced energy usage and these are the only savings used in the economic evaluation.

ENPV (based on CO2 emissions only): 54 946 euro. The economic net present value of the case study is positive which is an indication that the project is beneficial for the society as a whole, justified by the decrease of harmful air emissions.

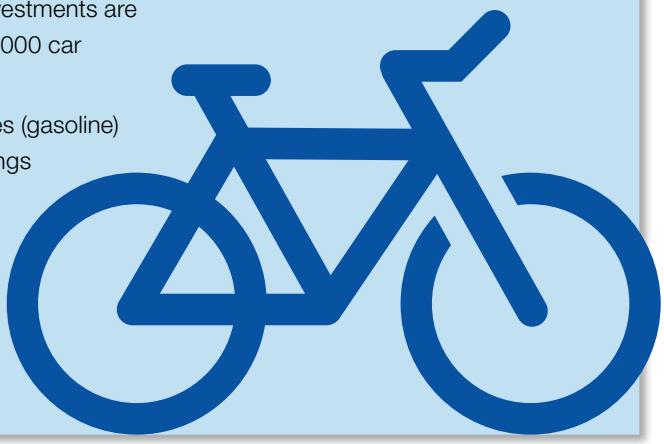
Car free week

Short description: Annually organised car-free week by means of variety of public transportation events

Investments: average of 6 000 euro for the pilot (services). Investments are made to promote the use of public transport among citizens (35 000 car users – 0.17 euro/person).

Savings: reduced use of fuel from 181 145 litres to 180 140 litres (gasoline) and from 55 899 litres to 55 590 litres (diesel). The resulting savings from the case study are limited to the reduced fuel usage and these are the only savings used in the economic evaluation.

ENPV (based on CO2 emissions only): 5 159 euro. The economic net present value of the case study is positive which is an indication that the project is beneficial for the society as a whole.



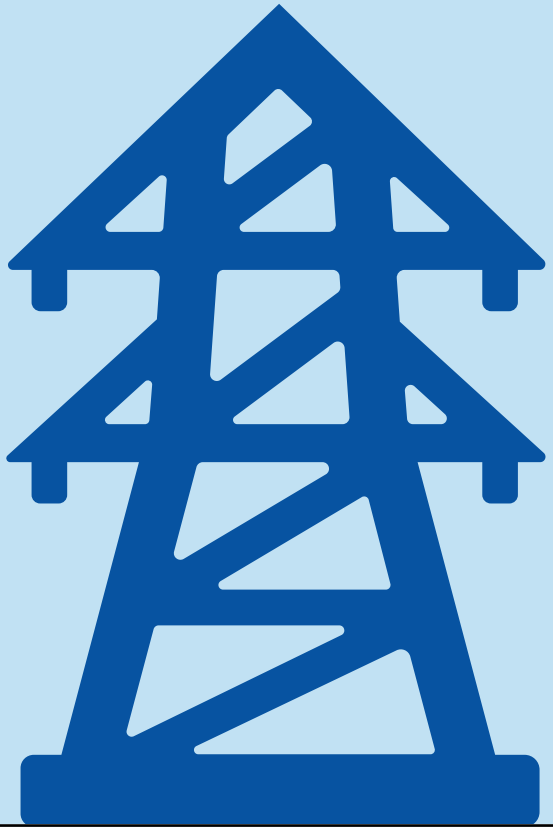
Renovation and insulation of block houses

Short description: Investment in renovations of existing block houses

Investments: 1 458 000 euro for the pilot (construction). Investments are rather high and are made to ensure energy efficiency of existing buildings (1 500 residents – 972 euro/person).

Savings: reduced use of energy from 13 500 000 to 9 000 000 kWh. The resulting savings from the case study are limited to the reduced energy usage and these are the only savings used in the economic evaluation.

ENPV (based on CO2 emissions only): 355 748 euro. The economic net present value of the case study is positive which is an indication that the project is beneficial for the society as a whole. It would be much higher if a larger time horizon is evaluated given the long term investment usage.



City of Oulu building supervision office – Guiding towards sustainable and energy efficient built environment

Short description: Extensive guidance to citizens to build energy efficient buildings beyond existing regulations.

Investments: 100 000 euro for the pilot (services). Reinvestments: 100 000 euro annually. Investments and reinvestments are made for an average of 350 people/year, resulting in 286 euro/person.

Savings: reduced use of energy up to 250 000 000 kWh. The resulting savings from the case study are limited to the reduced energy usage and these are the only savings used in the economic evaluation.

ENPV (based on CO2 emissions only): 155 million euro. The economic net present value of the case study is positive which is an indication that the project is beneficial for the society as a whole.

In order to select the most cost-effective interventions, two simple decision rules can be used:

Decision rule 1:
Interventions with ENPV less than zero should not be undertaken.

Decision rule 2:
Given a choice among alternative interventions, maximize the total ENPV.

All interventions are different in terms of their initial investment costs, energy and fuel savings. Because of the inherent differences between energy efficiency interventions in general, a clear interpretation of results is necessary to select the best actions for further implementation.

The financial impact is not always the best measure of success for interventions which seek further societal benefits, some of which cannot be converted to monetary values. For these reasons, the economic section of the cost-benefit analysis is the best starting point for comparing different interventions. •

Key findings regarding economic analysis:

1. Define the problem and determine the goals of the intervention

Any intervention planning process should start by determining the purpose and goals of the intervention, defining the problem the intervention is trying to solve, and how the success of the intervention should be measured. Making this phase properly makes evaluation of achieved progress achieved during and after the intervention much easier.

2. Collect sufficient financial data from the start

Unfortunately interventions lack sufficient economic data quite often. Interventions usually have some positive impacts, but without sufficient economic data and proper economic evaluations establishing funding priorities among existing alternatives is clearly a challenge.

3. Define the time horizon

Usually energy efficiency related interventions should have a relatively long time horizon to establish actual behaviour changes. A medium time horizon of 10 years is desirable to get clear results.

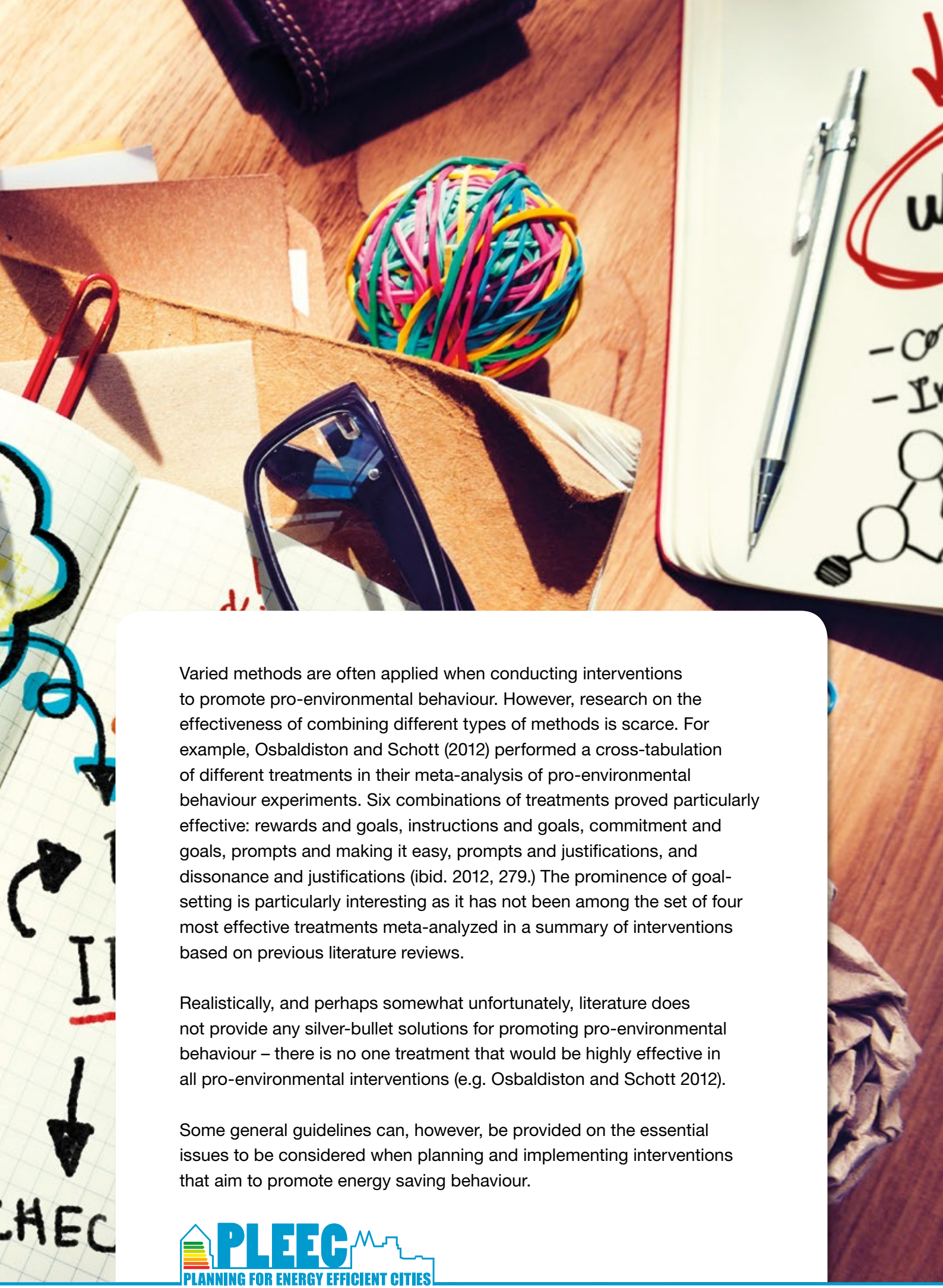
4. Remember the original goals during the intervention

Interventions tend to sprawl away from original goals. Checking the original goals during the execution phase keeps the intervention focused.

5. Remember and define also the non-monetary benefits of intervention in the evaluation

It is not always reasonable to evaluate the financial and economic benefits of an intervention. Some interventions have mainly non-monetary benefits, which can be hard to assess in economic terms.

5. HOW TO PLAN AND REALIZE SUCCESSFUL ENERGY SAVING INTERVENTIONS



Varied methods are often applied when conducting interventions to promote pro-environmental behaviour. However, research on the effectiveness of combining different types of methods is scarce. For example, Osbaldiston and Schott (2012) performed a cross-tabulation of different treatments in their meta-analysis of pro-environmental behaviour experiments. Six combinations of treatments proved particularly effective: rewards and goals, instructions and goals, commitment and goals, prompts and making it easy, prompts and justifications, and dissonance and justifications (ibid. 2012, 279.) The prominence of goal-setting is particularly interesting as it has not been among the set of four most effective treatments meta-analyzed in a summary of interventions based on previous literature reviews.

Realistically, and perhaps somewhat unfortunately, literature does not provide any silver-bullet solutions for promoting pro-environmental behaviour – there is no one treatment that would be highly effective in all pro-environmental interventions (e.g. Osbaldiston and Schott 2012).

Some general guidelines can, however, be provided on the essential issues to be considered when planning and implementing interventions that aim to promote energy saving behaviour.

GUIDELINES TO PLANNING, EXECUTING AND EVALUATING ENERGY-EFFICIENCY INTERVENTIONS

1. HOW TO GET STARTED?

DEFINE → EXAMINE

- YOUR PROBLEM
- YOUR GOAL
- THE BEHAVIOURS YOU WANT TO ADDRESS
- YOUR TARGET GROUPS
- THE APPROPRIATE METHODS
- YOUR COMMUNICATION STRATEGY
- YOUR RESOURCES
- YOUR SUCCESS INDICATORS AND YOUR BASELINE

THE COST-EFFECTIVENESS OF YOUR INTERVENTION

MAKE A PLAN FOR EVALUATION

2. HOW TO EXECUTE THE INTERVENTION?

- STICK TO YOUR PLAN
- ADJUST ACCORDINGLY
- MONITOR YOUR PROGRESS CONSTANTLY
- CHECK YOUR GOALS REGULARLY
- KEEP EVERYBODY INFORMED AND INTERESTED
- REMEMBER TO GATHER DATA AND FEEDBACK

3. HOW TO EVALUATE YOUR SUCCESS?

- CHECK YOUR DATA AND GOALS
- GATHER FEEDBACK
- ANALYSE FEEDBACK AND RESULTS
- EXAMINE BEHAVOURAL CHANGES BEFORE AND AFTER THE INTERVENTION
- ANALYSE THE COST-EFFECTIVENESS
- COMMUNICATE YOUR RESULTS

6. ENERGY EFFICIENCY AND BEHAVIOUR IN SIX MID-SIZED EUROPEAN CITIES

There is a great need to improve energy efficiency on the city level. Cities are a key contributor to climate change with an estimated 75% share of global greenhouse gas emissions being produced in cities (UNEP 2015). Buildings and the transport sector are the largest contributors to this share. Energy efficiency is key in reducing this ratio for urban activities. Energy efficiency can help cities relieve budgetary pressures stemming from the need to improve municipal services in the face of limited budgets. Therefore it is vital that the importance of behavioural incentives as an accelerator for technical and structural measures be recognized.

All cities possess their own unique combination of technological solutions and planning practices to promote energy efficiency. Thereby also the challenges faced by cities are complex. Changing the behaviour of the citizens, city planners, companies and other actors which all contribute to these challenges is therefore crucial when addressing the energy saving dilemma. The key challenges in energy efficiency of cities are, however, diverse. This report presents approaches that help practitioners in different sectors tackle the energy saving challenge.

Behaviour change is critical to achieving decrease in energy demand. **Understanding how people make choices on their energy consumption – whether consciously or unconsciously – is essential for designing energy saving policies.** More often than not, these efforts at the city level have not been planned strategically or streamlined with general city energy efficiency policies but are rather sporadic, scattered and often lacking in long-term effectiveness. Many small changes in behaviour can add up to big energy savings, but unless the small changes fit into the larger framework in energy efficiency planning of a particular city, their effects may be significantly reduced.

The goal of this report is to offer guidance for cities to conduct behavioural interventions to improve the energy efficiency in the many relevant sectors of city activities. The chapter at hand presents the past, present and future challenges of the six PLEEC cities from the behaviour-driven point of view. Some solutions are suggested and links provided to other chapters in this report for a more in-depth view into various issues of pro-environmental behaviour. The range of approaches and measures the PLEEC cities have used to undertake efficiency improvements via behavioural interventions has also been presented in PLEEC Deliverable 5.1. A more detailed presentation on how to plan and implement successful behavioural interventions to promote energy efficiency in cities is presented in chapter 5.

For a full account of the six cities' background reports on energy efficiency and behaviour, see the appendices.

6.1.

JYVÄSKYLÄ

6.1.1. Historical overview

Jyväskylä became more aware of issues concerning energy efficiency in the late 1990s. Since 1997, Jyväskylä has been implementing the National Energy Efficiency Agreement on the city's practices. The Agreement requires responsible energy and resource use in the city's own institutions and plans, and aims to achieve 9% energy savings in annual energy use between 2008 and 2016. As a continuation to the rising awareness, the Central Finland Energy Agency (CFEA) was founded next year, in 1998. The main task of the CFEA has been to promote renewable energy and energy efficiency in the region, and to support energy related regional policies and business development.

Jyväskylä has been active in adopting many national level policies and guidelines concerning energy efficiency. The citizens of Jyväskylä have also been active in environmental issues. Japa ry, the Jyväskylä Association of Sustainable Development, was founded in 2001 by concerned residential inhabitants who wanted to promote sustainable development in the Jyväskylä region. It is funded by the city and links together the voluntary work of citizens to the work of authorities. In addition to this, universities have played a key role in the more recent development of 'new economy' thinking where traditional "hard" industry has been replaced by new high-tech industry. •

6.1.2. Present situation

Today CFEA and Japa ry are the main actors in Jyväskylä when it comes to promoting energy efficient behaviour among local citizens and organizations. CFEA offers advice especially about energy efficient houses and energy efficient living. Japa ry on the other hand concentrates on waste reduction and recycling, sustainable mobility and organizing information and awareness raising activities in Jyväskylä during the annual national Energy Saving Week every year in October.

The municipality also actively participates in energy efficiency work. Jyväskylä has an ISO14001-based environmental management system and The Climate Programme (2011–2020) was accepted to be part of the environmental system by the City Council in 2011. The Climate Programme has a goal to reduce greenhouse gas emissions 20% from the 2005 level until 2020. To achieve this goal Jyväskylä has planned over 170 different behaviour-oriented tasks for its own organization. The building supervision office has an important role in guiding and promoting energy efficient building in Jyväskylä and the city's housing company works to promote awareness among its tenants.

Urban planning focuses on ambitious ways to promote energy efficient behaviour among citizens and organizations. For example, Lutakko and Kangas areas are old industrial sites near the city centre which are now under major redevelopment to become modern urban residential areas with efficient public transportation. Enabling better walking and cycling ways through the city is also an important part of new urban planning and investments.

On a strategic level, Jyväskylä has been taking steps toward sustainability. The new city strategy which was accepted by the City Council in December 2014 has strategic goals for changing the behaviour of the citizens. It aims to get people to explore and experiment and to take responsibility for oneself and others, including the environment.

Jyväskylä is becoming more resource efficient. The environmental policy in Jyväskylä aims to decrease the amount of waste and to increase the reuse of waste that is created. In 2013, Jyväskylä cooperated with the Finnish Innovation Fund Sitra in a joint project "Towards Resource Wisdom". The project created models for ecologically resource-wise lifestyle in urban environments in co-operation with local citizens, companies and organizations. •

6.1.3. Projects, programmes and actions in the key fields

Green buildings and land use

- Central Finland Energy Agency – advisory services on building and renovation
- City of Jyväskylä building supervision office – guidance and advice on building projects requiring a permit.

Mobility and transport

- Japa ry – mobility campaings for citizens' and employees
- City of Jyväskylä – mobility advice and campaigns for the city employees, mobility of citizens is affected through city planning

Technical infrastructure

- Central Finland Energy Agency – advisory services on building heating methods
- City of Jyväskylä building supervision office – guidance and advice on building heating methods (on building projects requiring a permit)
- Central Finland Energy Agency – advisory services on how to benefit from smart meters (through new information and behaviour change)

Production and consumption

- Central Finland Energy Agency – advisory services on energy efficient living and home maintenance
- Japa ry – advice on waste reduction and recycling; information and awareness raising activities during the annual national Energy Saving Week on week 41, October
- City of Jyväskylä – advice on efficient energy use for the employees
- "Towards Resource Wisdom" project, with Sitra in 2013

Energy supply

- Central Finland Energy Agency – advice on building heating and electricity production
- City of Jyväskylä building supervision office – guidance and advice on building heating methods (for building projects requiring a permit)

6.1.4. Main objectives and challenges of behaviour driven interventions in Jyväskylä

Municipal practices in Jyväskylä are largely energy efficient, with city policies reflecting the national climate and energy policies. Energy efficiency is implicit in most city actions and energy efficiency issues have been promoted in city policies for years also from the behaviour-driven viewpoint. According to the results of "WP2 City Report Jyväskylä", Jyväskylä has a lot to do in terms of sustainable transport. From a stakeholder point of view, the most important domains for energy efficiency in general are renovation and refurbishment, renewable energy, heating and cooling grids and private households. The most important driving forces regarding energy consumption in Jyväskylä are new technologies, economic transition and the information society.

The Climate Programme is the central framework for implementing behaviour related activities by Jyväskylä city. In addition, the city continues to work through Japa ry and the Central Finland Energy Agency, with funding and co-operation to offer advice and guidance to the citizens. In the future, Jyväskylä plans to concentrate on rationalising development around public transportation and energy infrastructures. Jyväskylä is planning to start negotiations with other Finnish municipalities for the next 2017–2020 term of Energy Efficiency Agreements as a part of the Energy Efficiency Directive. For the negotiations, Jyväskylä is going to create an action plan for future efforts to further increase energy efficiency and use of renewable energy sources, mainly in city organization. •

6.1.5.
Future recommendations by key fields

Based on the information gather during the PLEEC project in different work packages, the future recommendations for the municipality of Jyväskylä in the field of behaviour-driven energy efficiency are listed here.

Green buildings and land use

- There is constant pressure for scattered urban development. Restricting house building and commercial and services land-use as far as possible within a walkable and cyclable radius of the city centre.
- Developing a financial housing support system – favouring compact construction activities and providing the right frame for the right behaviour.
- City policies could be developed where land price corresponds with the energy efficiency of a new building.
- The land use costs could be demonstrated to the citizens through parking fees (and other possible fees).
- Communication strategy towards new builders, like tree planting schemes that reduce energy use in buildings with help of better solar access.
- Energy advice services to citizens and companies through the CFEA should be continued. CFEA should do more cooperation with city authorities.
- Developing financing practices which would monetize long-term energy costs in the near term would help Jyväskylä direct its energy efficient housing policies.

Technical infrastructure

- Maintaining the structural, integrated approach to heating and electricity production while exploring potentials and making choices for energy demand reduction is still called for.
- Smart grids have possibilities to engage consumers: visualizing and comparing energy use, an app that compares energy use with your neighbours, using the energy bill in communication with energy companies are some useful methods to explore.
- Resource saving could still be promoted via incentives for companies and households, for example via competitions.

Mobility and transport

- Through compact and energy efficient urban planning, rational transportation modes can be supported significantly and public transport be made more accessible. This can lead both to reduced costs for the inhabitants and reduced emissions.
- CFEA should put more effort into influencing the authorities responsible for transport infrastrucure planning.
- Reduce free parking and impose restrictive parking policies in the city centre.

Energy supply

- Real energy auditing including hidden energy and material demand of companies.

Production and consumption

- Raising awareness of energy issues in a more explicit manner is still called for, although these issues are covered implicitly in many city policies. These could be e.g. marketing campaigns targeted to consumers – if energy efficiency is a demand from consumers, the private sector will join the effort.
- Community building and collective responsibility are powerful methods. Engage neighbourhoods, involve the citizens, let them come with ideas and make them visible. Utilize peer pressure and trusted messengers.
- Energy consumption benchmarking should also be applied with households. Enabling building owners to monitor their own energy consumption and comparing their consumption to the best, the worst and average similar buildings and households is one of the most effective methods to reduce energy consumption of households.

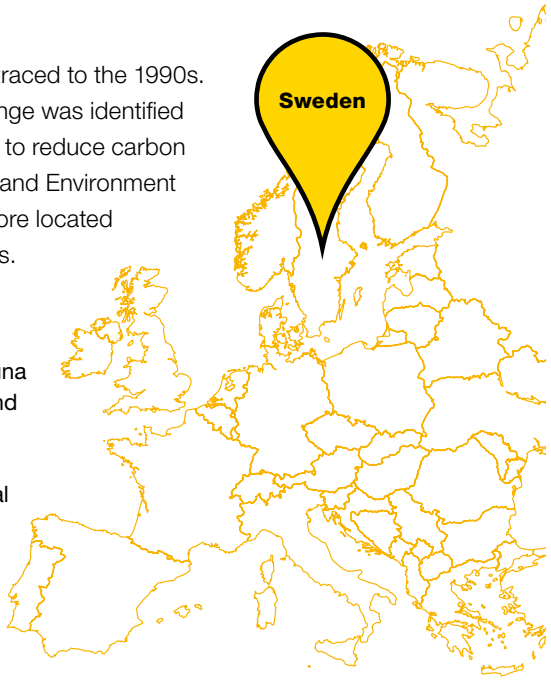

The environmental policy
in Jyväskylä aims to
decrease the amount of
waste and to increase
the reuse of waste
that is created.

6.2.

ESKILSTUNA

6.2.1. Historical overview

In Eskilstuna, the basis of the present day actions on behavioural change can be traced to the 1990s. The Agenda 21 process started at the beginning of the decade when climate change was identified as an important global environmental issue. In the 90s, Eskilstuna also set targets to reduce carbon emissions by 50% by 2010. As part of the Agenda 21 process, Eskilstuna Energy and Environment also developed their communication with the citizens by for example creating a store located in the city centre with information on energy issues and other environmental issues.



The city's environmental council was founded in 1993. In the late 90s, more progress was made on technical solutions than behavioural change. In the 2000s and afterwards Eskilstuna has particularly focused on different transport issues, like public transport marketing. In 2009, a person was hired to work with soft measures such as test traveller projects, bus design competitions, events etc. From 2012 onwards, Eskilstuna strengthened its efforts on mobility management and nowadays there are three employees that work with all sorts of mobility management from spatial planning processes to events and campaigns.

Eskilstuna was selected the best eco-municipality in Sweden in 2012. In 2012, cooperation between Eskilstuna city, the regional transport authority and Veolia (the company running the bus service) started. Waste management has been another key topic and optical sorting of waste begun in 2011 with a significant information campaign. In Eskilstuna, the social media, Twitter and Facebook have been in use with varying results. It has been experienced that it is important to inform people in this area but measuring the results of the marketing is challenging. •

6.2.2. Present situation

Eskilstuna has introduced energy and climate policies in most municipal sectors, in enterprise cooperation and in planning of the actions and procedures of the city. In the last few years, significant plans have been made in Eskilstuna and in the surrounding region. The municipal climate plan 2012 is considered in the formulation of the goals of the Eskilstuna (Deliverable 4.2./Eskilstuna). In addition, further significant plans and actions have been made in few years' time:

- Eskilstuna traffic plan 2012 including mobility management
- Spatial plan 2013
- Svelandsbana, the new railway connection

At present, Eskilstuna has extensive district heating powered with biofuel so there is no need to put equal efforts on thermal efficiency as some other European cities do. Overall, the focus therefore is more on electricity and traffic/mobility although thermal efficiency is not neglected. In terms of key fields, the following ones are emphasized: Green buildings and land-use, Mobility and transport and Production and consumption. Renewable energy is important but mainly with focus on biogas and solar energy.

Essentially, the Eskilstuna concern is the major force for projects and campaigns. In the concern the energy company, the public housing company and the municipal organization share the responsibility and all three have major projects in behavioural change, both separate and joint. In addition to the concern, there is an industrial organization that has worked well in the field of energy efficiency. Compared to other prominent Swedish Environmental municipalities, the power of NGOs and citizens seems less.

The municipality has also adopted a strong approach to reacting to pressing issues, which includes not waiting for national guidelines but the municipality taking proactive steps in climate-related initiatives. This means, for example, concerning the public or a strategy to brand the municipality on the basis of its climate initiatives. One example of such is the new "Partnership for climate" concept where a municipality gathers ambitious local companies and industry to network and to develop them to be pathfinders in climate issues. •

6.2.3.
Projects, programmes and actions in the key fields

Mobility and transport

- Walk and cycle to school (see Deliverable 5.1/ case M15)
- Bike campaign in May, continuing
- European mobility Week, continuing (see Deliverable 5.1/case M11)
- Test travel on public transport
- Cycle smart workplaces, continuing

Technical infrastructure

- Energy and climate advising, continuing

Production and consumption

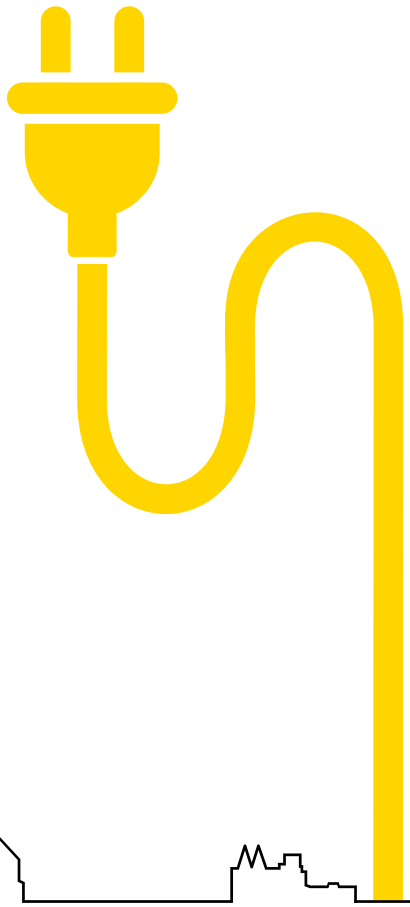
- Partnership for climate (for enterprises), continuing
- Energy efficient companies in Eskilstuna
- Environmental certification (for enterprises), continuing
- Strict and high demand on energy efficiency and renewable energy in procurement

Energy supply

- Map for solar energy, continuing

6.2.4.
Main objectives and challenges of behaviour driven interventions in Eskilstuna

According to results of "WP2 City Report Eskilstuna", the most important domains for energy efficiency in general in Eskilstuna from the stakeholders' point of view are renovation and refurbishment, renewable energy as well as pedestrian traffic and cycling. The most important driving forces in energy consumption in Eskilstuna are energy prices, new lifestyles and increasing welfare – forces which may work both to the benefit or the detriment of energy saving efforts.



Eskilstuna has an ambitious vision to be the most environmentally friendly industrial city in the world, which will be seen in energy efficiency actions and planning behavioural driven interventions in the future. These actions and plans include existing projects and traditional campaigns in the field of light traffic, public transportation and waste management. The use of the internet-based tools and social media possess an important role in promoting energy efficiency in the future.

County-based planning in different sectors will continue to be important in the energy efficiency work. The Södermanland County Administrative Board is responsible for ensuring that decisions from parliament and the Government are implemented in the county level (Deliverable 4.2./Eskilstuna). Activities to increase energy efficiency according to stakeholders focus mainly on subsidies and financial incentives, legal regulations, fees and penalties as well as with public or private investments (WP2 City Report Eskilstuna). •

6.2.5.
Future recommendations by key fields

Based on the information gather during the PLEEC project in different work packages, the future recommendations for the city of Eskilstuna in the field of behaviour-driven energy efficiency are listed below.

Green buildings and land use

- Good examples of on-line monitoring of energy use may be worthwhile to start in Eskilstuna in public buildings. When people and organizations see how their actions affect the use of electricity, it helps to change the habits also at the workplace. (see Deliverable 5.1/case P7)
- A new spatial plan has been produced in 2013. Changes in land use take a lot of time, but the new spatial plan will help in this area. A map of solar energy potential is furthermore one example of the optimal land use and positioning of buildings concerning micro/small scale energy production.
- Incentives for energy efficient refurbishment and building could be considered for private households and companies. (see Chapter 3.4)
- Continuing guiding of citizens, authorities and companies in energy efficiency to promote energy saving on the domestic level is crucial. To enable for more energy efficient building of privately owned housing, guidance aimed already in the planning phase of new houses would be beneficial (see Deliverable 5.1/ case P3).

Technical infrastructure

- Giving specific guidance and incentives to promote smart technologies in housing and lighting could be strengthened via established municipal energy advisory services. (see Chapter 3.4)
- An environmental management system could be established to coordinate energy efficiency work in the city's own institutes (if not already applied).

Mobility and transport

- Currently the most challenging area of CO_2 reduction in Eskilstuna is traffic. Eskilstuna has challenges with regional commuting and unsustainable transport. In the future the city must find solutions for decreasing the use of cars and increasing the use of pedestrian traffic and cycling. Good work has been done, and these efforts should be continued (Deliverable 4.2./Eskilstuna). For example, some effective mobility management campaigns affecting people's behaviour have been arranged. However, there is still work to be done and it is possible to lift up the share of cycling and pedestrian traffic via different campaigns, and more importantly, via developing the cycling and walking infrastructure by the examples from Holland and Denmark (see Deliverable 5.1./cases M2, M3, M13).
- There is also a lot of potential in smart mobility in a city which is technologically advanced (timing information etc.).
- Higher parking fees could be imposed in the city centre to provide a disincentive for public transport.
- On policy level: Enhancing policies on regional commuting (WP4). There has also been test travel campaign on public transport (Göteborg and Helsinki), which could be applicable in Eskilstuna.
- Keeping up and widening positive cooperation with other Swedish (e.g. current letter of intent with Västerås on labour market, transport, and commuting and energy efficiency) and Scandinavian cities and finding synergies like in building railways.
- Attention should be paid to the effectiveness and sustainability of the supply of goods.
- Incentives encourage people to choose sustainable transport modes. Managerial support from the workplace on such incentives is a viable option for promoting sustainable commute (see Chapter 3.4).
- Branding the city as "Sustainable transport city" would both create internal momentum and provide a regional example of good practices. Communicating about successful actions in this field keeps sustainable transport on the agenda of both the city administration and the citizens.

Production and consumption

- Ecological awareness of citizens in Eskilstuna is already high and the city communicates energy and environment issues effectively.
- Optical sorting of waste has changed the share of different fractions of waste. (see Deliverable 5.1/ Case T1)
- In the future, the attention should be turned to consumption and services, and to reduce the amount of waste generated and maybe to gather more specific waste fractions, such as cloths, different types of plastic etc.
- Eskilstuna uses extensive marketing measures to promote energy efficiency. In order to verify their effectiveness, marketing methods should be carefully planned. Target groups need to be specific and information tailored according to the target groups' needs. Clarity of the message of the marketing is important. (see Chapter 3.2)

Energy supply

- Renewable energy is seen as one of the most important energy efficiency domains according to stakeholders. From the behavioural point of view, this can be approached by promoting small-scale solutions for energy production via encouraging individual and clusters of heat pumps, solar cells and panels. For promotion methods, see Deliverable 5.1./E1.
- National level sustainable electricity certification system (est. 2003) will continue being important, as well as continuation of investments towards sustainable energy production. (WP4)

6.3.

SANTIAGO DE COMPOSTELA

6.3.1. Historical overview

In Santiago de Compostela, the work on energy efficiency and climate related issues started in the 2000s and the Aalborg Charter was signed in 2000. In the same year, the Local Environmental Council of Santiago de Compostela was created to consult in environmental issues. In 2012, the council of Santiago de Compostela created the area of Sustainable Urban Development and Innovation Department.

During the decade, several actions on sustainability and behaviour related interventions were carried out. The city itself has been the main organizer in these projects and campaigns, but different associations and universities have also been active. Actions have been introduced related to recycling, waste reduction and mobility management. A by-law that included a bonus for waste reduction won several awards between the years 2002–2004, for example the "Green Flag for Sustainable City" and "International Award of Good Practices". This practice is still ongoing and has reached good results.

In 2006, the Metropolitan Transport Plan was accepted for the Santiago de Compostela region. The main goal was to reach an equilibrium between pedestrians, private vehicles and public transport. The plan was revised in 2010. Also, a Sustainable Mobility Plan (SUMP) was started in 2010 in Santiago de Compostela. The improvements of the plan focused on small changes and gradual awareness on mobility management and quality of life trough better transport conditions. The plan and actions related to it are still ongoing. •

6.3.2. Present situation

At present, the main actors promoting energy efficient behaviour are the city council participating in environmental education, campaigns and research projects, public institutions (University of Santiago de Compostela), and some associations (SOGAMA – Environmental Galician Society). There are minor actions implemented by other companies that are focused on changing the behaviour of their consumers. For example, Schneider Electrics has realized a behaviour driven campaign "Xperience Efficiency" in November 2014. It focused on explaining through games and tips how the performing of daily activities can be done in a more energy efficient way.

Energy efficiency improvement in a historical city, where the actions are conditional on heritage conservation, is a key field in local politics. Waste reduction and transport efficiency, which focus on public transport promotion and improvement, are also priorities.

During the last year, significant plans have been completed. The Director Plan in sustainability and Energy Efficiency 2020 is a new instrument for planning, supporting and implementing the city-related sustainable and energy efficient policies. An important aspect and a challenge in Santiago de Compostela is the energy efficiency refurbishment in the historical part of the city, where actions are conditional on heritage conservation. Revision of the Special Plan is the municipal tool for this area. In addition, EFFESUS and SMART-IAGO projects are treating conservation and energy efficiency issues.

During the last two years, Santiago de Compostela has joined energy efficiency related networks. The CIVINET network is a Spanish and Portuguese association for sustainable mobility, energy saving and emission reduction. Covenant of Mayors is a European movement where participating local and regional authorities have committed to 20% reduction of CO2 emissions by 2020, but no actions have been made yet. One objective of Smart Cities Spanish Networks is to provide smart public services that are more efficient also in energy issues. •

6.3.3.
Projects, programmes and actions in the key fields

Mobility and transport

- Bike rental service, 2006–2011(see Deliverable 5.1/ case M14)
- Metropolitan Transport Plan, 2006, and revision to the plan, 2010
- Sustainable Urban Mobility Plan, 2010 and continuing (see Deliverable 5.1/ case M7)

Technical infrastructure

- By-law about waste, 2002 and continuing
- Glass recycling campaign, 2011
- Individual composter installation campaign, 2014
- Por una Navidad ecologica campaign, 2014

Production and consumption

- Good Environmental Practices, 2006
- Zero Emission City Project, 2014–2014
- EFFESUS Project, 2012 and ongoing
- Opere Project, 2013 and ongoing
- Xperience Efficiency by Schneider Electrics, 2014 and ongoing

Energy supply

- Sustainable Development Plan of USC, energy consumption generated with co-generation, 2003
- Creation of the Local Environmental Council of Santiago de Compostela, 2000

6.3.4.
Main objectives and challenges of behaviour driven interventions in Santiago de Compostela

From the stakeholders' point of view, the most important domains for energy efficiency in general are renovation and refurbishment, public transport, heating and cooling grids, public lighting and industry and commerce. Stakeholders in Santiago see that both city administration and other authorities are the parties able to influence energy efficiency in the future. Also, regarding renewable energy sources as well as motorized private transport, different private interest groups can play an important role besides the administrative agencies, as well education of private citizens. (Deliverable 2.3./Santiago de Compostela.)

Current plans in behaviour driven interventions concentrate on the results proposed in the different both closed and ongoing projects and campaigns. In the future, an important instrument for planning is the above mentioned Director Plan. Another instrument is the integral management tool for smart cities, which consists of consumption control, automatic regulation of water and energy, promotion of energy efficiency culture and behaviour, and PDCA of energy efficiency measures. Thirdly, the question how heritage conservation in the old city can be harmonized with mobility and other energy efficiency related aspects is currently discussed. The Special Plan will help with these questions.

Santiago de Compostela has challenges with readiness to change toward becoming a "smart city". In other words, Santiago has a lot to do with increasing skill levels and the amount of higher educated people in its population. There are also challenges in the availability of IT-infrastructure (which is below European average), marketing and innovative thinking. (Deliverable 2.3./ Santiago de Compostela.) As energy efficiency policies mostly follow regional policies, the city council itself has limited powers in terms of enforcing households or companies towards more energy efficient behaviour. Regional and local plans have been made to reduce energy consumption in public transport, however these efforts have been largely unsuccessful.

6.3.5.
Future recommendations by key fields

Based on the information gather during the PLEEC project in different work packages, the future recommendations for the city of Santiago de Compostela in the field of behaviour-driven energy efficiency are listed below.

Green buildings and land use

- The challenge in Santiago de Compostela in terms of green buildings and land use arises from historical buildings, high energy consumption and the low role of municipality as a policy maker.
- Projects on on-line monitoring of energy use may be worthwhile to start in Santiago de Compostela. When people and organizations see how their actions affect the use of electricity, it helps to change the habits. Systematic energy audits in public and apartment buildings could also help in raising awareness (see Deliverable 5.1/case P7).
- Encourage modernizing of old heating and air conditioning (see Deliverable 5.1/Case P3).
- Continue carefully planned refurbishing of historical buildings.
- Campaigns about energy efficiency for local authorities, emphasis on cost benefits (see Chapters 4. and 5.).
- Encourage and steer planning of public spaces in such a way that multifunctional space – utilization is possible.
- Marketing campaigns and guidance for residents and landlords about the benefits of retrofitting and of different available renewable energy options should be planned (see Chapter 3.2).
- Make sure land use planning supports sustainable transport and encourages walking and biking (like defining more pedestrian zones to make walking/cycling more attractive) (see Deliverable 5.1/Case M17).

Energy supply

- As Santiago de Compostela has an ideal location for solar energy use, interventions should encourage and guide inhabitants and companies in changing to solar energy. (see Chapters 3.4 and 5.)

Mobility and transport

- Commuting and biking present the main challenges regarding mobility and transport. There is a high ratio of private car ownership and only a fraction of daily trips from the surrounding municipalities are done by public transport (see Chapter 3.5).
- Increased traffic control could promote traveling to school by foot/bike. Making it more difficult to take private transport is a powerful disincentive.
- Planning cycling infrastructure should be started by defining main target areas. Allowing for public participation in the planning process could guarantee that the most potential routes are planned, bringing added value to this process and ensuring future benefit.
- Electric bicycles could be piloted for commuting purposes with e.g. city employees. Introduce a system for electric bicycles with wide tires that fits for the old streets.
- Test travel campaign on public transport could be worthwhile in Santiago de Compostela. The campaign could be realized with the aid of experiences from Göteborg and Helsinki (see deliverable 5.1/Cases M5 & M10), and the campaign should reach all the inhabitants of the municipality.

Production and consumption

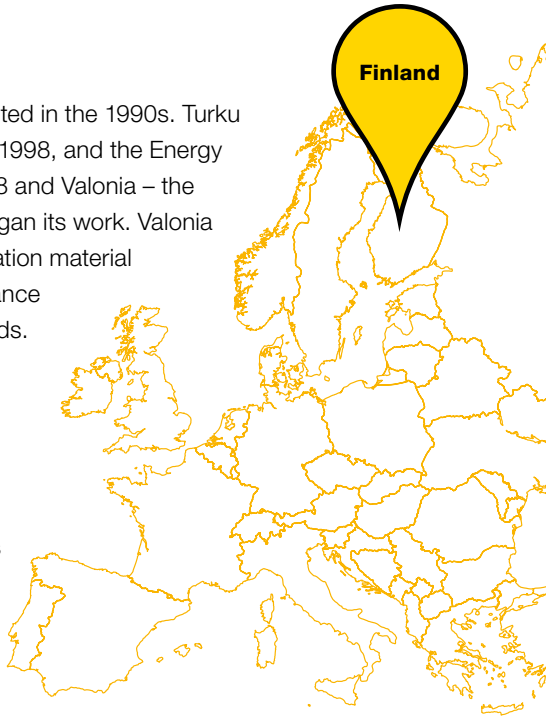
- In the future, the city council should turn attention to consumption, services and circular economy, and to diminish the amount of waste generated.
- Students in the environmental field could be employed in planning energy efficiency interventions and incentives as part of their studies, in cooperation with the municipality or SMEs.
- Citizens should be involved in creating a brand for an energy efficient Santiago. Involving the citizens in developing energy saving measures will create commitment and hence be more effective in achieving permanent behaviour change. Social pressure and peer-to-peer ("trusted messengers") tactics have also shown promising results (see Chapter 3.1).
- The city council should promote the use of energy audits in order to identify the biggest energy losses and the biggest potential. Different certification and audit systems are a good means of committing companies into energy saving as they entail longer term planning, goal-setting and commitment.

6.4.

TURKU

6.4.1. Historical overview

From a historical point of view, active work with environmental issues in Turku started in the 1990s. Turku signed the Aalborg Charter in 1996. Turku Agenda 21 Agency was established in 1998, and the Energy Agency of Southwest Finland in 1999. These two agencies joined together in 2008 and Valonia – the Service Centre for Sustainable Development and Energy of Southwest Finland began its work. Valonia has arranged a wide array of campaigns, events, seminars, and produced information material over the years. The target groups for Valonia's work are the public sector (for instance municipalities), companies, organizations, as well as local residents and households.



In Turku, biofuel based district heating has been heavily invested in. Turku Energia's Oriketo biofuel heating plant started to operate in 2001 and in Varissuo in 2011. The energy source of both plants is wood. The output of the Oriketo plant corresponds to one sixth of the district heating of Turku. Heat has been produced also from municipal waste (the waste incineration plant was closed down at the end of 2014), and by utilising landfill gas and waste heat from customers. The Kakola wastewater treatment plant (est. 2009), has also proved to be a reliable and profitable investment. The plant utilises energy waste from wastewater, producing approximately one tenth of the Turku district heating. The plant also supplies almost all the district cooling Turku requires.

The Climate and Environmental Programme 2009–2013 was approved in 2009. The aim of the programme is to reduce greenhouse gas emissions per inhabitant by 30% from the level of the year 1990 by 2020. The main objective is to increase the share of renewable energy in the production of district heating and electricity by improving energy efficiency in all sectors and activities and by promoting the possibilities for sustainable mobility. To reach the goals concerning behaviour change, eco support training was started by the City of Turku. Also, the infrastructure of walking and cycling routes in the city centre was another major concern.The City of Turku started sustainable development budgeting as a part of the Climate and Environmental Programme. The city offices and public utilities were required to set goals in emission reduction. •

6.4.2. Present situation

The central document guiding sustainable development in Turku is the Climate and Environment Programme 2009–2013 that will be followed until 2015. Finland is now obligated to comply to the EU's goal to reduce CO2 emissions by 80–95% by 2050 (Ministry of Employment and the Economy 2014). The goal of the National Energy and Climate Strategy is to decrease energy consumption and increase the share of renewable energy to 38 per cent by 2020. (Deliverable 4.2./Turku) In the field of energy production, Turku Energia's goal is to increase the share of renewable energy in the production of electricity and heat to 50% by the year 2020.

In a few years' time important plans and action plans have been made in the Turku region. The structural model 2035 for the Turku urban region describes the desired development of the community structure in the long term. The model guides land use planning on a general level and functions as the starting point of the regional land use plan and general plan. The regional council of Southwest Finland leads regional traffic system planning in the area. As a part of the Turku urban region structural model 2035 work, the new regional traffic system plan was published in 2014. The public transport programme Föli, organised jointly between six municipalities in the Turku region, was introduced in July 2014. A joint ticket system is a vital part of the programme. The goal is to attract more people to choose the bus instead of the car.

The City of Turku has also asked for ideas from the city employees how to save money and lower the costs of the city. Over 1 500 ideas were received, some of them were related to behaviour and energy. The ideas are currently going through a second round of processing and many of them will be put into action shortly. •

6.4.3.
Projects, programmes and actions in the key fields

Green buildings and land use

- Climate-Proof City – Tools for Planning.

Mobility and transport

- European mobility Week, local events, continuing
- Take the Bus to Work, 2013–2015 (see Deliverable 5.1/ case M8)
- Biking to Work, 2012 (see Deliverable 5.1/ case M16)
- By Bike to Work competition, continuing (see Deliverable 5.1/ case M12)
- Turku urban region public transport FÖLI, 1. July 2014 →

Production and consumption

- Eco-support training, continuing (see Deliverable 5.1/ case P5)
- Establishment of a procurement and logistics centre, 2013
- The City of Turku stated to buy electricity produced by 100% from renewable energy sources. The agreement for renewable energy is effective during the period 2013–2015 with an option for 2016.
- Eco Home, 2013–2014
- Kelaa (Sustainable consumption and quality of life), 2008–2011
- National Energy Efficiency week

Technical infrastructure

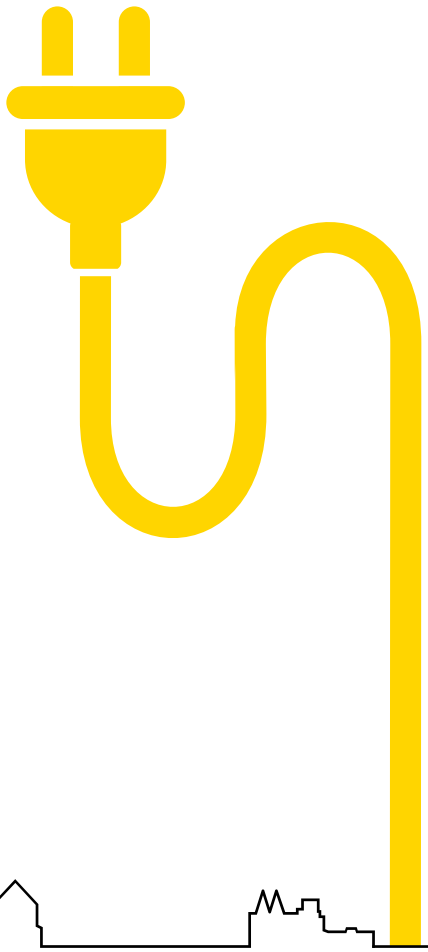
- Energy and climate advising, continuing
- Energia Online web service, continuing
- Kakola wastewater treatment plant, 2013
- Renewal of street lightning, 2013 – and 2015

6.4.4.
Main objectives and challenges of behaviour driven interventions in Turku

The goal of the Climate and Environmental Programme is to reduce greenhouse gas emissions per inhabitant by 30% from the level of the year 1990 by 2020. The biggest reductions can be achieved by increasing the share of renewable energy in the production of district heating and electricity, by improving energy efficiency in all sectors and activities, and by promoting the possibilities for sustainable mobility.

Some rather ambitious targets especially regarding carbon neutrality have been set for Turku. The ultimate goal is for Turku to be carbon neutral by the year 2040. However, as new strategies for energy efficiency were approved in June 2014 they include very little on behavioural driven energy efficiency. In addition, the city of Turku has worked on a road map for energy and climate actions from the autumn of 2014. The road map will include some actions for behavioural driven energy efficiency.

In general, changing the modal split towards more cycling, walking and public transportation is of main concern in Turku. (Mäkinen 2014 in Deliverable 4.2./Turku). Energy is in general of less interest compared to other planning related themes, however general energy advisory services have established a strong foothold in Turku. One of the most important behavioural instruments in reaching above mentioned goals was starting the eco support training. •



6.4.5.
Future recommendations by key fields

Based on the information gathered during the PLEEC project in different work packages, the future recommendations for the city of Turku in the field of behaviour-driven energy efficiency are listed below.

Green buildings and land use

- Improving the energy efficiency of both renovation and new construction should be heavily invested upon. To allow for this, more effective advisory services are needed in this sector. The new areas, in particular Skanssi, will hopefully pave the way for more sustainable planning practices.
- Energy advice by the building supervision office could be piloted to allow for low threshold and proactive information for households planning to build new detached houses. (See PLEEC Deliverable 5.1., case P3.) Advice should particularly be given on the energy efficient building solutions available and on how to integrate RE solutions to houses.

Mobility and transport

- Major advancements for public transport have been achieved by Föli, which has been created by combining the local and regional transport between Turku and five surrounding municipalities. There are talks about widening the area to other surrounding municipalities as well. Cross-traffic connections are however not prevalent in the regional traffic. Improving cross-traffic connections between surrounding areas could improve the modal split towards public transport in the surrounding municipalities.
- Cycling routes are patchy at many parts of the Turku city centre and need developing to make cycling more appealing.
- European Mobility Week has become an established activity in Turku with various campaigns and events, in addition to various other campaigns promoting sustainable mobility. These should be continued.

Technical infrastructure

- Turku Energia energy company has installed smart meters to all detached houses. Informing about the use of these meters has however been lacking. Online data is accessible only via the company's website and consumption data is updated only once a day. In order for direct feedback to be effective, it needs to be more easily accessible, for example vie a smart phone app. Indirect information in electricity bills need to be more informative (see Chapter 3.3).
- Parts of city street lightning will be replaced by LEDs by the end of 2015. This process is very welcomed and should reach a wider coverage as now it includes approximately less than a quarter of all street lights. Street lighting should be expanded in the riverside area to encourage pedestrian traffic and cycling also in the wintertime.

Production and consumption

- There have been several successful campaigns to promote sustainable consumption. These should be continued with more segmentation – addressing specific consumer groups. (see Chapter 3.2)
- The City of Turku already uses 100% renewable energy in city owned buildings. This fact is not very well advertised. The city should brand itself as energy efficient more strongly and act as a forerunner.

Energy supply

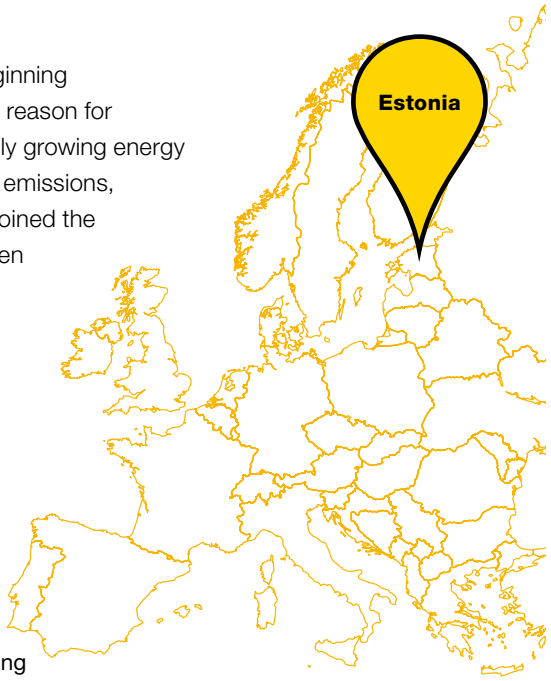
- The Oriketo waste incineration plant is being shut down and a new plant will be built in Salo. Continuing of waste education at household level is key to reducing the amount of waste generated.
- Energy advice service for consumers in the Turku region is ongoing by Valonia and is complemented by events. Different events for promoting small-scale energy production have proven successful and should be continued.

6.5.

TARTU

6.5.1. Historical overview

In Tartu, active work on energy efficiency and behaviour change started in the beginning of 2000s. Most actions and campaigns have been made during recent years. The reason for the raised awareness on environmental issues is EU's climate policy and the rapidly growing energy prices. Targets set by the European Union, the 20-20-20 reduction in greenhouse emissions, are leading decisions and actions by the government of Tartu city. Tartu has also joined the Aalborg Commitments. An important point in promoting the energy sector has been the establishment of Tartu Regional Energy Agency in 2009.



The main tools in changing behaviour in energy efficiency have been study days, contests and promotions. Various projects carried out by means of information dissemination play an important role. One method that has been used by the city to promote the development of sustainable solutions is personal example. The city of Tartu has introduced environmentally friendly means of transportation (gas cars, electric cars) to draw attention to the city's citizens and businesses, and develop solutions for sustainable habits.

Over the years, a number of traditional campaigns have been developed which are organized on a regular basis: a car-free day, city leaders' bicycle trip, celebration of Children's Day, a competition to identify most energy-saving buildings, construction of underground waste containers for apartment buildings, to save space and to direct more residents to sort waste and re-use. Since 2002 Tartu has also been actively involved in EU projects, including ones promoting energy-related issues. Key areas have been transport, water, waste, alternative fuels and building technologies. •

6.5.2. Present situation

The main interest of the city and the various campaigns and training courses aimed at guiding the behaviour of the inhabitants is to ensure the future of a cleaner urban environment and improve the quality of life for residents. By Tartu Agenda 21, the main target is "Tartu – a sustainably developing, socially responsible and economically thinking town". The main applied areas are administration, environment and society. No exact information and numbers about fulfilling this agenda are anyhow offered.

In recent years, "Tartu City Transport Development Plan 2012–2020" was accepted. The main objectives in this plan are to reduce motorization and to increase the share of public transport and light traffic in the overall urban transport also with the help of mobility management and behavioural change. The introduction of biogas in the city buses will start in 2017 and half of the public transport vehicles should be environment friendly.

Main tools are campaigns and workshops, to a lesser extent social media and publications. In Tartu, the city itself is the main organizer of projects and campaigns on behavioural change, to a lesser extent, the NGOs are involved in this work. At present, the most important target group is seen to be the children, and the idea is "for children's sake". •

6.5.3.
Projects, programmes and actions in the key fields

Green buildings and land use

- Elaboration of energy saving measures for renovation of apartment buildings (see Deliverable 5.1/ case G2)
- Fund KredEx, ongoing (see Deliverable 5.1/ case G1)

Mobility and transport

- European Mobility week, yearly events
- Car free week (see Deliverable 5.1/ case M9)

Production and consumption

- Ökotugi
- Environmentally themed Olympiads in schools
- Natural and environmental curricula in schools and kindergartens
- Youth-oriented international training courses on sustainable development
- Energy and climate advising, continuing (see Deliverable 5.1/ case P4)

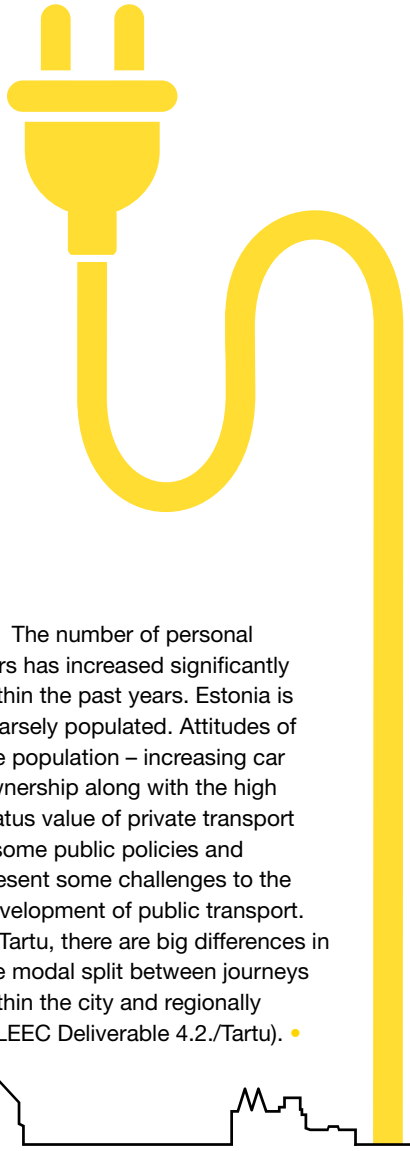
6.5.4.
Main objectives and challenges of behaviour driven interventions in Tartu

The most important goals of the Estonian environmental strategy are the promotion of environmental awareness and the implementation of environmentally sustainable technologies. These and a sustainable mode of production are the preconditions for the solution of numerous problems. According to the Estonian environmental strategy, environmental protection must be placed higher than the interests of political parties and current economic problems. All who use the natural environment must be held fully responsible for their activities. Traditional nature protection has to be promoted to deepen the understanding of the value of nature in society.

In Estonia, energy production causes the highest share of CO2 emissions. Energy supply is mostly based on imports (oil and gas) and 85% of electricity is produced from Estonian oil shale. Higher energy efficiency of energy production is mostly steered by the need to become less fuel dependent. In Tartu, the main employers are the city along with the university and there are no significant industries (PLEEC Deliverable 4.2./Tartu). Most energy related challenges are thus related to transport and residential heating. In essence, the main key themes of behaviour-driven energy efficiency in Tartu are the development of light and public transport, sustainable energy and sustainable resource use.

In Tartu, the plan is to continue further development with existing projects and with traditional campaigns in the field of light traffic, public transportation, and waste management. Further, the plan is to increase the use of internet-based tools and social media. Also, county based planning in different sectors is considered important. The Development Strategy "Tartu 2030" addresses the future challenges of the city's development. The strategy focuses on urban structure reformation, which has a direct link to modifying citizen behaviour change via structural means.

Private ownership is high in Estonia and therefore there are limited opportunities for a municipality to affect household decisions on e.g. renovation of buildings or connection to the district heating network. These constraints present barriers to behaviour change. Tartu city transport development plan 2012–2020 addresses problems related to motorization and the transport system, namely the fact that car usage has grown while the use of public transportation has decreased (PLEEC Deliverable 4.2./Tartu). The plan aims to facilitate reducing private car use via new transport and taxation policies and by raising the attractiveness of alternative transport modes.



The number of personal cars has increased significantly within the past years. Estonia is sparsely populated. Attitudes of the population – increasing car ownership along with the high status value of private transport – some public policies and present some challenges to the development of public transport. In Tartu, there are big differences in the modal split between journeys within the city and regionally (PLEEC Deliverable 4.2./Tartu). •

6.5.5.
Future recommendations by key fields

Based on the information gather during the PLEEC project in different work packages, the future recommendations for the city of Turku in the field of behaviour-driven energy efficiency are listed below.

Green buildings and land use

- Building refurbishment is one of the main issues that need to be addressed to decrease energy use of households. (See Deliverable 5.1/ case P3.)
- Renovation of Soviet-era apartment buildings to decrease energy consumption in Tartu has been addressed incentive-wise already with successful results (PLEEC Deliverable 5.1./G3). This activity should be continued as the results have been very promising with the investment grant being often the tipping point for renovation decisions. Both authorities and private actors should still be informed about available measures.

Mobility and transport

- Mobility issues present the main challenges in Tartu also from the behavioural point of view. Special attention should be paid on how to transform citizens' attitudes into more in favour of public and light transport. (See Chapter 2.2.)
- There is a need to develop transport planning across local borders (PLEEC Deliverable 4.2 /Tartu). Special attention should thus be paid to promoting regional cooperation between neighbouring governments to allow for more efficient regional transport and to take joint efforts to improve the competitiveness of public transport.

Production and consumption

- Raising awareness on energy issues has been addressed with varied methods with some good results. Setting a personal example by the city of Tartu itself in introducing environmentally friendly solutions is a good means to draw attention to these issues at companies as well and to maintain energy efficiency issues on the city's agenda. (See Chapter 5.)
- Privatisation of the housing market poses challenges on planning to have an effect on behaviour-driven energy efficiency as the municipality has limited influence on household decisions regarding e.g. refurbishment. Any informational campaigns on energy efficiency promotion should therefore be integrative and utilize various approaches and measures. (See Chapter 5.)

Technical infrastructure

- Replacing public lighting with LEDs is one of the measures that be undertaken to improve energy efficiency in Tartu city area. It is important to consult the citizens in order to ensure that the dimming changes are experienced as suitable also in areas which might have road security concerns.

Energy supply

- From the stakeholder's point of view, renewable energy is one of the most important domains for energy efficiency. There already are strong incentives to invest in renewable electricity in Estonia. However, less than 5% of single-family-houses are connected to district heating, making heat pumps and wood furnaces the main heating sources. To improve the energy efficiency of these heating modes, it is recommendable to raise awareness about their proper use (see e.g. PLEEC Deliverable 5.1./E1).

6.6.

STOKE-ON-TRENT

6.6.1. Historical overview

In the United Kingdom, fuel poverty is one of the most difficult questions affecting energy efficiency. The sharp rise in fuel prices in recent years has led to an estimated doubling of the numbers of people in fuel poverty in the UK. Since 2004, gas and electricity prices have risen by 109% and 71% respectively (Affordable Warmth Strategy 2012). The official definition of fuel poverty has changed.

In the past, a household was defined as fuel poor if it needed to spend more than 10% of its income on fuel to maintain comfortable conditions (usually 21°C in the living room and 18°C in other rooms). However, this definition was criticised as being over-sensitive to price changes and technicalities in the calculation, and the Hills Review resulted in a more sophisticated definition of fuel poverty, based on households having both:

- higher than average required fuel costs, and
- if spending this amount on fuel would push residual income below the official poverty line.

This is known as the 'Low Income High Costs' indicator (LIHC).

In 2011, the city of Stoke-on-Trent had 14.7% (15 847 households) that were affected by fuel poverty. Fuel poverty is caused by a combination of the following three main factors:

- High Costs of Energy;
- Low Incomes; and
- Home Energy Inefficiency.

The built environment, particularly the old housing stock is ill fit for energy efficiency. In response to this challenge, a number of programmes have been introduced which seek to tackle fuel poverty. Traditionally programmes have focused on physical interventions. In the last 6 years, there have been 44 724 energy saving measures installed into 24 886 homes in city at a cost of £37.7m.

In recent years there has been an increased recognition in the City of Stoke-on-Trent that changing our behaviour, through relatively minor alterations, can deliver wide ranging benefits in terms of energy efficiency. In response to this, there has been the introduction of a number of projects and programmes that have sought to focus on behavioural change within their approach, as well as traditional physical measures.

In 2008, the City Council commissioned the fuel poverty charity 'Beat the Cold' to deliver a programme of energy advice in Stoke-on-Trent. The programme sought to provide a wide range of energy services to residents in the city through training, advice lines, homes visits and attendance at community events. In addition to this, the programme also sought to train other key stakeholders operating in the area to enable them to provide advice to residents of the city.

The key focus of the project was to ensure that all of the City's residents had free and impartial access to up-to-date energy efficiency information to help them make informed choices and lifestyles changes in regard to energy efficiency.

Running in parallel with the 'Beat the Cold' intervention was the introduction of the North Staffordshire Warm Zone (2007–2013). In addition to a number of 'hard' measures (e.g. loft & cavity insulation, boiler replacement, energy efficient bulbs, etc.) the programme offered a number of 'soft' measures to residents – for instance face-to-face advise to residents and energy efficiency awareness sessions in primary schools.

More recently, the council's Housing Services Division in partnership with the city council's public Health Department managed a Warm Homes Healthy People programme. This programme provided funding to third sector agencies to increase their capacity to provide affordable warmth services over the winter periods. This has helped reduce winter pressures on local health services and ensure vulnerable people can access services for support. Support includes home energy advice/ behavioural change as well as winter checks, emergency shopping errands, telephone advice and home visits.

In terms of the built environment, The City Council of Stoke-on-Trent has also produced Sustainability and Climate Change – Supplementary Planning document in 2012, which seeks to change behaviour and embed sustainability considerations as a main factor in spatial and building planning process. Through a structure approach to sustainability, the document encourages people proposing building work to consider sustainability and energy efficiency at the conception stage and design their building around this concept.

In terms of mobility and transport, during the last 15 years the municipality has invested in bike routes in the city (160 km), especially in years 2008–2010 in the Cycle Town programme. Despite these actions, the share of the modal split of cycling has not increased, and low ca. 2%. The Local Transport Plan 2012 shows that trips in the area happen mainly within the urban area itself. Up to 59% of the population travels less than 5km every day. This is seen as an opportunity for investment in sustainable commuting, and the ambition of the plan is to raise the share of sustainable commuting. Recently the Travel Smart project has continued this work. •

6.6.2. Present situation

At present in Stoke-on-Trent the main focus in behaviour driven energy efficiency is on housing and fuel poverty. This is important in both economical and in social terms. The City Council is the largest landlord in the city and it has a leading role in delivering behaviour driven energy efficiency proposals. The City Council is also writing a new fuel poverty strategy for years 2016–2020. A newly started project, Powerhouse Central, is also one action to promote this subject and especially to promote actions connected to energy production, energy conservation and innovative technology. The intention is also to ensure energy security to local industry, promoting research and development in the city and the application of research on energy conservation into commercial manufacturing.

In 2012 the City Council adopted the Green Homes and Affordable Warmth Strategy. The strategy aims to reduce household energy consumption and domestic carbon emissions by accelerating the installation of energy saving and energy generation measures into the city's housing stock. The strategy provides a plan for investment and activity which ensures that there is a comprehensive and consistent approach to tackling fuel poverty and housing related energy efficiency issues in the city. The strategy acknowledges that behaviour change can be a key method to tackling energy efficiency. The strategy promotes the education of consumers in terms of paying, choosing suppliers and identifies the need to train staff from the City Council who work within the housing stock on issues surrounding energy efficiency.

In general terms, the city's current performance in terms of energy efficiency is low, however Stoke-on-Trent has undertaken significant work in order to improve the old, inefficient housing stock in the city, particulary in areas of high fuel poverty. Stoke-on-Trent's average Standard Assessment Procedure (SAP) rating for energy efficiency of the social housing stock and provate sector stock is 69 and 59 respectively. This is over the national average SAP rating of the UK's social housing and private stock which is 62 and 53 respectively. In 2010 Stoke-on-Trent was ranked in the top 10% of local authorities for improving its housing stock.

The resulting social and economic costs pose a major challenge for the city. Sustainable solutions must be reached at all levels of sustainability – the social, economic and environmental – in order to guarantee long-lasting results. Energy efficiency developments in Stoke-on-Trent must therefore be conducted with the social aspect at the forefront (PLEEC Deliverable 4.2 /Stoke-on-Trent). When it comes to behaviour-driven energy efficiency interventions, public participation in planning should be heavily emphasized.

6.6.3. Projects, programmes and actions in the key fields

Green buildings and land use

- Warm Zone, 2007–2013

Mobility and transport

- "Travel Smart"
- Stoke-on-Trent cycling strategy

Technical infrastructure

- Solar Photovoltaics, 2010–2012
- Powerhouse Central Project, 2014 and ongoing

Production and consumption

- Beat the cold, 2008
- Fuel Switching and Energy Advice, 2011–2013
- Energy company Oblication
- Community Energy Saving Programme, 2010–2013
- Warm Homes Healthy People Programme 2011 and ongoing

6.6.4.
Main objectives and challenges of behaviour driven interventions in Stoke-on-Trent

Fuel poverty forms the essential framework for future action in Stoke on Trent. Action to alleviate this issue is planned to continue with further development with existing projects and seeking new ones. Much hope is set to new technologies, for example in district heating.

Another important aspect in Stoke-on-Trent is spatial planning. The city was originally established of six separate towns, and this results in the unique polycentric spatial structure. Also, inhabitants are very much connected to their own communities, and this might decrease the need to travel, if inhabitants could find the necessary services at walking distance. This spatial structure makes it also a challenge, because this kind of city structure makes it difficult for investors to find attractive areas to invest. (PLEEC Deliverable 4.2/Stoke-on-Trent.)

To a large extent, influencing the behaviour of citizens in Stoke vis-à-vis transport choices is very much bound to planning of transport networks. The difficulty for public transport to effectively serve the dispersed travel demands created by the spatial development of the the city results in a higher share of private car use, despite low car ownership levels and affordability issues. •

6.6.5. Future recommendations by key fields

Based on the information gather during the PLEEC project in different work packages, the future recommendations for the city of Stoke-on-Trent in the field of behaviour-driven energy efficiency are listed below.

Green buildings and land use

- Develop Fuel Security into a brand, which is used in communication. Underline the benefits of retrofitting to the citizens and not just the occurring energy and financial losses.

Mobility and transport

- Walking and cycling represent only 13% of current modal share. As most of the trips made daily are less that 5km for 59% of the population, this presents ample opportunities for investing in sustainable transport modes and walking and cycling light traffic in particular.
- Hard measures, such as building cycle lanes, should be supported by various softer measures such as promotion and training, with emphasis on personal finance and health benefits.
- For public transport to become an affordable and easy travel option, a longer term view of spatial planning is required, requiring denser development.
- To address the environmental impacts of buses themselves we will continue to work with local operators to identify opportunities to invest in low emission vehicles.

Technical infrastructure

- The renewal of the housing stock is the main issue to be addressed particularly in the private housing sector. When addressing the fuel insecurity issue of privately rented houses, target groups should be addressed specifically with tailored information. Peer-to-peer information, trusted messengers and first adopters are some methods worth applying in addition to financial incentives. (See Chapter 3.)

Production and consumption

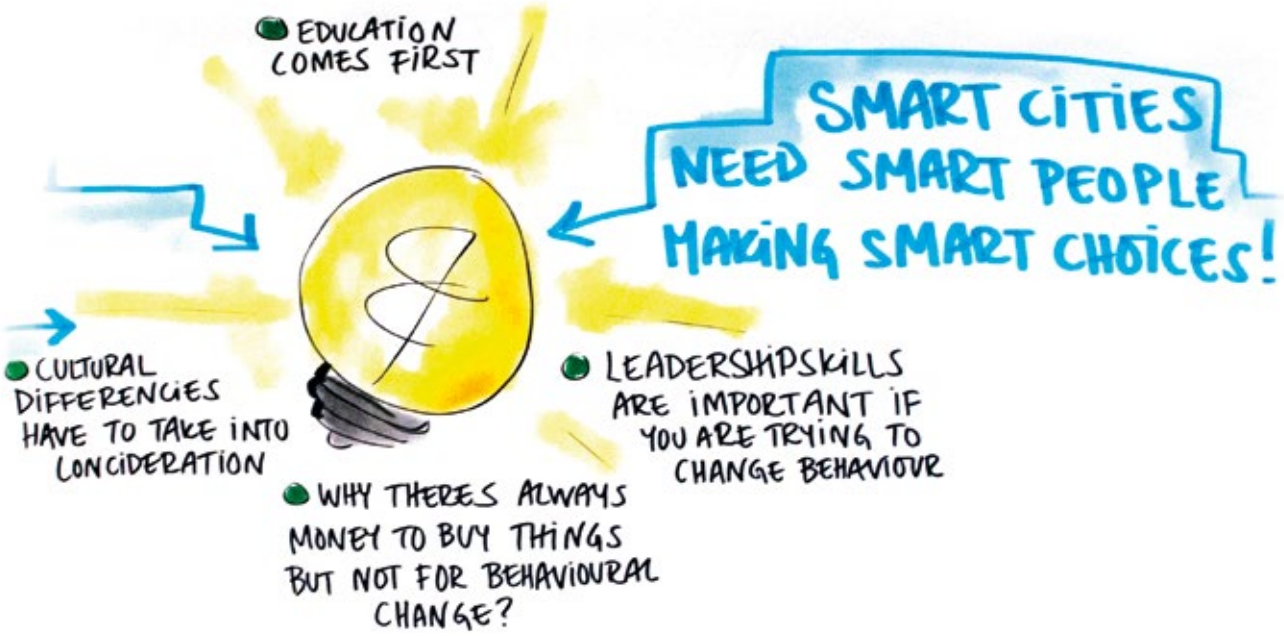
- According to a stakeholder survey (PLEEC City report Stoke-on-Trent), increased awareness and behaviour change is seen as important in the city. These measures should be supported by incentives and public-private partnerships where possible to ensure that the most pressing issues are addressed and vulnerable groups are involved.
- Greening municipal pro-curement practices would help create a market for green companies and generate more green growth in the area.
- Offer support for companies adopting energy efficiency measures – for instance rewards, advice and financial support. (See Deliverable 5.1/ case P6.)

7. CONCLUSIONS

Energy smart cities start with behaviour change. From the point of view of city policy, however, behaviour change regarding energy use presents numerous challenges. Coherence and consistency in the design and use of policy instruments is crucial. If people are urged to do one thing but at the same time the price of the said alternative presents a strong disincentive to the behaviour, messages are bound to be mixed. Promoting the use of public transport, for example, will most likely not reach its objectives as long as it is cheaper to use private cars, or the planning of public transport routes is not up-to-date. When designing policies, the combination of incentives, regulation and information should be well reasoned and take into account the context-specific factors inhibiting behaviour change.

Urban systems are complex and human behaviour even more so. Behaviour is very much context-driven and subject to a multitude of situational and structural drivers. Therefore designing behavioural energy efficiency interventions is by no means an easy feat. There are several strategies for changing consumer behaviour, and different combinations of these strategies can make a difference under right conditions. Consumer behaviour is highly contextual, and therefore the success of one strategy in a given context does not directly imply success in another context. As stated by Stern (1999, 464), the extent to which personal behaviour can be changed by interventions via for example education or information, is to a large extent dependent on the strength of contextual factors.

The aim of this report has been to address essential aspects of promoting pro-environmental behaviour, namely regarding energy efficiency. The aim was to provide a general overview of the issues which need to be considered when planning energy efficiency interventions. Understanding why people behave the way they do in relation to their energy use will go a long way in planning more successful energy efficiency interventions. Really thinking through what type of approaches and messages form the best interventions and what sort of barriers might be faced also serves the purpose of making the intervention as cost-effective as possible.



All in all, any efforts to reduce citizen's energy consumption should not be dismissed as too simple or minor as they present an opportunity to foster a more collective action. The power of social influence should not be underestimated – we do care about what our neighbours or colleagues think and do. Providing people with just information might increase awareness, but rarely results in actual behaviour change and consequent energy savings. Therefore messages need to be framed right, their context and timing carefully considered – they need to be meaningful, engaging, encouraging and personalized. Building upon the positive instead of preaching, making energy saving a habit and paying attention to possible rebound effects will set the process in motion. A concept often intangible and hard to grasp, really understanding how much energy is consumed in our daily activities is guaranteed with proper feedback. Also acknowledging various barriers to energy saving may help overcome them with different measures, such as incentives or improved information.

There is a growing body of evidence on the potential of behavioural interventions on promoting energy efficiency. Naturally both technological interventions and energy infrastructure play a crucial role in facilitating – or hindering – energy saving measures of the behavioural kind as well. However, there is evidence to suggest that technological interventions alone have rather low impact without any accompanying plan to promote behaviour change. This does work the other way too – no matter how well planned and realized a behavioural campaign is, it might not achieve its goals if the energy infrastructure structures does not permit changing one's behavioural patterns. In an ideal situation behaviour, structures and technology complement each other.

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