

eTEACHER

# Design for Behaviour Change for Energy End-Users

Short report introducing key concepts

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## Contents

Summary .....	2
1 What influences energy use in buildings? .....	4
1.1 Domestic .....	5
1.2 Non-Domestic .....	6
1.2.1 Office Buildings .....	7
1.2.2 Health Care Buildings .....	7
1.2.3 School Buildings .....	8
1.3 Summary .....	8
2 Understanding and Changing Behaviour .....	9
2.1 Behavioural Causes – the “COM-B” framework .....	9
2.2 Behaviour Change Interventions .....	10
2.3 Changing Behaviour: MINDSPACE.....	11
2.4 Changing a System .....	11
2.5 Summary .....	12
3 Enabling Change: a comprehensive approach to Intervention Design.....	13
3.1 Enabling Change: Overview .....	13
3.2 Programme level considerations .....	13
3.3 Project level considerations .....	14
3.3.1 Develop a Feedback Forum (“Brains Trust”).....	15
3.3.2 Identify Actors and Actions .....	15
3.3.3 Design “doable” behaviours.....	15
3.3.4 Create an “Enabling Environment” .....	16
3.3.5 Use “Enabling tactics” – evidence-based behaviour change techniques .....	16
3.3.6 Framing a Hopeful Invitation .....	17
3.3.7 Find the “Right Inviter” .....	17
3.3.8 Pre-test Interventions .....	18
3.3.9 Learning and Evaluation.....	18
3.4 Summary .....	18
4 Links to eTEACHER work packages.....	19
5 References .....	20

## Summary

This short report provides an overview of key concepts related to behaviour change initiatives to save energy in buildings. It draws upon the teaching and research experience of the authors, along with initial findings from a review of literature which commenced in October 2017.

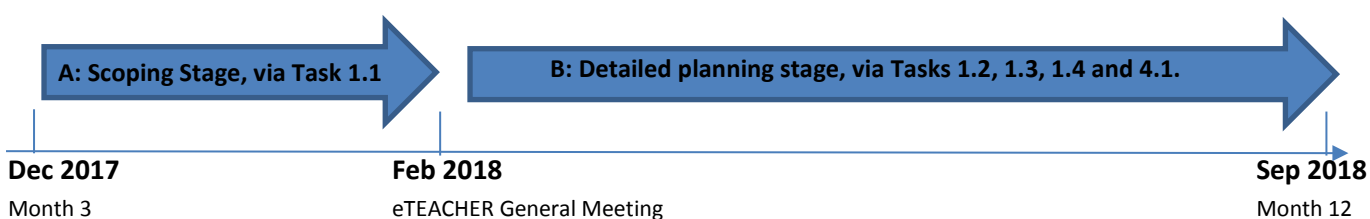
The report highlights key themes for the eTEACHER project to partners as part of Task 1.1, which will be explored further through follow-on workshops and discussion. Ideas will then be further developed via relevant work package tasks (particularly 1.2, 1.3 and 4.1) to then specify how they will be put into practice within eTEACHER (task 1.4).

The report addresses four key issues across four sections:

1. Influences on energy use in buildings
2. Understanding and Changing Behaviour
3. “Enabling Change” – a framework for behaviour change design
4. Links to eTEACHER work packages

The key insights and recommendations (in blue) for eTEACHER drawn from this report are as follows:

1. Energy use in buildings depends upon the **Building Envelope, Building Services, Human Factors** and the wider **Context**. Therefore, each case study building that eTEACHER studies requires consideration of all of these unique factors. Data providing an overview of these factors should be collected as early as possible to aid project design.
2. Research on the causes of human behaviour identifies three over-arching behavioural influences: **Capability; Opportunity; and Motivation**. Each of these issues should be analysed in relation to each case study building to aid the development of eTEACHER tools as behaviour change interventions. In particular, the context of behaviour (i.e. the “opportunity” to do it) is a highly significant influence, the impact of which is often under-estimated.
3. Behaviour change initiatives should be clear about the **actors involved and the actions to be undertaken**. In these terms, eTEACHER has a broader focus than user (energy-related) behaviour. Rather, eTEACHER seeks to promote behaviour change by **building users AND building managers/owners**, in the latter case by improving their energy management decisions. Therefore, eTEACHER aims for behaviour change by all “**building stakeholders**”. There are **two types of behaviour** in question: **energy-saving actions** and **engagement** with eTEACHER tools.
4. Behaviour change literature emphasises the need to design interventions around **specific behaviours undertaken by specific actors** in a given context. Thus, eTEACHER should consider each **stakeholder** and **associated behaviour** (whether energy-related or engagement with eTEACHER) specifically in the **context** of the building that they use/manage. An initial picture in the first few months of the project of potential behaviours to focus upon for each case study building is essential to inform later detailed design of interventions.
5. In terms of timing, behaviour change projects benefit from initial **scoping activity followed by detailed planning**, involving relevant stakeholders in all phases. Our recommendation is to use two phases for year one: Phase A is a “scoping” stage undertaken in the run-up to the next eTEACHER meeting (in Nottingham in February 2018), conducted through Task 1.1; Phase 2 is the detailed planning stage, conducted in the remainder of year 1, predominantly through Tasks 1.2, 1.3 and 4.1, leading to specifying the intervention plan (via Task 1.4).



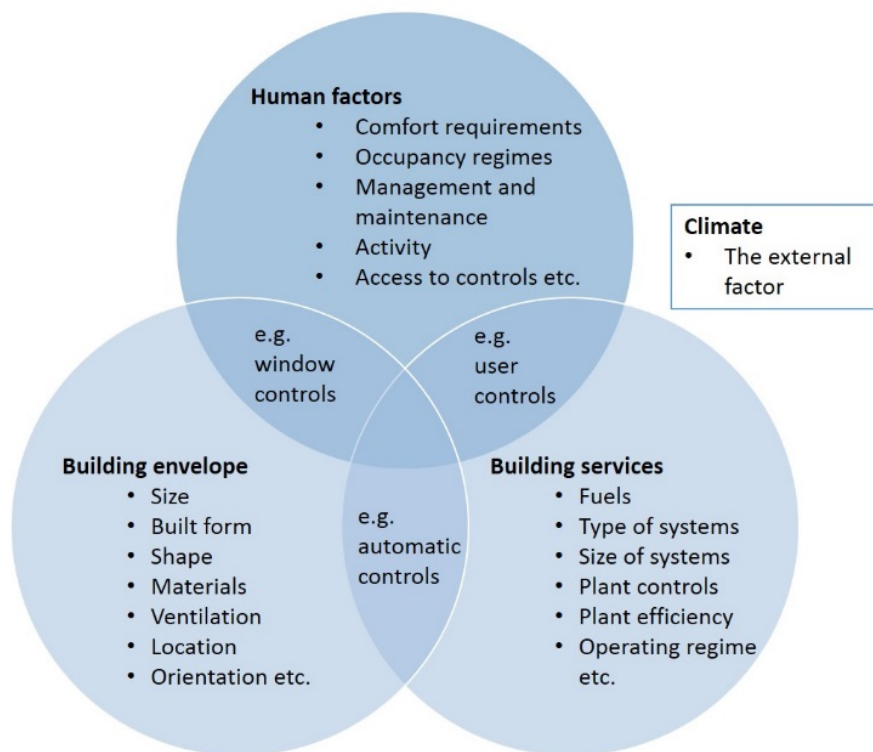
6. **“Enabling Change” offers an evidence-based process** to design Programmes (i.e. “eTEACHER” as a whole) and Projects (i.e. interventions for each case study building). We recommend using each aspect of Enabling Change to design eTEACHER, as detailed in this report. The steps to be undertaken are detailed on pages 12 and 13. We will explore the specifics of how to implement these steps via workshops and meetings in months 3 and 4.
7. The Enabling Change approach recommends that at both Programme and Project level, proposals are discussed and co-developed with a **sounding board to “reality check” the viability of the ideas**. For eTEACHER we recommend using and widening the existing **Advisory Group at programme level**, and setting up a **“Feedback Forum” for each case study building**. Each group should include stakeholders directly involved in case study buildings and sympathetic experts from eTEACHER partner’s professional networks. The process can allow for different levels of commitment – for example, ongoing contribution via a group for those with more commitment to the project, and one-off feedback on ideas from others. We suggest initially eliciting feedback on project plans from potential members in the Scoping stage (Phase A). This feedback feeds into the next general meeting and towards agreeing the process for running an Advisory Group and Feedback Forums for Phase 2 and the remainder of eTEACHER.
8. **Information and feedback provision** can be a reasonably effective behaviour change approach, achieving savings of the order of 5-30%. It has most power when motivation is high and when feedback is timely, salient, intelligible and actionable. Frequently these savings only endure for a limited period of time. eTEACHER relies predominantly on this approach. There is a significant risk of the project **having very little impact** if feedback does not fulfil the criteria above – the capabilities of case study buildings’ energy systems should be assessed early on (in Phase A) to broadly judge whether these criteria can be met, followed by detailed analysis in Phase B. This issue, along with project evaluation concerns (see below) may create a case to install monitoring/metering equipment on some sites.
9. **User-engagement** is key to behaviour change and central to our recommendations for eTEACHER is the role of engagement or enablement. eTEACHER can create the possibility for deeper change through **enabling community building between building users/stakeholders**, for example through communication tools that enable dialogue about energy issues and interventions. In this way, the project can seek to develop or reinforce social comparison and spread norms related to desired behaviours. The approach of using “Feedback Forums” to develop the interventions can play an important role in developing this sense of engagement and ownership.
10. There is an emerging evidence base on the applicability and effectiveness of specific **behaviour change techniques**. This evidence can be drawn upon to select specific techniques to meet the aims of specific interventions. For eTEACHER, although there is already a commitment to ICT-based interventions, there is still **flexibility about the techniques that could be used** with each intervention. Candidate techniques at present include Gamification, and Building Community. Specific techniques should be identified through tasks 1.2 and 1.3 during the detailed planning stage, leading to a selection via task 1.4.
11. **Evaluation of behaviour change projects** should gather data on and test a clearly-articulated “Theory of Change”, which links specific behavioural interventions to predicted changes in behaviour. For eTEACHER, as discussed above, evaluation should focus upon evidence of **energy-related behaviour and engagement with eTEACHER tools by all building stakeholders**. This should be supported by evidence on the influences on behaviour, in terms of Capability, Opportunity and Motivation. **Baseline data for energy use** is a key requirement – we recommend identifying current availability of baseline data in Phase A so that the February meeting discusses existing baseline data and the action that can be taken to improve baseline evidence prior to interventions.

This report provides discussion of key ideas that inform the recommendations above. Through training sessions and meetings in the coming months, project partners will discuss these principles and develop a step-by-step checklist for putting the “Enabling Change” process into practice for the eTEACHER project.

# 1 What influences energy use in buildings?

Energy use in buildings can vary dramatically from one building to the next, even those with very similar construction can differ in their use of energy. Three main factors influence the energy use of a building – the building fabric and its physical performance, relating to the energy efficiency of a building; the energy system within a building which can comprise of heating systems, mechanical ventilation etc.; and finally, the occupants of a building directly influence the energy use, after all “buildings don’t use energy, people do” (Janda, 2009). However, these three factors also overlap with one another, shown in Figure 1.1.

Figure 1.1: Key factors which Influence energy use in building (CIBSE Guide F, 2004)

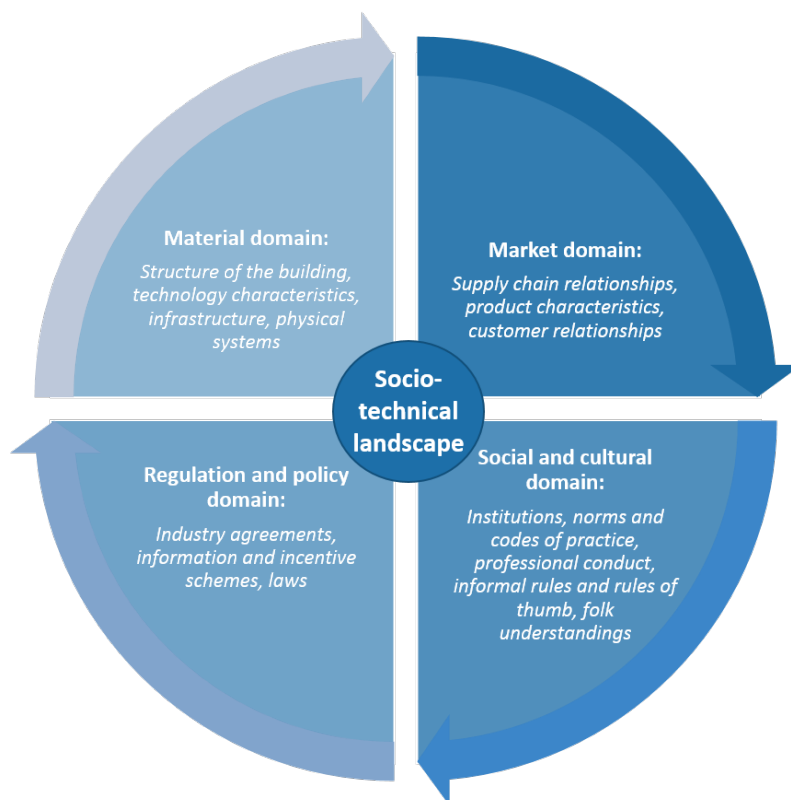


It is the overlap between human factors and the building fabric and building services that the eTEACHER interventions target to reduce energy consumption through behaviour change. However, the overlap between the human factors and the building factors will be different depending on the building typology and its use, whether that be domestic or organisational use. With domestic energy use there is a direct connection between the user’s energy efficiency behaviour and the cost of energy, however in the non-domestic sector there is often no direct connection to the personal wealth of individual employees/users of those buildings (EEA, 2013). Within this report organisational energy behaviour is used to describe energy behaviours within the non-domestic sector, where motivation for energy efficiency engagement often relies upon corporate and social responsibility objectives and societal norms. Organisational energy behaviours can be represented by the influential factors shown in Fig 1.2 (developed from CSE, 2012).

The central socio-technical landscape is constructed through various factors interacting, which in turn creates a “landscape” of possibilities and opportunities (and barriers) for energy efficiency within the organisation. This socio-technical landscape will be different for each organisation and shaped by the four categories of influential factors surrounding it. Although the diagram does not refer to occupant behaviour directly, within an organisation occupant behaviour can be influenced by the various categories. Occupant behaviour is linked to the material domain with respect to the building and its controls (and their access to these), as well as the social and cultural domain through both formal and informal organisational procedures. Occupant behaviour within an organisation context is

influenced by a mixture of both conscious and unconscious drivers (what is the perceived norms, comfort seeking) as well as individual habits (CSE, 2012). The regulation and policy domain of organisational energy behaviour can also have a significant influence in the design and implementation of behaviour change interventions as some organisations may have strict policies regarding use of IT equipment and access to certain websites. This may limit the potential of certain ICT interventions without engagement from the whole organisation (organisation heads and staff).

**Figure 1.2: Key influential factors relating to organisational energy behaviour (adapted from CSE, 2012)**



The differences between organisational and domestic settings will need to be considered in eTEACHER with regards to user engagement with the interventions, particularly those in organisation settings who may not connect to the need for energy efficiency.

### 1.1 Domestic

Energy use within domestic buildings has been found to be extremely specific to individual homes and although the building fabric and energy systems present has an influence on the energy efficiency, it is the occupants of these buildings who have a direct impact on the energy consumed. This is because everyone is different and have very different expectations of comfort within their own home which has an influence on the temperatures demanded within the building, the duration of use of HVAC systems and the way in which the building is heated or cooled (whether the whole house is treated as one or whether individual zones are altered as desired).

Domestic buildings are far more susceptible to external temperature fluctuations due to weather conditions compared to non-domestic buildings and as space and water heating within domestic buildings can account for around 80% of the final energy consumption, weather is a major factor in domestic energy consumption (BEIS, 2017). However, weather related factors are not the only influence on energy consumption within domestic buildings, other factors include;

- Individual household characteristics (size of household, disposable income etc.)

- Energy efficiency of individual building (age, insulation levels, glazing etc.)
- Energy prices (often disposable income affects how influential this is on energy consumption)
- Number and use of electrical appliances;
  - Lighting
  - Cold appliances (fridge-freezer etc.)
  - Wet appliances (washing machine, dishwasher etc.)
  - Consumer electronics (TVs, game consoles etc.)
  - Home computing
  - Cooking appliances

In the domestic sector there are still behavioural barriers to energy efficiency, even with the direct connection between energy efficiency behaviour and energy cost. Pelenur & Cruickshank summarised these behavioural barriers to include;

- Beliefs/information – lack of knowledge/expertise of energy efficiency or lack of trustworthy information
- Cost – upfront costs, complexity of discounted costs vs. perceived benefits
- Family/partner/household – reaching consensus in multi-person households often challenging
- Institutional – incentives wrongly targeted, view that consumer choice hampered by government and/or energy companies
- Landlord-tenant/housing associations – split-incentives
- Personal behaviour – “energy practices”, lifestyle choices
- Property itself – physical constraints of building, conservation, heritage

For eTEACHER, it will therefore be important to understand the residents’ beliefs and energy practices pre-eTEACHER in relation to both influences on energy consumption and energy behaviours. Especially to identify whether any behavioural barriers may impact the success of eTEACHER if not taken into consideration before deployment.

## **1.2 Non-Domestic**

The non-domestic building stock is extremely diverse in building types (age of building, construction & building fabric), scale of buildings (size, may be part of existing building or collection of multiple buildings) and the use of buildings (activities carried out in the building, intensity and duration of use). On top of this there are additional factors relating to the organisations that own the building, those that operate the building and those that occupy it. Buildings can be owner occupied or rented out, may be professionally managed or may be controlled remotely. These factors add to the complexity of implementing interventions across the sector to reduce energy consumption. Ultimately for eTEACHER it is the range of building users which need to be understood in detail, however their interaction with the building and energy use within it is a vital part of identifying potential savings opportunities. Most users have limited influence over the energy efficiency of non-domestic buildings due to many having dedicated energy managers or management systems in place. However, even when users do have some influence over energy efficiency there may also be a range of behavioural barriers to energy efficiency within non-domestic buildings, such as those reported by BEIS (2016);

- Lack of interest by users in energy efficiency
- Lack of sharing the objectives (the need behind improving energy efficiency in the building)
- Inertia
- Imperfect evaluation criteria
- Split incentives
- Other priorities

**For eTEACHER, each building typology has different characteristics regarding energy use and user types** which will require tailored targeting to achieve savings. To do this some of the factors which influence energy use in each building category need to be understood further.

### 1.2.1 Office Buildings

**Office buildings** can vary in energy consumption due to the size (floor area, number of staff), style (open plan, individual), energy system in place and whether the office occupies part of a building or the whole building. The building occupants will have an impact on energy use through use of appliances, lights and environment controls such as HVAC systems. This use is likely to be influenced by the employee's role, company rules of conduct and normative expectations within the office (Nye & Hargreaves, 2009). Barriers to energy behaviour change may be caused by employees not paying for the energy bill, being unaware of the energy demands of the office, or not seeing any benefit for themselves directly in energy savings. Hong and Lin (2013) identified some Influences within office buildings to reduce energy consumption, including;

- Making changes to the cooling and/or heating set-point temperatures
- Making use of occupancy controls/sensors
- Encourage adaptive comfort measures
- Use of daylighting controls
- Achieving an optimum HVAC operation schedule

For eTEACHER it is best to target behaviour change in both staff members and building energy management for improved energy efficiency. However consideration of the organisational factors, introduced earlier, which impact engagement with the eTEACHER intervention will need to be identified pre-eTEACHER. This will involve collecting data on various factors such as: energy efficiency policy, staff's access to energy settings, staff attitudes and awareness of energy use.

### 1.2.2 Health Care Buildings

Energy consumption in **health care buildings** typically accumulates from lighting, air conditioning, hot water usage, heating system use, medical and computing equipment within the building. Various studies have investigated the potential energy savings possible in health care buildings relating to how the building space is utilized, how the use of the building is managed, the building infrastructure and the equipment used. Garcia-Sanz-Calcedo (2014) suggests that energy efficiency of health care buildings can be improved by;

- Improvements in service water heating – their study found an average hot water consumption of 450 litres/m<sup>2</sup> across the sample of health care buildings investigated
- Improvements in lighting – lighting can account for an average 30% of the total electricity consumption in health care centres
- Improvements in HVAC systems – HVAC represents an average of 50% of the total electricity energy use in a typical health care centre
- Improvements in the building fabric – helps to lower the heating/cooling loads of the building via improved thermal insulation
- Renewable energy generation
- Energy bill optimisation

As health care centres are likely to have a high number of inconsistent users via visitors and patients it is likely that they will have no influence on improving the energy efficiency within the health care centre. Therefore, eTEACHER is likely to focus more on the energy managers of the buildings and consistent users such as the staff members within the building.



### 1.2.3 School Buildings

Energy consumption within **school buildings** can vary significantly depending on numerous factors including the age of the school building, its state of repair, its energy efficiency, whether it is a primary or secondary education facility, its occupancy level, duration of use and in the electrical equipment used (number, type and energy intensity).

Secondary schools are typically more energy intensive due to larger scale buildings, longer operating hours, higher numbers of students (and often staff too) and more electrical equipment (specific to subject areas). Within the UK the Carbon Trust reports (2012) over half (60%) of energy use in schools comes from space heating, 16% from hot water usage, 12% from catering and a further 8% from lighting (with the remaining 6% coming from other energy consuming activities such as use of office equipment). Energy savings in schools are typically targeted to switching things off, better maintenance or refurbishment. However, added complexity comes from escalated use of ICT in some schools, the management of school buildings (whether private or publicly owned) and the increased popularity in schools now being used as a community resource (increasing hours of use, increasing user numbers and the use of resources).

The Carbon Trust has attempted to help save energy within school buildings in the UK by suggesting five main steps that schools should follow (2004);

1. Know the baseline energy use/cost – so savings can be measured against
2. Check heating and cooling controls are set to appropriate temperatures
3. Create good housekeeping practices – such as turning off lights and equipment after hours
4. Compile an energy checklist to identify where energy savings can be made
5. Raise awareness and encourage both staff and students to help

In school buildings typically the building users remain consistent (at least during weekdays and term time) therefore eTEACHER may want to target all building users, including staff members, estate staff, students and building energy managers. However, similar to office buildings, the organisational factors will need to be considered pre-eTEACHER deployment, such as the school policies and staff commitments towards energy efficiency. The school students will also need to be taken into consideration regarding the level any intervention is aimed at, particularly if including younger school children who may have little understanding regarding energy efficiency.

### 1.3 Summary

This section has shown that there are a multitude of factors which can impact the energy consumption of a building, and some of the differences between domestic and non-domestic building typologies. As eTEACHER involves various pilot building typologies, both domestic and non-domestic, with a multitude of different users, understanding the context behind each building is vital. This means that information is needed on the individual building properties (including the building fabric, the building systems and any potential upgrades planned over the project lifespan), the building use (what is the building used for, is it in constant use, how energy intensive is the use of the building) and the building users. It is important that the views of the building users are captured relating to the energy use within the building with regards to comfort levels, expectations and if there are any current issues or suggested improvements before eTEACHER is deployed so to best tailor our recommendations to have the biggest impact in each pilot building. Therefore DMU will develop data collection methods to capture this data in the coming months.

## 2 Understanding and Changing Behaviour

This section provides a brief overview of key concepts to understand influences on behaviour and strategies for changing behaviour. We provide links to the eTEACHER project through recommendations linked to each theme.

### 2.1 Behavioural Causes – the “COM-B” framework

How can the causes of human behaviour be explained? This question was addressed systematically by Michie, van Stralen and West (2014), who synthesised research evidence to develop the “Behaviour Change Wheel”, a framework for understanding and designing interventions to change behaviour. The core of the wheel is the “COM-B” (pronounced “combi”) model, which highlights three key influences on human behaviour (Figure 2.1). In brief, COM-B describes how *Capability* and *Opportunity* relate to the *Motivation* to carry out a Behaviour, and that each construct influences (and is influenced by) the performance of the Behaviour itself. This framework is a useful overall checklist for understanding any behaviour or behaviour change initiative.

Figure 2.1: COM-B Model (Michie, Stralen and West, 2014, pg. 62)



*Capability* and *Motivation* relate to the person or people carrying out the behaviour. For example, can they actually do it? Does it align with their habits and instinctive responses (automatic motivations) or the things they consciously wish to do (reflective motivations)? *Opportunity* relates to the wider context in which the behaviour takes place. *Social opportunity* includes whether social norms and expectations support or hinder performance of a behaviour, and the influence of rules and regulations. *Physical opportunity* relates to aspects of the physical environment, such as cycle lanes to support the take-up of urban cycling.

These categories enable us to comprehensively consider all influences on behaviour, and which issues a particular intervention can or should affect. The research evidence on behaviour change emphasises that Opportunity (or the “context” of behaviour) is a highly significant influence (e.g. Stern et al. 2017) and is often under-emphasised relative to individual motivations. For example, good intentions to recycle waste at home are unlikely to lead to action unless there is a convenient kerbside collection. Thus, systematic attempts to change behaviour focus upon creating an “enabling environment” (Robinson, 2012) that makes the behaviour relatively easy to perform.

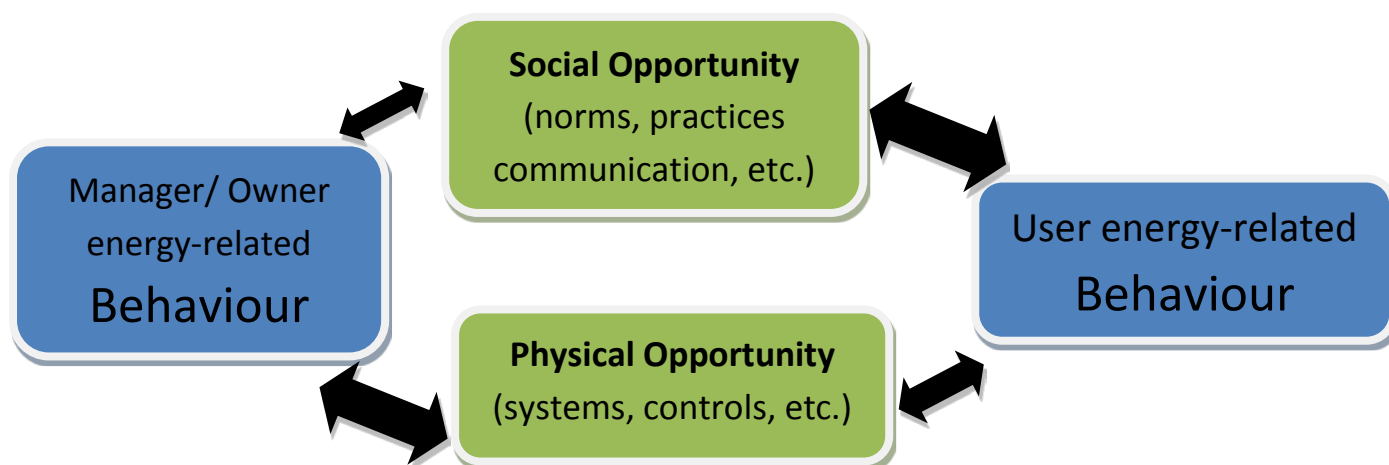
The eTEACHER project is concerned with behaviour in several different building contexts (e.g. residential, office) and many different behaviours by various actors (e.g. residents controlling heating; visitors using lighting; energy managers installing new cooling systems; building owners purchasing insulation). COM-B can be used to map out the key influences affecting behaviours for each actor and action (see section 3.3.3), drawing upon evidence of the energy and control systems at each case study site and the views of building users and managers/owners.

It is worth stressing that when the eTEACHER project is viewed through the lens of behaviour change, **three distinct behaviours** are of relevance (Figure 2.2):

- **User energy-related behaviours** (e.g. tenants' use of lighting)
- **Building Manager/Owner energy-related behaviours** (e.g. installation of efficient heating systems)
- **Engagement** with the eTEACHER tools by all stakeholders (e.g. degree of use of an eTEACHER app)

This is a key consideration in terms of the potential energy saving impacts of the target behaviours. As discussed above, context plays a key role in behaviour, so in buildings with an energy manager, influencing their decisions will be likely to have a major impact upon user behaviour through influencing context, in particular the "Physical Opportunity". Users may influence each other through norms of behaviour and communication, making user-to-user interaction a key aspect of the "Social Opportunity" for change. Engagement with eTEACHER interventions can affect or shape the relationships between stakeholders and each other or with energy-related behaviour.

**Figure 2.2: eTEACHER addresses two distinct "Behaviours"**



The image above focuses on Opportunity, as this is a key factor. However, in addition, Motivation and Capability are likely to be very different according to the type of stakeholder. For example, Energy Managers may be highly motivated to save energy, whilst building tenants may lack motivation on financial, environmental or other grounds. The key implication from this is to consider **each stakeholder** and **associated behaviour** (whether energy-related or engagement with eTEACHER) specifically in the **context** of the building that they use/manage.

## **2.2 Behaviour Change Interventions**

Behaviour change interventions can be seen as actions taken in order to change a specific behavioural pattern. They can be categorised into two main types; *informational strategies* and *structural strategies*. Informational strategies aim to change behaviours through the provision of information which can change people's understanding, awareness, norms and attitudes. Structural strategies aim to change behaviours by changing the context where decisions are made regarding behaviours. See section 2.4 for a discussion of the impacts of these approaches.

As discussed above, eTEACHER is a hybrid of these approaches. While the influences on User Behaviour are largely informational, the project also aims to influence the behaviour of building owner and managers, which may lead to action affecting the context in which building users consume energy.

### 2.3 Changing Behaviour: MINDSPACE

In recent years, researchers have sought to synthesise principles for effective behaviour change approaches. One widely used framework is “MINDSPACE” (Dolan et al., 2010), which summarises several evidence-based principles for non-coercive behaviour change (Figure 2.3).

**Figure 2.3: MINDSPACE – a checklist for non-coercive influences on behaviour**

MINDSPACE: “non-coercive” influences on behaviour	
<b>Messenger</b>	We are heavily influenced by who communicates information
<b>Incentives</b>	Our responses to incentives are shaped by predictable mental shortcuts such as strongly avoiding losses
<b>Norms</b>	We are strongly influenced by what others do
<b>Defaults</b>	We ‘go with the flow’ of pre-set options
<b>Saliency</b>	Our attention is drawn to what is novel and seems relevant to us
<b>Priming</b>	Our acts are often influenced by sub-conscious cues
<b>Affect</b>	Our emotional associations can powerfully shape our actions
<b>Commitments</b>	We seek to be consistent with our public promises, and reciprocate acts
<b>Ego</b>	We act in ways that make us feel better about ourselves

For eTEACHER, MINDSPACE offers a useful checklist to apply when developing specific interventions or for understanding influences on particular behaviours – it is likely to have particular value in the latter stages of WP1. For example, it draws attention to Social Norms – this points to interventions (e.g. App functionality) that can highlight to building users when their peers are carrying out a target behaviour. Priming (e.g. a text-based reminder to carry out an action) could be combined with a prior public Commitment (e.g. to turn off all lights overnight) to support a target behaviour. Finding and working with an appropriate Messenger is key when building users are introduced to eTEACHER interventions, as explored in section 3.

### 2.4 Changing a System

Behaviours do not occur in isolation, but rather they are part of a wider system (Michie, van Stralen and West, 2014). For example, energy use in a building is a property of a system that includes infrastructure, expectations for thermal comfort, norms of behaviour, and much more. A whole-system perspective, which goes beyond the behaviour of individuals, is the most powerful approach to identify opportunities for significant and durable change.

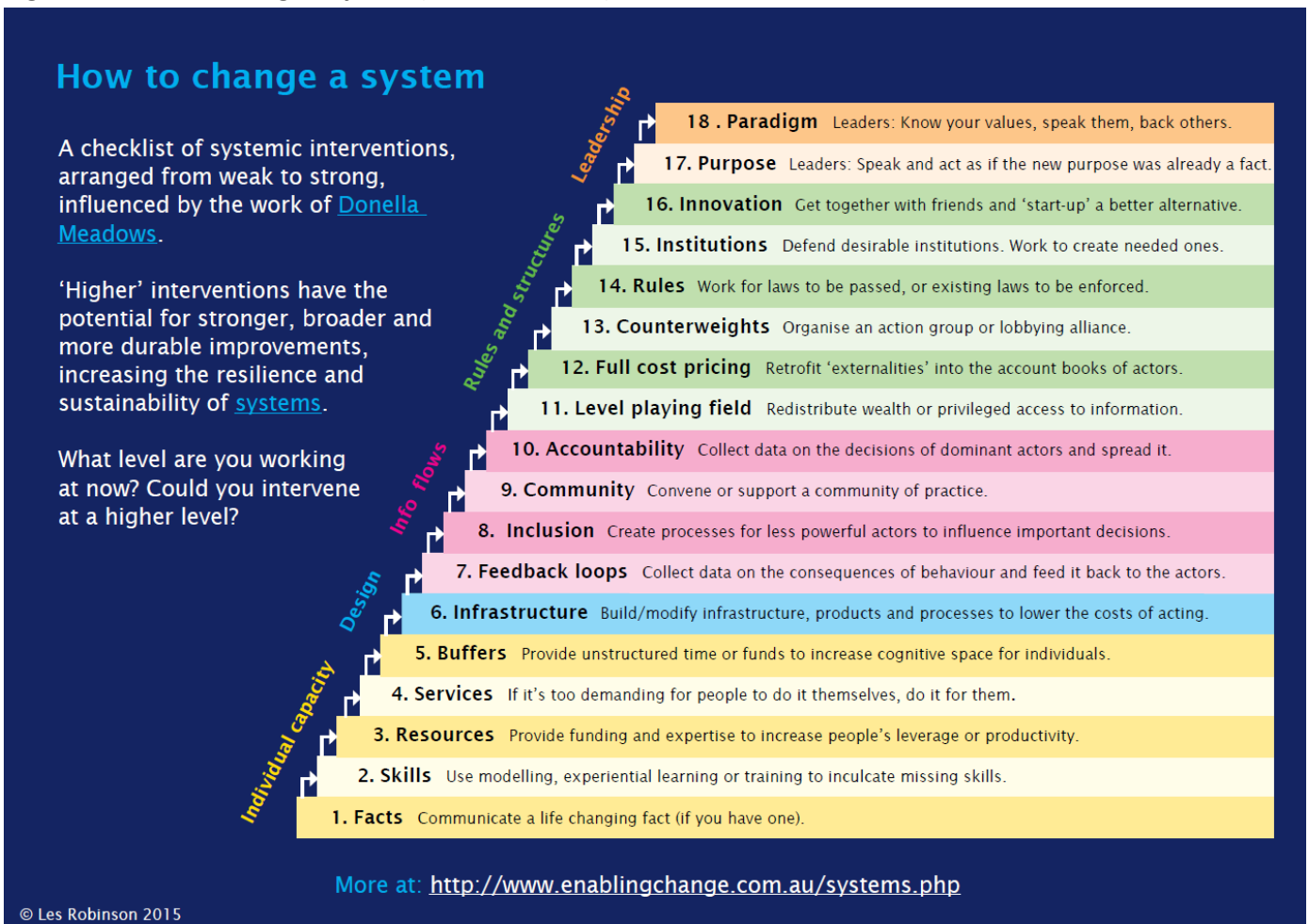
A widely-used conceptual tool to aid whole-system thinking is shown in Figure 2.4. This framework, developed by Meadows (1999) and updated by Robinson (2015), highlights generic approaches to system change, ranked in terms of which has the greatest potential leverage. It can be usefully applied to aid the design of a change intervention.

Mapping eTEACHER onto the framework in Figure 2.4, we can observe that the project seeks to influence:

- **1: Facts** – making building users aware of energy issues
- **6: Infrastructure (for energy managers)** – through improved energy management systems
- **7: Feedback loops** – both for building users and managers,

This mapping highlights the opportunities and potential limitations of the project. For example, providing information is a commonly used strategy, but has a poor track record of encouraging behaviour change, except when a strong motivation to change exists (e.g. Fisher 2013). Feedback is relatively powerful when it is timely, salient, intelligible and can be acted upon (e.g. Darby 2006; Tiefenbeck et al. 201) and can lead to energy savings of the order of 5-30% (Abrahamse et al. 2005). However, the conditions above, which enable feedback to work, may often not prevail due to constraints in metering and monitoring in case study buildings. Therefore, each eTEACHER intervention will require careful design to enable effective feedback, perhaps including installation of new equipment, in order to minimise the significant risk of having a negligible impact.

Figure 2.4. How to change a system (Robinson, 2015)



Robinson (2015) stresses the challenge of seeking to intervene at a higher level of leverage. At present, eTEACHER targets relatively low leverage points, so this aspect is worth consideration. Opportunities may exist in terms of:

- **Community (no. 9 in above framework)** - enabling information flows between users, including linking users to energy managers
- **“Spillover effects”** (Dolan et al., 2010) - creating a context that may make it more likely for wider systemic change to take place (e.g. improved *Rules and Structures* or stronger *Leadership*)

Community could be developed via an eTEACHER App or use of existing technologies (e.g. WhatsApp, a noticeboard) to enable discussion on energy issues between users or between users and energy managers. Spillover effects could be designed for by identifying the key factors that could support energy saving for each case study building, and designing eTEACHER interventions so that they could potentially support a “spillover” of that nature. For example, including a “suggestion” functionality that enables users to directly request action from building owners may lead to the spillover of rules being passed (point 14) to control energy use on a site.

## 2.5 Summary

This section has introduced three conceptual models that can be applied to aid design of eTEACHER – COM-B; MINDSPACE; “How to change a system”. These will be explored further in the workshops that follow this report. Together, they point to the need for careful design that engages with the specifics of each behaviour, user and building context.

### 3 Enabling Change: a comprehensive approach to Intervention Design

This section introduces key principles for the design of behaviour change interventions. We do this using Les Robinson's (2012) "Enabling Change" framework. In each section we report recommendations for how the principles behind the Enabling Change approach can be applied in the specific case of the eTEACHER project.

#### 3.1 Enabling Change: Overview

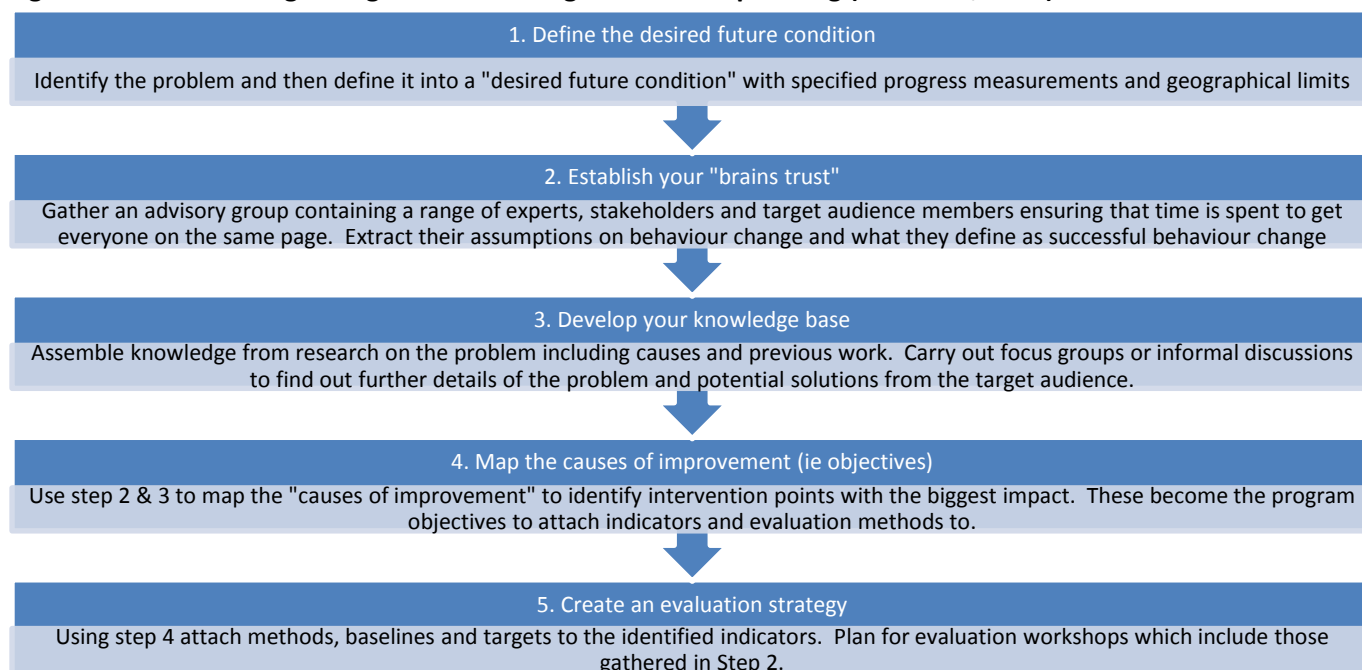
Approaches to behaviour change have been practiced and evaluated by both researchers (e.g. Michie, van Stralen and West 2014) and those that develop research-informed practice (e.g. McKenzie-Mohr and Smith 1999; Robinson 2012). Robinson's Enabling Change approach fits in the latter category, synthesising research evidence into an accessible format targeted towards developing effective behavioural interventions. The Enabling Change process has two different levels of planning: programme level (Fig. 3.1) and project level (Fig. 3.2). The programme level defines the medium/long term objectives for the behaviour change intervention, whereas the project level plan deals with the logistics of carrying out such interventions on the ground focusing on ensuring engagement with people.

For eTEACHER, we interpret programme level as meaning eTEACHER as a whole, and project level as regarding interventions for each case study building.

#### 3.2 Programme level considerations

Figure 3.1 illustrates the Enabling Change process as applied at Programme level.

Figure 3.1. The Enabling Change Process – Programme level planning (Robinson, 2011)



For eTEACHER, many of these considerations are already part of the project plan. For example, work package 1 aligns with Step 3, developing the knowledge base and work package 4 includes evaluation planning (Step 5).

The desired future condition (Step 1) is for case study building stakeholders to be empowered to save energy via the eTEACHER tools. Thus, use of the tools (**engagement**) and **energy savings** through the actions of each stakeholder are the **two key issues** to target and measure progress against. Therefore, indicators and evaluation methods should be developed in relation to these two key themes.

We would recommend using the eTEACHER “**advisory group**” to fulfil step 2. We would suggest extending membership, or eliciting one-off feedback from stakeholders connected to the project, to enable feedback on the range of issues that ETEACHER explores (behaviour change, ICT development, etc.) from people external to the eTEACHER team. This feedback should be **well-timed** (e.g. to feed into key stages of the project) and from **diverse stakeholders** focussed on the questions of **whether our proposals will work in practice** and **what success would look like**. In part, the advisory group function has been designed into eTEACHER through the multi-partner multi-sector partnership, which can enable interchange of ideas from a range of stakeholders.

On a practical level, we suggest that **eTEACHER partners identify people from their professional networks who can offer their input** (e.g. through a phone call or one-hour meeting). For example, DMU can seek input from colleagues who have worked on similar ICT-based energy management projects. We would suggest that this feedback is gathered and shared in time to be viewed and then discussed **at the next two general assembly meetings**. As per Step 5, individuals who contribute to the advisory group should also be invited to feedback on project evaluation as eTEACHER develops. We would suggest in the first instance, gathering feedback from individuals as part of WP1 to feed into the February general assembly meeting.

### 3.3 Project level considerations

The project level stages of employing Enabling Change are shown in Figure 3.2.

**Figure 3.2. The Enabling Change Process – Project level planning (Robinson, 2011)**



### 3.3.1 Develop a Feedback Forum (“Brains Trust”)

A key aspect of the Enabling Change process is the use of a “Brains Trust” at both levels of planning. A brains trust is defined as a group of people that draws on the “diversity of experts, stakeholders and members of the target audience.” (Robinson, 2011, pg. 4). Robinson’s argument, based upon research evidence from many failed behaviour change projects, is that if they are developed from the top-down without adequate consultation with those directly involved, there is a high risk that they will fail to plan around key factors that will affect their success.

For eTEACHER we recommend developing a “Feedback Forum” for **each case study building**. We suggest “Feedback Forum” as a more accessible term in English – an easy to understand term should be developed for the Spanish and Romanian case studies. Members should be drawn from **stakeholders who will be influenced by the intervention** (e.g. energy manager(s); building users) and **diverse experts** (via partners’ professional networks) who can offer insight and feedback (e.g. DMU can invite feedback on proposals for the Nottingham school from professional contacts who work in energy efficiency in schools in the UK). We suggest a two-stage approach. Firstly, prior to the February meeting, partners offering case study buildings support activity to:

- Identify **specific individuals** that could contribute to a feedback forum for each building
- Broadly **introduce the project to** these individuals, to identify:
  - Their **views on the need and viability** of the proposed project
  - Their interest in **contributing in some way** to a feedback forum
  - **Potential other members** of a feedback forum that they know

The results of this activity can be fed into the meeting in February. The next stage aligns with Task 1.2 of Work Package 1, and may be explored through focus groups or 1-1 input from feedback forum members via meetings or phone calls. The specific strategy for this can be agreed at the February meeting, and will link up with other aspects of Enabling Change (7: Find the Right Inviter and 8: Pre-testing). The process can allow for differing levels of commitment – some members may offer ideas on a one-off basis, others may be part of a group that meets several times to help develop eTEACHER tools. Overall, this strategy provides eTEACHER with a vital reality check to give the interventions the best possible chance of success.

### 3.3.2 Identify Actors and Actions

Early on within any change project, it is worthwhile to *identify* all relevant stakeholders and consider their *point of view and potential involvement*. This, in essence, is a stakeholder analysis. Identifying stakeholders relies upon specific knowledge of the situation where a change initiative is taking place. As discussed in Robinson (2012) and a wealth of documents on project planning, active involvement of stakeholders tends to lead to greater support for interventions and improved take-up.

For eTEACHER, this activity will be led via Task 1.2 within work package 1. It will rely upon input from case study partners and the development of a feedback forum. As with the feedback forum, some initial broad mapping of actors and in particular of their agency to influence energy use will be gathered over the first 4 months to feed into the February general assembly meeting.

### 3.3.3 Design “doable” behaviours

Literature on behaviour change design is emphatic in emphasising the need to be **specific** about target behaviours (Robinson, 2012; Michie, van Stralen and West, 2014). For example, rather than speaking generally about saving energy, an intervention should identify **specific actions by specific people** (e.g. energy managers receiving feedback on electricity use and respond to anomalies; office staff setting computers to “sleep” when away from their desk).



Robinson (2011) also emphasises that these behaviours should be “doable”, that is (building upon the COM-B) model, something that individuals are capable of doing, and which they are supported to do by their environment.

Thus, any behaviour change project involves a **choice of target behaviours**. The Behaviour Change Wheel (2014) offers useful criteria to help select target behaviours for a specific context:

1. The *likely impact* if the behaviour was changed.
2. *How easy it is* to change the behaviour
3. The potential for a *spillover effect* (that is of any changes having a positive influence on the wider system supporting the behaviour)
4. *Ease of measurement*.

Therefore, interventions can be designed in a relatively systematic way, by understanding the situation and then developing an intervention plan. This makes explicit a “**Theory of Change**” for the project, which is how each *intervention* will (in theory) lead to desired *outcomes* – the evaluation strategy then tests this Theory of Change.

For eTEACHER, this means that for each case study building, we need to identify the **specific behaviours by specific actors** that we will try to influence. This part of Enabling Change is mainly addressed via Task 1.2 – combining social research on how to support energy-related behaviour change in general and the specifics for each case study building. However, as with the previous aspects of Enabling Change, some “scoping” activity during the first four months (see 3.3.1) can provide an initial sense of issues such as:

- What **baselines data** exists of energy-related issues?
- What **issues are stakeholders concerned with** in relation to energy in the case study buildings? (e.g. issues of comfort, affordability, etc.)
- What **agency and control do building stakeholders** have over energy (e.g. heating controls)?
- What **opportunities for energy savings** exist? Which stakeholders have behavioural influence over these opportunities?

Based upon this input, we can aim to identify specific opportunities for interventions for each case study:

- In a broad sense at the February meeting
- Specified in detail over months 4 to 12, building upon input from the Feedback Forum and eTEACHER partners, employing the Behaviour Change Wheel process to select interventions.

### 3.3.4 Create an “Enabling Environment”

For sustained behaviour change we need to ensure that the environment is modified to allow for the desired behaviour to be easy, safe, comfortable, pleasant and rewarding (Robinson, 2012). Robinson (2012) suggests six main categories to modifying environments to enable the desired behaviour which include: **building a community**; **creating ease**; and **lowering costs**. The remaining three categories discourage the undesired behaviour by methods such as; **raising the cost**; **thwarting** the undesired behaviour; and by **regulation**.

For eTEACHER, evidence from each Feedback Forum will help to identify key issues to create an enabling environment. Through Task 1.2, evidence can feed into and improve the design of eTEACHER tools, or the ways in which these tools are deployed (e.g. using trusted individuals or organisations to promote use of the tools).

### 3.3.5 Use “Enabling tactics” – evidence-based behaviour change techniques

On a project level, “Enabling Tactics” are essentially the range of evidence-based behaviour change techniques that can be combined to form an effective intervention. A **behaviour change technique** is defined as “an active

component of an intervention designed to change behaviour” (Michie, van Stralen and West, 2014). Behaviour change techniques may include methods such as (Michie, van Stralen and West, 2014, pg.146);

- **Habit formation** – prompting rehearsal and repetition of a behaviour in the same context repeatedly so that the context elicits the behaviour. For example, encouraging office staff to turn off a PC before leaving work.
- **Goal setting** – setting or agreeing on a goal defined in terms of the behaviour to be achieved. For example, users of a building aiming to collectively reduce electricity use by 5%.
- **Self-monitoring of behaviour** – a method for a person to monitor and record their own behaviour(s) as part of a behaviour change strategy. For example, using a log book to record daily electricity meter readings.

The Behaviour Change Wheel (2014) documents scores of evidence-based methods, including those above, and recommends applying a range of complementary methods to align with the specific behavioural goals of an intervention.

For eTEACHER, there is already a commitment to particular modes of engagement (e.g. use of an app and energy management platform), but there is also flexibility about how these are designed, and the techniques used. Thus, through Tasks 1.2 and 1.3, specific techniques can be identified, drawing upon the Behaviour Change Wheel, which can be applied through the eTEACHER tools. At this stage, some techniques that hold promise include **Gamification** (to increase motivation by building users to engage in energy saving); **Information Provision** (for motivated energy managers); **Building Community** amongst building users around shared efforts to save energy.

### 3.3.6 Framing a Hopeful Invitation

Behaviour change interventions are most effective when they align with pre-existing goals or motivations of those involved (Robinson, 2012). “Framing” plays a key role in communication on sustainability-related issues (Crompton, 2010) – for example, eTEACHER could be introduced by building managers as an educational tool to help users save energy, or introduced by peers to other building users to help them manage comfort and bills. These two framings are likely to engender different feelings towards the project and different modes of engagement.

The effectiveness of eTEACHER will not rely upon the quality of the tool itself, but also crucially on how it is framed or marketed to building users. Research evidence suggests that effectiveness is enhanced through framing to align with the needs and concerns of building users, and if possible, collaborating with them to develop the approach. This issue can be addressed through the steps outlined above to consult with stakeholders via Feedback Forums to identify issues, hopes and concerns related to energy use.

### 3.3.7 Find the “Right Inviter”

There is a general consensus that the “right inviter” is needed for communications to lead to desired actions (Robinson, 2012). In many cases, due to the influence of social networks and social norms (McMichael and Shipworth, 2013), this will be someone seen by the recipient as similar to them (e.g. friends, or high-status members of a community of peers). Robinson (2012) details a number of highly successful behaviour change campaigns that achieved their positive results by recruiting respected members of a community to spread a message to peers.

For eTEACHER, there should be a focus on identifying the right inviter(s) for each intervention within each case study building. For users, this is likely to be a trusted peer; for managers this may be a colleague or professional peer. In practice, a combined approach may be used, with a trusted peer introducing or inviting a member of the eTEACHER team to introduce the tool via a meeting, or forwarding an email drafted collaboratively.

### 3.3.8 Pre-test Interventions

It is standard practice in behaviour change interventions to seek to pilot interventions on a small scale to better understand their *effectiveness* and *potential barriers* to success.

For eTEACHER, there are two key aspects of pre-testing – **technical** aspects of software development; and **communicative** aspects of how users engage with the tools. We envisage technical aspects being managed via the respective work packages focussed on software development. From a communicative perspective, we recommend using the Feedback Forum, or other engagement tools (e.g. resident surveys) to explore receptivity to interventions as part of Task 1.2, both in terms of **engagement and behavioural response**. For example, the wording of a reminder message to shut down a PC at the end of a work day could be piloted via text messaging to help inform how this function is integrated within an eTEACHER app.

### 3.3.9 Learning and Evaluation

Learning and evaluation requires a clear strategy to be developed as early as possible. Baseline data is crucial to enable comparison before and after interventions (McKenzie-Mohr and Smith, 1999). A strong evaluation strategy should explicitly address each aspect of the proposed links articulated through a project's theory of change, which links the interventions to the actions that may result (Robinson, 2011). For example, for a project which seeks to encourage householders to install loft insulation via advertising a low-cost offer, evaluation should gather data on: insulation activity before and after the intervention; if and how householders engaged with the advertising campaign; their rationale for taking up the offer or not.

For eTEACHER, we recommend that evaluation (as developed via Task 4.1) should focus upon **two key types of stakeholder** (building users and building managers/owners) and two key issues: **energy-saving behaviour** and **engagement** with eTEACHER tools. This data should be supported by **evidence of behavioural influences** for each case study building (i.e. Motivation, Capability and Opportunity to carry out the desired behaviours).

We recommend identifying baseline evidence of energy usage as early as possible, potentially installing monitoring or metering equipment. As the heating season plays a key role in many relevant behaviours and interventions, we recommend identifying and beginning to collect **baseline energy consumption data** as soon as is practically possible. We suggest that the February meeting discusses existing baselines and the actions that could be taken to improve baseline evidence prior to interventions. Task 1.2, as detailed above, will gather evidence of behavioural influences (broadly in the first few months, in more depth from months 4 to 12).

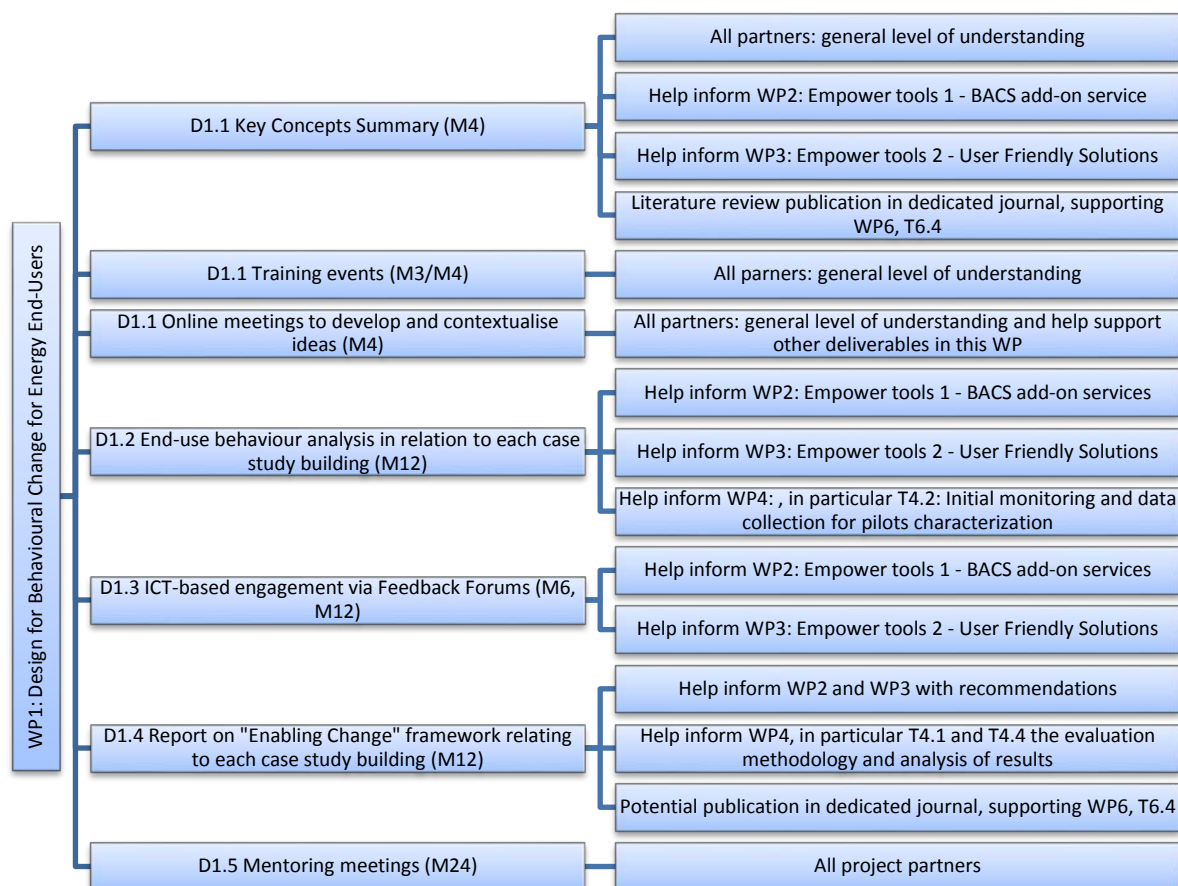
## 3.4 Summary

This section has introduced each aspect of the Enabling Change process, highlighting implications for how eTEACHER is developed. Many aspects of eTEACHER take this explicitly into account already, in particular through the developmental work package 1.

However, the discussion does highlight some ways of working that would benefit from a more explicit focus within the project design, particularly relating to developing input from stakeholders to inform in design of the eTEACHER tools via a programme level Advisory Group and project level Feedback Forums for each case study building.

## 4 Links to eTEACHER work packages

The outcomes from WP1 have specific influence on future work packages on the eTEACHER project. This is summarised below;



The next planned steps for Work Package 1 are as follows:

- At least two training events will be held via WebEx with project partners – ideally one representative from each project partner to attend, but mandatory for WP1 partners. These training events shall further explain and explore the ideas and concepts presented within this report and get feedback on how the behaviour change principles we outline can be applied within eTEACHER. As part of this we shall present an Enabling Change template which we would request is completed by each project partner in WP1.
- An online (WebEx) meeting will be held with each project partner following the training events, during Month 4, to develop and contextualise ideas following on from the training events and clarify any questions surrounding the Enabling Change template.
- A summary report, reporting on the development of the ideas presented within this report from the training events and follow up meetings with the project partners, will be produced and circulated in M4 (by end of January).
- Nottingham City Council shall be arranging workshops which aim to inform partners and users about the key things we have learned from this research and via a feedback forum collect views from them on what ideas appeal to them. They will also be used to gain more information to aid the logistical side such as what hardware and software users currently engage and are comfortable with.

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