EnergyMeasures

Tailored measures supporting energy vulnerable households

D1.2

Guidelines for integrating behaviour change approaches while engaging energy poor

http://www.energymeasures.eu

@NRGMeasures

December 2020

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 894759

Document Information

Deliverable ID	1.2		
Deliverable Title	Guidelines for integrating behaviour change approaches while engaging energy poor		
Lead beneficiary	UCC		
Contributing beneficiaries	EA, DUNE		
Due date Annex I	2020.12.31		
Issue date	2020.12.31		
Dissemination level	Public		
Author(s)	Niall Dunphy, Lauren Quinlivan, Breffní Lennon		
Document checked	Breffní Lennon, Niall Dunphy	Date:	2020.12.31

The EnergyMeasures Project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement no. 894759. For more information on the project, its partners, and contributors please see http://www.energymeasures.eu.

EnergyMeasures Consortium

	University College Cork – National University of Ireland, Cork	IE
	Energy Action CLG	IE
DuneWorks	DuneWorks BV	NL
HET PON	Stichting PON	NL
EINDHOVEN	Gemeente Eindhoven	NL
KAMP C innovatie in de bouw	APB Kamp C	BE
	Samenlevingsopbouw Antwerpen Provincie vzw	BE
Polska Sieć Energie Cités	Stowarzyszenie Gmin Polska Sieć Energie Cités	PL
ХАБИДОМ	Residential Building Management Company Habidom DOOEL	MK
EcoEnergy	Association Municipal Energy Efficiency Network EcoEnergy	BG
TIG	Tighean Innse Gall	UK
OIKOPLUS	Oikoplus KG	AT

Project Coordinator:

Dr Niall Dunphy, Director, Cleaner Production Promotion Unit, University College Cork, Ireland

t: + 353 21 490 2521 | e: n.dunphy@ucc.ie | w: www.ucc.ie/cppu

Table of Contents

About EnergyMeasures 5

1 Introduction 8
- **1.1 Background** 8
- **1.2 Structure** 8

2 People's relationship with energy 9
- **2.1 Energy consumption** 9
- **2.2 Energy poverty** 10

3 Behaviour and behavioural change 12
- **3.1 Behaviour** 12
- **3.2 Energy-related behavioural change** 15

4 Behaviour Change Interventions 16

5 Guidelines 19

6 Conclusion 26

7 References 27

Appendix 1 – Potential energy-related behaviour change measures 32

Appendix 2 – Prospective low-cost energy measures 34

About EnergyMeasures

EnergyMEASURES is working to address energy poverty in seven European countries, namely: Belgium, Bulgaria, Ireland, Netherlands, North Macedonia, Poland and the United Kingdom. The project comprises two complementary and synergistic strands of work.

The first strand involves working with energy poor households to improve their energy efficiency through a combination of low-cost measures, and changes in energy-related behaviours and practices. Recruited householders will be provided with low-cost energy measures and empowered to change their energy-related behaviours and practices through an approach that takes account of existing housing conditions and is reflective of their lived experience.

The second strand comprises working with municipalities, energy authorities, housing associations and other relevant actors to assess how current multi-level institutional contexts affect efforts to alleviate energy vulnerability in the participating countries. This knowledge will be used to develop and support the implementation of policy and practice measures which will address structural issues that combine to trap households in energy poverty.

Through this work the project contributes to reducing participants' vulnerability to energy poverty, while at the same time cutting household energy consumption and associated GHG emissions.

For more information see **http://www.energymeasures.eu**

Description of the deliverable and its purpose

This deliverable provides an overview of how behaviour change will be integrated into energy poor household engagement within EnergyMeasures. The work presented includes a short review of energy-related behaviour concepts and theories along with models of behaviour change. It outlines behaviour change methods used by similar initiatives, and forwards an approach to integrating behaviour change methods and techniques in conjunction with the deployment of low-cost energy conservation and energy efficiency measures.

Glossary

2M	An energy poverty metric indicating expenditure over twice the national median share of income in meeting energy needs.
ABC	Attitude-behaviour-context (model of behaviour)
AR5	Fifth Assessment Report (of the IPCC)
BCW	Behaviour change wheel
DoA	Description of Action
GHG	Greenhouse gas(es)
hEP	Hidden energy poverty
IPCC	Intergovernmental Panel on Climate Change
mEP	Measured energy poverty
M/2	An energy poverty metric indicating absolute expenditure on energy is less than half the national median.
pEP	Perceived energy poverty
RES	Renewable energy source(s)
TPB	Theory of planned behaviour
VBN	Value-belief-norm (model of behaviour)
WP	Work Package

1 Introduction

1.1 Background

The initial work package of the EnergyMeasures project comprises the preparatory work for the two strands of activities to be undertaken in realising the project work programme, namely: (a) multi-stakeholder engagement to assess and contribute to improvement in the institutional context; and (b) the household engagement of targeted segments of energy poor. This output relates to the second of these strands, and is focused on the integration of behaviour change approaches with the engagement of households suffering from energy poverty. EnergyMeasures partners will engage directly with householders living in energy poverty in seven countries: Belgium, Bulgaria, Ireland, Netherlands, North Macedonia Poland and the United Kingdom. In each of these countries energy poor households will be identified[1], characterised and engaged for energy-related behaviour change. This project was designed with the aim of considering not only potential energy savings associated with buildings' technical attributes, but also taking into account the social dimension of the lived experience of energy, and indeed of energy poverty. To this end, the project partners will work with households to analyse the ways in which they use energy and how these intertwine and relate to everyday routines, habits and expectations. It is envisaged that this will allow us to better understand the practices and behaviours that combine to shape household energy consumption. Developing this understanding of the householders' energy-related practices, habits and behaviours in addition to the physical aspects of their home enables us to apply insights into the intersections between energy use, socio-economic privilege and gender, and help energy poor households better understand and potentially change the way they relate to, and use energy. In this way, opportunities to save energy will be identified, as will potential barriers to behavioural change – this identification will enable the project to develop behaviour change plans tailored for the different households. This project deliverable is prepared to support this household engagement, it addresses the integration of behaviour change during the engagement of the energy poor. The work presented provides an overview of energy-related behaviour concepts and theories along with models of behaviour change. It details behaviour change methods used by similar initiatives, and forwards an approach to integrating behaviour change methods and techniques in conjunction with the deployment of low-cost energy conservation and energy efficiency measures.

1.2 Structure

The report is divided into six parts, the first of which is this brief introductory section, which outlines the background and purpose of the deliverable, and provides a description of its structure. The next section drawing from the literature comprises a treatment of energy-related practices and behaviours, and introduces the topic of energy poverty. The third section deals with concepts and theories of behaviour change, and specifically considers energy-related behaviour change. The fourth section discusses behaviour change interventions and outlines some of the ways that comparable projects have integrated behaviour change into their activities. The next section draws this information together in the preparation of household engagement guidance (integrating behaviour change), with the sixth and final section drawing some conclusions on the work presented, and outlines how this deliverable will be used within the project.

[1] See also EnergyMeasures Deliverable 1.1 'Review of Methods of Identifying Energy Poor Households'

2 People's relationship with energy

2.1 Energy consumption

With the energy sustainability discourse, there is a growing focus on domestic energy consumption. Furthermore, while in the past technical innovation was often presented as the means to reduce energy consumption, increasingly changing people's behaviour is becoming a focus for policy and research (Kok et al., 2011). There are however differing perspectives on how and why people consume energy, and how they relate to the energy system. Dunphy *et al.* (2017, p. 10) observe that different (sometimes competing) perspectives[2] position people in very different ways vis-à-vis the energy system. Depending on the perspectives people may be considered as consumers, clients, users, beneficiaries and/or citizens – they argue that the role attributed to households has '*implications in terms of visions for change and understanding how energy behaviour is shaped*'.

Traditionally, the dominant view on energy use was very much a rationalist, consumerist perspective in which energy users were seen solely as consumers, and moreover it was envisaged that they made rational choices about energy-related purchases including the consumption of energy. In this view, energy is treated just as another commodity – and choices are made on the basis of assessing the costs and benefits of different options. In this rational choice model of human behaviour, changing attitudes and influencing the adoption of pro-environmental behaviours would appear to be a simple matter of ensuring the preferred behaviour is more attractive (usually financially) and/or providing more or better information. This perspective is reflected in the preponderance of communication and marketing approaches used in energy-related behaviour change initiatives (Axon *et al.*, 2018), including the recently much in vogue applications of 'nudge' theory and social marketing to encourage shifts in individual behaviour (Barr and Prillwitz, 2014).

Notwithstanding the continued reliance (arguably over reliance) on communication measures to encourage behaviour change, there is a growing acknowledgement within academic discourse that such rationalist perspectives can be problematic. Such rational choice approaches have been criticised, for example for considering the physical, social, cultural and institutional contexts that shape and constrain people's energy choices (Owens and Driffill, 2008; Maréchal, 2009, 2010). The consumption of energy is intrinsically intertwined with almost every aspect of daily lives in the modern world (Dunphy, Revez, Gaffney, Lennon, Sanvicente, *et al.*, 2017). People do not consciously 'choose' to use energy, rather energy use underpins a wide range of everyday practices, many of which are taken for granted or considered 'essential' (Hunt and Ryan, 2014). Indeed, energy use is typically not considered abstracted from the goals to be achieved – for many, energy is practically invisible[3,4], if it is considered it is viewed as a means to an end – cooking a meal, heating a living space, watching TV, *etc.* – rather than something that is consumed in its own right.

[2] See for example, Mullally, Dunphy and O'Connor's (2018) exploration of competing framings of energy citizenship.
[3] As Pink and Mackley (2012, p. 7) observe, citing Harold Wilhite (2005, p. 2), Energy is somewhat invisible as '*(p)eople do not consume energy per se but rather the things energy makes possible such as light, clean clothes, travel, refrigeration and so on*'.
[4] Unless of course there is a disruption in supply or an inability to pay, and then it quickly becomes visible again. This is of course very pertinent when dealing with energy poor households, for whom energy (and the associated expenditure) will inherently be more visible than for the population at large.

We therefore suggest that sociological explanations of energy use and those from rationalist perspectives can complement each other effectively[5], with the latter providing a rounded account of individual decision-making processes, while the former considers the contexts which constrain them (Dunphy, Revez, Gaffney, Lennon, Ramis Aguilo, *et al.*, 2017). Understanding the practices and behaviours of the energy poor also of course requires an appreciation of the issue of energy poverty. Section 2.2 comprises a short overview of the issue outlining how it is defined and measured, and explaining the relevance of behaviour change within the project.

2.2 Energy poverty

Energy poverty (also referred to as fuel poverty[6]) refers to a condition where households have insufficient income to meet the most basic levels of energy needed to provide home heating, lighting, cooking and appliance use (Boardman, 2010). Although linked, energy poverty is distinct from income poverty (Healy, 2003; Pachauri and Spreng, 2011). Palmer, Macinnes and Kenqay (2008) point out that not all those who suffer from income poverty are in energy poverty and indeed not all those who are energy poor are necessarily income poor. The condition of energy poverty results from a combination of high energy prices, low household incomes, inefficient buildings and appliances, and specific household energy needs[7] (Bouzarovski, 2014). Thus, Healy (2003, p. 2) observes '*Fuel poverty is caused by a complex interaction between low income and domestic energy inefficiency*'. As a result, energy poor households either pay an above-average share of their income on energy, and/or they live in a cold and uncomfortable home with a reduced quality of life. Energy poverty can result in serious consequences including *e.g.,* impact on physical health and mental well-being, premature death, restricted lifestyles (including impact on children's learning), social exclusion, *etc*. (Thomson, Snell and Liddell, 2016).

Energy poverty is a complex and multi-faceted issue, and there are multiple (and varying) definitions of the phenomenon[8]. Dubois (2012, p. 107) observes that energy poverty can manifest in a number of ways *'... from excessive energy expenses, which can result in energy debts or to the reduction of other budgets like the food budget, to a rationing of energy consumption and cold homes, with possible effects on health, quality of life and on the quality of buildings*'. There has been a great deal of effort expended in defining and developing measurements for energy poverty including a variety of expenditure-based approaches and subjective measures (an overview of energy poverty indicators is included in deliverable 1.1[9]). As '*Energy poverty is a culturally sensitive, multi-dimensional concept that varies over time and by place and is thus not easily captured by a single indicator*' (Bouzarovski *et al.*, 2020, p. 41), the EU Energy Poverty Observatory (EPOV) recommend using a suite of both consensual self-reporting and expenditure-based indicators, which they

[5] see Section 3.1 for an overview of theories on behaviour

[6] This report takes the approach that the phrases 'energy poverty' and 'fuel poverty' can be used interchangeably, and agrees with Bouzarovski and Petrova's (2015, p. 37) argument that the term '*fuel poverty incorrectly places an emphasis on the supply of energy carriers to the home'*. Accordingly, the term energy poverty has been selected as the more appropriate term to use.

[7] These individual factors will influence the energy poverty of households to varying degrees

[8] For the purposes of this report, Thomson, Snell and Liddell's (2016, p. 5) succinct definition captures it rather well as *'when households have insufficient funds to pay for the most basic levels of energy needed to provide them with heating, lighting, cooking, and appliance use'*.

[9] EnergyMeasures D1.1 Review of Methods of Identifying Energy Poor Households, Section 3 Measuring energy poverty (*pp*.10-13)

suggest should be viewed and used in combination. They suggest the following four principal approaches to indicating energy poverty:

1. High share of energy expenditure in income (2M). Households who expend over twice the national median share of their income in meeting energy needs. The metric captures those who expend a disproportionately high amount on energy, indicating a possible prioritisation over other costs [10];
2. Low share of energy expenditure in income (M/2). Households whose absolute expenditure on energy is less than half the national median. This is also referred to a form of hidden energy poverty (hEP) and captures those households who restrict their energy consumption (and expenditure) below that which would be considered necessary to meet their basic needs;
3. Inability to keep home adequately warm (Keep warm) – this is a basic self-reporting of thermal discomfort, and what might be termed perceived energy poverty (pEP);
4. Arrears on utility bills (Arrears) – based on households' self-reported inability to pay utility bills on time within the last 12 months.

Appreciating the complex nature of energy poverty[11] is key to understanding the problem and working towards addressing it. The distinction made between energy poverty and income poverty, discussed above, is not simply one of semantics, rather acknowledging and understanding the difference leads to more effective measures. As would be expected, income support, through *e.g.,* welfare mechanisms, is proven effective in alleviating income poverty, however the phenomenon of energy poverty requires a more considered response, with reducing energy demand (including, where appropriate, through energy-related behaviour change) providing a more appropriate and sustainable solution than fuel subsidies or income support (Goldemberg, 2012)[12,13].

EnergyMeasures is built on the premise that reducing energy demand is the most effective and sustainable means of ameliorating fuel poverty. The project will couple provision of tailored no- and low-cost energy measures with a wide-ranging engagement on household energy use and encourage, enable and support householders to change their energy-related practices and behaviours. Following an evaluation of both the physical building context and social context of the households and residents, a tailored package of low-cost measures will be agreed with householders, who will sign up to a bespoke energy behaviour change plan that fits the way they live their lives. The following section will provide an overview of behaviour theories and concepts relevant to such an approach.

[10] Meyer et al. (2018), presenting Belgian metrics, refer to: measured energy poverty (mEP) for too high energy expenditure for income; hidden energy poverty (hEP) for too low energy expenditure; and perceived energy poverty (pEP) for those who self-report
[11] Indeed given its multifaceted nature and the differences in manifestation, one can almost speak of energy poverties
[12] Albeit there are of course cases of energy poverty which would require financial support (at least initially)
[13] Fuel subsidies do nothing to reduce the long-term vulnerability of households to energy poverty, and (may) encourage wasteful and polluting behaviour. In contrast reducing the energy demand required to achieve a basic level of energy services (including through behaviour change) will directly reduce energy vulnerability as well as reducing climate impact.

3 Behaviour and behavioural change

3.1 Behaviour

Human behaviours are not simple or straightforward, they are complex, non-linear and influenced by a number of various factors (Lucas *et al.*, 2008). People's behaviours determine how they act socially within particular environments, and tend to be influenced by emotions, habits and morals, as well as social and normative factors. These many influencing factors can make changing behaviours challenging (Martiskainen, 2007). It is widely accepted that habits and routines (*e.g.*, how we light and heat rooms) form the basis of most energy consumption behaviours, rather than one-off behaviours (Heimlich and Ardoin, 2008; Sovacool *et al.*, 2019).

A range of theoretical models have been devised so as to better understand human behaviour and thereby more effectively encourage behavioural change. Generally, these models have originated from the discipline of psychology – and increasingly in acknowledgement of the social context of behaviour also from sociology – with additional contributions from fields including neuroscience, (behavioural) economics, *etc*. Theories on behaviour and behavioural change are often grouped into four main categories: economic, educational, psychological and sociological, each of which provide a variety of diverse theoretical lenses with which to examine the topic of domestic energy use behaviour (Chatterton, 2011).

Economic and psychological theories, and the models derived from these areas, have been used extensively in policy intervention[14]. Such theories describe energy use behaviours as a product of deliberation, and rationalistic decisions, whereby information and prompts, such as the provision of explanatory information, form the basis for individual's decision-making (Chatterton, 2011). Within the realm of social psychology, three main models have been recognised for their exploration of the relationship between human psychology and energy conservation behaviour. These include the attitude-behaviour-context (ABC) model, the theory of planned behaviour (TPB) model and the value-belief-norm (VBN) model (Shi, Wang and Wang, 2019).

The dominant approaches to understanding behaviour have been based the rational choice theory, which suggests that individuals are capable of making choices regarding their behaviour[15]. This is exemplified by the Attitude-Behaviour-Context (ABC) model, in which attitude and external conditions are seen as the key variables in determining behaviour. However, a 'value-action' gap is often observed, with a discrepancy between how an individual intends to act and how they actually act, or as Blake (1999, p. 275) observes '*differences between what people say and what people do*'[16]. Barr & Prillwitz (2014) posit that factors largely ignored by rational choice-based models, such as the ABC models – including *e.g.,* physical environment, infrastructure, social practice – are linked to unsustainable behaviours. They suggest that this reveals inherent limitations in such models in understanding behaviour and instigating large-scale behaviour change (and societal transformation), such as that necessitated by the required transition to a more sustainable

[14] These rationalist behaviourist approaches are popular, as their narrative better fits the world-view of many policy-makers and their approach is congruent with the technocentric perspectives which heretofore dominated planning and delivery of services (and goods), and particularly energy .

[15] A number of studies, for example, found that attitude influenced adoption of pro-environmental behaviour (Gadenne et al., 2011; Liu and Bai, 2014).

[16] In environmental policy-making this can result in erroneous expectations of individuals acting in a particular, idealised manner.

energy regime. Shove (2010) comments that such societal transformation will require establishment of more sustainable regimes, rather than a reliance on any one single actor[17].

There are a number of socio-psychological frameworks, which aim to understand behaviours in relation to attitudes, alongside situational and local contexts (Hogg and Vaughan, 2009). The Theory of Planned Behaviour (TPB) (Ajzen, 1991), another prominent conceptual model of human behaviour strives to reflect social, psychological and contextual antecedents to behaviour (Heimlich and Ardoin, 2008). In contrast to the ABC model, TPB does not consider attitude to have a direct effect on behaviour, but rather is based on the concept of 'subjective expected utility', or the perceived value expected from a behavioural outcome (Ajzen, 1991; Kurz *et al.*, 2015; Verplanken and Roy, 2016). An individual's specific perceptions of the potential costs and benefits associated with a behavioural choice will lead to the formation of an attitude, which in turn determines behavioural intention (Ajzen, 1991). In this perspective, subjective norms and control of cognitive behaviour (along with behavioural intention) are considered direct determinants of behaviour.

The third prominent model used to explain human behaviour (often in relation to energy conservation) is termed the Value-Belief-Norm (VBN) theory of environmentalism (Stern, 2000). VBN theory formed through the integration of a range of models developed using norm-activation theory of altruistic behaviour, which proposes a chain of variables leading to pro-environmental behaviour (Schwartz, 1977; Verplanken, 2011). VBN theory asserts that fundamental values determine personal norms, or a sense of obligation to act a certain way, which in turn drives altruistic actions. It postulates that when an individual's attention has been drawn to an environmental issue, pro-environmental behaviours are only exhibited if pro-environmental values form part of the individual's identity (Verplanken, 2011; Kurz *et al.*, 2015). The model acts as an analytical framework for the investigation of psychological variables that affect human behaviour (Shi, Wang and Wang, 2019) and for promoting pro-environmental behaviours amongst members of the population who find it difficult to translate their pro-environmental values into actions.

Each of the prominent theories of behaviour discussed above presupposes that explicit choices are to be made and assumes a level of rationality (or at least bounded rationality[18]) in decision-making. As discussed in Section 2.1, many of the behaviours people display in the course of their day-to-day life are not the result of conscious decisions, but rather are embedded in socio-cultural and physical contexts. Developing an understanding of these behaviours requires an appreciation of the social practices and that make up daily life. For instance, Bourdieu developed his theory of practice to counter arguments that behaviour was '*driven by economic rationality*', in which he posits that practices are precognitive (Pink, 2012, p. 17). While there is no unified 'practice approach', Schatzki (2001, p. 2) observes there is agreement of the interconnectivity of all human activity within a 'field of practices'[19], and that this field is '*the place to study the nature and transformation*' of whatever subject matter they are interested. Warde (2013, p. 18) suggests that the

[17] The ABC model places responsibility for addressing climate change with the individual, assuming that their behavioural choices will make a difference and expecting them to deal with complex issues in isolation. For this reason, as well as the fact that the ABC model does not consider the extent to which governments themselves maintain unsustainable economies and ways of living, the ABC model's effectiveness at influencing policy remains debateable (Shove, 2010).

[18] Bounded rationality implied rational decisions, but within the constraints of available information and mental capacity.

[19] Schatzki (2001, p. 2) argues that practice approaches agree '*phenomena as knowledge, meaning, human activity, science, power, language, social institutions, and historical transformation occur within and are aspects or components of the field of practices'.*

distinctive feature of practice theory[20] approaches is that they '*view practices as the fundamental unit of social scientific analysis*' in preference to individual actions[21]. Warde (2005, p. 137) suggests that consumption should not be just considered in terms of demand and transactions but studied '*as an integral part of most spheres of daily life*'. Halkier, Katz-Gerro and Martens describe practice theories as '*a set of cultural and philosophical accounts that focus on the conditions surrounding the practical carrying out of social life'* (2011, p. 3).

We suggest it is useful to complement and supplement rationalist views or energy use with perspectives which take account of the practice-centred nature of our lives, in which social practices may be thought of as individual patterns of energy use (Barr & Prillwitz, 2014). While practices are performed by individuals, they are shaped (and sustained) by socio-political and physical contexts (Gram-Hanssen, 2011), including *e.g.,* infrastructure, governance systems, institutional arrangements, social norms and values. Crivits and Paredis (2013) argue therefore that a practice approach is neither purely individualistic nor rigidly structural, but takes account of the wide variety of factors shaping everyday behaviour. Social practice theory moves away from the traditional focus on individual behaviour and explores on the social contexts which frame everyday actions (Moloney *et al.,* 2010; Hargreaves, 2011).

Energy consumption in, and of, itself is not a behaviour but rather as Martiskainen (2007, p. 12) observes '*a consequence of behaviours'*. Household energy-related behaviour therefore refers to the everyday activities conduct in the home which require the use of energy. This may take the form of using central heating to heat rooms or using hot water for showering, for example (Martiskainen, 2007). As Abrahamse and Shwom (2018, p. 4) point out the '*important point that social practice theory emphasizes is that energy consumption isn't actually about energy at all, but rather about using energy in activities that serve a purpose in our lives*'. In this regard, Pink's (2012) treatment of household practices and their relationship to '*configurations of place and individual biographies and identities*' is of particular relevance[22]. Shove (2003 cited in Lopes, Antunes and Janada 2019) relates how the frequency of bathing and showering has substantially changed over a few generations, which she explains is not (only) due to personal choice, but rather a combination of physical and social and cultural contexts[23]. Dunphy *et al.* (2017, p. 29) posit that '*focussing on people's practices provides a lens both on how people use energy in their everyday lives, as well as the meaning that people's everyday practices hold for them'*. Such knowledge can provide insights to how households can move to more sustainable modes of energy consumption in a way that aligns with their way of living[24]. Section 3.2, which follows, provides an overview of concepts of, and approaches to, behavioural change, with a particular focus on changing energy-related behaviours.

[20] Warde (2013) was referring specifically to the second generation of practice theorists emerging in the 1990s & 2000s (see for example Schatzki, Cetina and Savigny, 2001).

[21] As opposed to the focus on personal actions of individuals by disciplines such as economics, psychology and a good deal of microsociology.

[22] See Pink (2012) specifically: Chapter 4 'Beyond the dishes: Putting Kitchen Practices in Place' *pp.* 45-65, and Chapter 5 'Making the sensory Home: Laundry Routes and Energy Flows' *pp.* 66-83.

[23] Described by Lopes, Antunes and Janada (2019, p. 4) as a '*confluence in the relationship between indoor plumbing, hot water provision, the number of bathrooms, and a host of social discourses about sanitation and social order, pleasures, duty and nature*'.

[24] Kurz *et al.* (2015) hold that changes in lifestyles, such as in energy practices, are the outcome of material, procedural and socio-discursive meanings underpinning social practices. Understanding this, and acknowledging completing (and complementary) household priorities can help to design a more effective household energy-related behaviour change plan.

3.2 Energy-related behavioural change

This idea of changing behaviour has most commonly been seen within the public health sector, with the goal of changing public behaviours to reduce negative outcomes of lifestyle choices, such as smoking (Michie and Johnston, 2012). There is widespread recognition of the potential of energy-related behaviour change to address rising energy use and its climate effects (Heimlich and Ardoin, 2008; Moloney, Horne and Fien, 2010). For instance, the significance placed by the Intergovernmental Panel on Climate Change (IPCC) in its Fifth Assessment Report (AR5) on behavioural and lifestyle choices highlights their perceived importance.

This has led to increasing appeals to individuals to reduce their impact on the environment and particularly to minimise their climate impact. However, there are many (individual, social, and structural) barriers which limit an individual's willingness (and indeed their ability) to alter their personal behaviour and lifestyles, despite a high level of general public support for addressing climate change (Ockwell, Whitmarsh and O'Neill, 2009; Hayles and Dean, 2015).

The development of effective intervention strategies for targeting energy behavioural change is dependent on our understanding of energy conservation behaviours. The design of effective interventions can prove a challenge due to the fact that it may be neither practical nor possible to address all relevant behaviours as part of an intervention, due to the varying circumstances and motivations underlying each individual behaviour. Interventions which target singular behaviours may prove too specific to be efficient, while those with a wider focus on 'saving energy' run the risk of being too broad to be effective (Karlin *et al.*, 2014). Recent research has led to energy conservation behaviour been categorised into two distinct dimensions: efficiency and curtailment behaviours (Dietz *et al.*, 2009; Attari *et al.*, 2010; Gilligan *et al.*, 2010).

- *Efficiency behaviours*, once-off behaviours that may necessitate occasional actions, *e.g.,* purchase of efficient appliances or equipment or investment in structural changes. While there is a financial outlay associated with these behaviours, they do not result in lost amenities and generally produce longer-lasting effects (Karlin *et al.*, 2014). Efficiency behaviours can be further divided into high-cost (e.g., installation of insulation) and low-cost measures (*e.g.,* replacing incandescent lamps with LED lights);
- *Curtailment behaviours*, no-cost (or very low-cost) energy-saving behaviours requiring repetitive efforts to produce energy savings, including *e.g.,* turning off light switches, lowering thermostat settings, closing curtains, *etc*. Karlin *et al.*, (2014) reports that some associate them with reduced amenities or decreased comfort. The energy-saving potential of curtailment behaviours is generally considered less than that of efficiency behaviours (Gardner and Stern, 2002).

A third type of energy saving behaviour is acknowledged by others – Sweeney *et al.*, (2013) for example sees maintenance behaviours as distinct from curtailment:

- *Maintenance behaviours*, the maintenance and repair of energy-using appliances to improve their performance and efficiency.

To date, the majority of policy interventions have tended to place more of a focus on efficiency behaviours (Darnton *et al.*, 2006; Morrissey *et al.*, 2016). However, energy saving behaviours are very varied – they

encompass a diverse set of behaviours (many of which include subsets) that differ greatly in terms of their relative financial cost, effort, and required knowledge for implementation. With regard to lighting, for example, distinctions can be made between installing energy-efficient lighting, setting lighting timers, or turning the lights off when one leaves a room. The varied nature of energy behaviours requires that effective behaviour change intervention strategies be diverse in their nature (Karlin *et al.*, 2014).

4 Behaviour Change Interventions

Behaviour change interventions can be understood as those actions designed to influence a specific behavioural pattern, at both the individual and societal levels. Michie, van Stralen and West's (2011) *Behaviour Change Wheel*[25] offers a framework for understanding and designing behaviour change interventions. The core of the BCW framework is the COM-B model shown in Figure 1, which posits that there are three interlinking sources of human behaviour (which in turn are influenced by behaviour), namely:

- Capability – psychological and physical capacity to engage in the activity;
- Opportunity – external factors that make a behaviour possible or prompt it;
- Motivation – brain processes that initiate and direct behaviour.

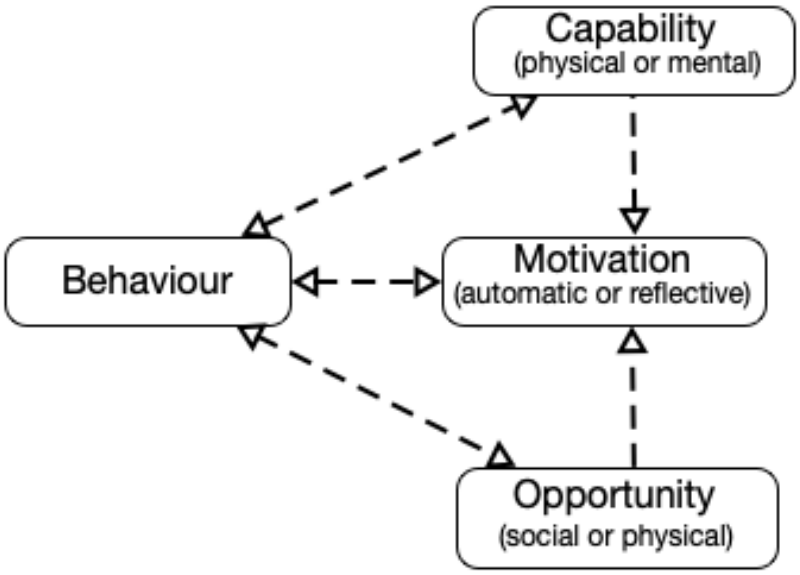

Figure 1: Representation of Michie's COM-B system (derived from Michie, van Stralen and West, 2011, pp. 4, 7)

These three sources from which a behaviour may arise, form what is essentially a determining central hub, around which nine intervention functions[26] aimed at addressing the potential deficits in one or more of these conditions are positioned. The third layer in the wheel comprises seven policy categories that should allow for those interventions to take place, namely:

- Legislation;

[25] Developed following a systematic review of behaviour change approaches, in which Michie, van Stralen and West (2011) identified nineteen behaviour change frameworks 'covering nine intervention functions and seven policy categories that could enable those interventions'

[26] Restrictions, training, education, enablement persuasion, incentivisation, coercion, modelling, environmental restructuring

- Regulation;
- Fiscal measures;
- Environmental and social planning;
- Service provision;
- Communication and marketing;
- Guidelines.

Figure 2 below offers a visualisation of the behaviour change wheel' (BCW)[27] with its three constituent layers developed by Michie, van Stralen and West (2011)

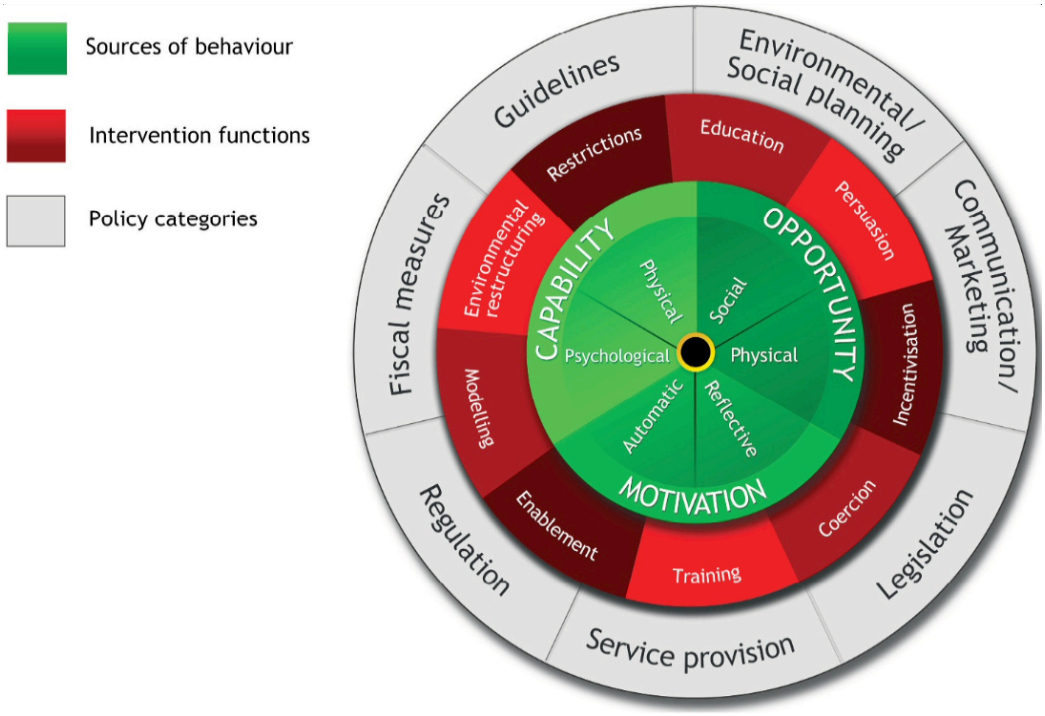

Figure 2: Behaviour change wheel (sourced from Michie, van Stralen and West, 2011, p. 7)

None of the frameworks reviewed by Michie, van Stralen and West (2011) engaged with the full range of intervention functions or policies available, and only a small number demonstrated a clear link to a specific model of behaviour. This analysis perhaps offers us some insight into why behaviour change interventions have largely failed to deliver on their promise to date. In some recent work[28], we similarly found a clustering of effort around a small number of intervention functions and policy categories, with a dearth of initiatives taking other approaches. Morrissey *et al.,* (2016) explored approaches to behaviour change across five European countries, identifying and characterising behaviour change initiatives in France, Italy, Ireland, Spain and the UK. The research found a focus around communications and marketing and a consequential over-reliance on traditional education and awareness-raising approaches, and suggest that '*such projects will likely struggle to achieve sustained or meaningful behaviour changes*' (Axon *et al.*, 2018, p. 584).

[27] See also Michie and Johnston (2012), and Michie, Atkins and West (2014) for further work on the behaviour change wheel.
[28] ENTRUST: Energy System Transition Through Stakeholder Activation, Education and Skills Development. Horizon 2020 Grant Agreement # 657998) https://cordis.europa.eu/project/id/657998.

Table 1 below examines the behaviour change approaches used by ten EU-funded projects (Horizon 2020 and Intelligent Energy Europe), which focused on household energy behaviour and practices. Project reports were reviewed, and activities which corresponded to the nine behaviour change intervention functions identified. As would be expected, there was an emphasis on education, through information and awareness campaigns; and service provision, in the form of bespoke household energy advice. There were also some examples of enablement in which a number of projects provided energy efficiency devices to households (coupled with the energy advice).

Table 1: Behaviour change approaches adopted by selected EU-funded energy efficiency / energy poverty projects

EU Project	**Topic**	**Behaviour Change Intervention function** (after Michie *et al.* 2011)
REACH	IEE Energy Efficiency Consumer behaviour ec.europa.eu/energy/…/projects/reach	• Training (volunteer advisors)[29] • Service provision (energy advice)
ACHIEVE	IEE Energy Efficiency Consumer behaviour ec.europa.eu/energy/.. /projects/achieve	• Training (volunteer advisors) • Service provision (energy advice) • Enablement (provision of energy devices)
TRIME	IEE Energy Efficiency Consumer and Products ec.europa.eu/energy/…/projects/trime	• Training (volunteer advisors) • Service provision (energy advice)
FIESTA	IEE Energy Efficiency Consumer and Products ec.europa.eu/energy/…/projects/fiesta	• Education (information campaign) • Service provision (energy advice) • Enablement (provision of energy devices) • Incentivisation (lotteries)
EC-LINC	IEE Energy Efficiency Consumer Behaviour ec.europa.eu/energy/...en/projects/ec-linc	• Service provision (energy advice) • Enablement (provision of energy devices)
SAVES2	H2020-EE-06-2016 Engaging private consumers towards sustainable energy cordis.europa.eu/project/id/754203	• Education (information campaign) • Incentivisation (competitions)
ASSIST	H2020-EE-06-2016 Engaging private consumers towards sustainable energy cordis.europa.eu/project/id/754051	• Service provision (energy advice)
STEP-IN	H2020-EE-06-2017 Engaging private consumers towards sustainable energy cordis.europa.eu/project/id/785125	• Service provision (energy advice)
EmpowerMed	H2020-SC3-EC2-2018 Mitigating household energy poverty cordis.europa.eu/project/id/847052	• Service provision (energy advice)

[29] Note: Training of citizen-volunteers as energy advisors is included as a behaviour change measure, as the trainees are themselves members of the target group and the training provided will equip them to change their energy related behaviours in addition to acting as energy advisors to their peers. Where training was provided to project team members of other professionals such instruction was not counted as a behaviour change measure.

EU Project	Topic	Behaviour Change Intervention function (after Michie *et al.* 2011)
STEP	H2020-SC3-EC2-2018 Mitigating household energy poverty cordis.europa.eu/project/id/847080	• Education (information campaign) • Service provision (energy advice) • Enablement (provision of energy devices)

Provision of information[30] (on its own) is insufficient for sustainable behavioural change. Abrahamse *et al.* (2005) observe that while provision of information may increase knowledge, this does not lead to changes in energy-related behaviour, or to reductions in energy consumption. However, combining information provision with other interventions such as: monitoring, feedback, and rewards can lead to greater success (Morrissey *et al.*, 2016)

But of course, which informtion and how it is communicated is also of importance. Karlin *et al.* (2014) suggest that understanding the drivers of energy behaviours is vital for the development of appropriate interventions – to address different behaviours, but also different types of people. They note that energy feedback, for example, is effective when dealing with price-conscious individuals, promoting both curtailment and efficiency behaviours, and suggest moral appeals may bring about curtailment behaviours, with information campaigns promoting efficiency behaviours. Understanding these differences and appreciating the implications for interacting with different households will result on more effective, targeted interventions.

For all the many behavioural theories and models, it is perhaps arguable that no one approach can explain human behaviour. Psychological approaches can help appreciate the factors influencing people's discrete behaviour sand choices, while approaches like social practice theory help to understand the social embeddedness of, and gain insights into much of our domestic practices (Morrissey *et al.*, 2016). Given there is no comprehensive model of human behaviour, both individualistic and socially orientated accounts of energy related behaviours offer useful perspectives on people's energy-related practices and energy behaviours. In this regard, the different models and perspectives on behaviours presented in previous sections can prove useful, as they facilitate a pragmatic approach to be taken in the development of behavioural change interventions.

5 Guidelines

The following guidelines outline the general approach to integrating behaviour change approaches while engaging energy poor within the EnergyMeasure project. The approach described below aims to reflect the discussion on energy consumption and approaches to behaviour change presented as Sections 2, 3 & 4.

The adopted approach sees energy use not as a behaviour which can be changed, for as Martiskainen (2007, p. 12) observes energy use is '*a consequence of behaviours*' – and it is therefore these that are of interest. Moreover, it recognises that energy-related behaviours are not just isolated discrete actions, but are the

[30] This report posits that the context of energy provision is important – the provision of household energy advice could be seen as little more than education – however providing possible solutions to acknowledged household problems (such as thermal discomfort and affordability) arguably makes this a different proposition (which explains its categorisation as a service provision in Table 1). This is especially the case where it is combined with the deployment of energy efficiency and conservation measures as was the case with a number of the project reviewed on page 21, and will be the case with EnergyMeasures.

result of the (often complex) social practices that make up domestic life. Accordingly, developing insights into household energy practices and behaviours is a key part of the work to be undertaken.

Behaviour change is ongoing and repetitive process, which requires support. Provision of ongoing support is an important part of the approach outlined in the guidelines (such support will be provided through household visits, telephone calls, video chats, email, online forums, *etc.*). We also see the importance of ongoing support to optimising the effectiveness of the no-cost and low-costs measure, noting Schüle *et al.'s* (2011) proposition that continued provision of good quality information reduces the rebound effect**.**

Over the following pages, guidelines will be outlined which detail the steps to be taken in engaging with energy poor households and how behaviour change is integraed, including: registration and preliminary data collection; first household visit and gathering of information; data analysis and preparation of bespoke plans; second household visit, deployment of energy measures and agreement of behaviour change plan; and provision of ongoing support.

1. Registration and initial gathering of data

Following confirmation that a household wishes to participate, householders should be invited to register with the project, and arrange their first visitation. This registration may be completed in a number of ways including: returning a physical paper form; via telephone call[31]; via email or over the internet; in person at time of recruitment[32]; *etc*. Participants should be asked to provide the following basic information[33]:

- Contact name, telephone number and email address;
- Confirmation that they meet the criteria for participation in the project[34];
- Address of dwelling (including any specific access information);
- Number of persons living in the household;
- Size of dwelling;
- Number of rooms;
- Sources of energy used in dwelling[35].

2. First household visitation/contact

Given the on-going Covid-19 pandemic, a cautious approach should be adopted face-o-face interactions with households. Where household visits are permitted[36], and householders agree to visits, project energy

[31] This telephone call may take place at time of expression of interest or at a future scheduled time
[32] In-person recruitment could take place at community events, through introduction by community 'gatekeepers', etc.
[33] The location details and size of dwelling will allow for efficient scheduling of visitations
[34] During the recruitment stage it will have been made clear that EnergyMeasures is focused on assisting households suffering from energy poverty. Prospective participants have conducted a self-assessment exercise to assess their eligibility, which will be checked prior to registration.
[35] Households should be requested to collect energy billing data in advance of first visitation. Such information will likely be available from energy suppliers (in many cases, customers' account information can be accessed online).
[36] Due to Covid-19 a physical visitation may not be possible due to public health restrictions. Where face-to-face contact is permitted and householders agree to visits, such engagements should adhere to public health guidance and best practice, adopting a cautious approach to such interactions.

advisors should adhere to public health advice and best practice. Indicative measures are included in Box 1 on page 22. During household visitations there are four key steps to be undertaken, as detailed below.

Step one: The project energy advisors should introduce themselves to householders on arrival and outline the details of the visitation. Details collected during registration should be confirmed (including eligibility).

Step two: Using the templates devised for the project (and through discussion with householders), energy consumption data (both electricity and heating energy) should be collected for the household[37].

Step three: The project energy advisors should undertake a tour of the household to gather information about the physical and technical aspects of the dwelling, and to look at energy-using appliances, including measuring power consumption using energy monitoring adapters.

Step four: Householder(s) should then be engaged in a discussion (using the interview schedule developed for the project) covering their household practices, examining their use of particular appliances, discussing perceived energy-related problems, exploring potential solutions, *etc.*[38] . Table 2 below outline indicative information to be gathered about different aspects of the dwelling through steps 3 & 4.

Table 2: Examples of information which will feed into selection of low-costs measures and behaviour change plan

Area	Queries	Area	Queries
Heating system	Type and age of system? When was boiler last serviced?	Bathing	Shower or bath? Water flow rates? How many per week? length of time?
Radiators	How many? What type? Air-blocked? Reflective foils at back? Obstruction to heat?	Window and doors	Are windows double-glazed? Are there draughts? Do windows (hinges) need to be adjusted?
Lighting	No of light bulbs? Type? Wattage?	Chimney	Is there an open fire? How often is it used? Can flue be closed?
Fridges, freezers	Temperature setting? Quality of seals? Positioning? Frequency of defrosting?	Cooking	What type of appliances are used? Cooking routine? Is kettle constantly boiled?
Laundry	How many loads a week? at what temperate? (which program?) only full loads?	General devices	Power consumption (on / standby/ plugged in)? Use per day? time on stand-by?
Hot water	Is there hot water cylinder jacket? Lagging on pipping?	General	Is there an issue with mould?

Box 1 below outlines the indicative measures (subject to local public health advice and guidance) to be used during the household visits, until such time as the Covid-19 pandemic has resolved.

[37] Where records are not readily available (*e.g.,* of because there is district heating or households have *ad hoc* energy purchases *e.g.,* fuel oil, solid fuels), estimates can made, for example, using allocation methods (taking dwelling size into account) in the case of the former, and by using householders' recollections in the case of the latter.

[38] Detailed notes will be taken of these interviews, and if required (and with householder permission) audio-recordings.

Pre-visitation check that both householders and energy advisors are symptom free, have not had close contact with someone who tested positive or suspected of having Covid-19, and have not travelled to a country (or region) with high prevalence of Covid-19 within the last 14 days;

- The duration of visits will be kept to a minimum. As much of the visit as possible will take place outside the home, including introductions and check-ins;
- Social distancing will be practiced, where rooms are too small to allow for this, householders will be asked to observe from adjacent rooms during inspections, to ensure adequate distance is kept;
- Householders will be requested to ensure good ventilation throughout the duration of the visit, with doors and windows open where possible;
- Facemasks or a face covering will be worn by the energy advisor and householder during the visit;
- Energy Advisors will wash their hands and sanitize before entering and leaving the homes[39];
- Before leaving, Energy Advisors will wipe down all surfaces with which they may have come in contact, using appropriate cleaning wipes or similar, which they will bring with them and dispose appropriately;
- Householders will be asked to notify the team if they discover subsequent to the visit that a close contact has tested positive for Covid-19 (this will be verified via a follow-up call by the project team).

Box 1: Methods to reduce, refine, and replace person-to-person contact involved in household visitations

Visit #1 alternative / supplementary approach

While ideally this initial visitation would take place in the in-person manner originally envisaged, this may not be possible due to restrictions on travel and inter-personal contact arising from the Covid-19 pandemic. In this eventuality, alternative remote data collection approaches will be used to develop understandings on both the physical aspects of their home and the people's day-to-day lives.

Participating householders[40] will be asked to take photos of their homes and daily lives *i.e.,* photo-elicitation (see e.g., Soaita and McKee, 2020), and to make videos, *i.e.,* video-elicitation (see e.g., Storm-Mathisen, 2018), and record voice memos about their everyday energy practices. The project team will provide prompts and questions to direct the householders in their recordings.

To facilitate and support this unexpected requirement for remote engagement, specific resources will be developed for project partners and provided along with specific guidance within the context of Task 2.1: Internal capacity-building.

3. Data analysis and evaluation

The insights on supplied by householders on their daily practices, the information collected on the dwelling and appliances within, and the quantitative data collected on energy consumption should be analysed and

[39] Advisors will carry their own personal hygiene materials. Gloves will not be used due to the risk of contamination

[40] While many participants will have access to their own smartphones, such technology is not ubiquitous (and availability will differ between countries). To overcome such technical exclusion the project will in so far as possible lend equipment to households as required

assessed in a systematic manner. In achieving this the energy advisor (with appropriate support from colleagues and partners) will:

- Compare the consumption data with that of similar households to highlight elevated levels of consumption and indicate those households where there is particular scope for energy savings;
- Compare the aggregate power consumption data for appliance with the total energy consumption to indicate so-called hidden energy use within the household *i.e.,* consumption attributable to devices unaccounted for (*e.g.,* second freezer) or incorrect estimates of usage time of known devices;
- Examine individual device-level consumption data to indicate saving potentials associated with them, and so determine the relative importance of behaviour associated with each;
- Review the consumption data and analyse the information supplied by the households to develop an understanding of their household practices and what they mean for their patterns of energy use;
- Use the developed knowledge to:
    - Work with householders to, select a package of no-cost and low-cost energy conservation and efficiency measures which are most appropriate for the dwelling;
    - Devise a tailored behaviour change plan[41] for householders to implement in their daily lives[42], including a relevant mix of efficiency, curtailment, and maintenance behaviours.

4. Second household visitation

The second household visitation[43] should take place following the analysis of the collected information, the identification of appropriate low-cost measures, and the preparation of household behaviour change plan. This should take place as soon as practical after the initial visitation to maintain the householders' interest in and engagement in the initiative. During the second visitation the project energy advisors will

- Provide households with a brief report detailing the energy undertaken for the household;
- Talk householders through the report highlighting key results and relating how they relate to the recommendations;
- Discuss with the householders the no-cost and low-cost energy conservation and efficiency measures most appropriate for them, and agree a package of measure to be deployed;
- Talk through, and as appropriate, assist the householders in deploying the energy measures;
- Present the tailored household behaviour change plan, talk through the various proposed behaviours, and discuss its adoption with householders, Identifying barriers and where possible potential supports;
- Provide energy saving information brochures relevant to both the deployed energy measures and suggested efficiency, curtailment, and maintenance energy behaviours;

[41] This will be based on a template prepared within task 2.2
[42] See **Error! Reference source not found.** on page 33 for some simple examples of the type of information that will inform such plans
[43] Or remote contact if necessitated by Covd-19 restrictions

- Inform householders of EnergyMeasures supports available to optimise use of their energy measures, but particular to support their changes in energy-related behaviours;
- Get householders to sign project participant sheet to (i) confirm completion of household visitation; (ii) acknowledge receipt of energy measures; (iii) agree to household behaviour change plan.

Visit #2 alternative / supplementary approach

As for the initial visitation, Covid-19 related restrictions on travel and inter-personal contact may require this second contact to be also realised remotely. The reports and low-cost measures could be delivered to the participating household in advance. Project energy advisors could then follow up with a call to talk though the report and behaviour change plan. Video calls could be used particularly to support households in the deployment of their chosen cost and low-cost energy conservation and efficiency measures.

As mentioned previously, to facilitate and support this unexpected requirement for remote engagement, specific resources will be developed for project partners and provided along with specific guidance within the context of Task 2.1: Internal capacity-building.

5. Follow-up support for householders

Ongoing support for behaviour change will be provided to households over the course of 2-3 further household contacts – these may take the form of in-person visits (where circumstances permit), but will emphasise telephone and video calls both for reasons of public health (as previously discussed) but also as a means of increasing the efficiency of the process. Here the project energy advisor will talk the householders through their experience of the low-costs measures and of implementing changes in their energy-related behaviours – collecting feedback from the participants, providing advice and guidance where possible, and redirecting for support if appropriate. Assistance will be also provided where needed in choosing appliances, reading energy bills, switching energy providers, and accessing grants.

In addition to these direct household contact there will be regular text alerts, email bulletins and social media updates to keep people engaged. The project will provide a dedicated behaviour-change support section on www.EnergyMeasures.eu. This section will include energy saving tips, household energy calculators, but moreover will work to create a 'behaviour change community' by integrating social media and inviting participants to share energy saving tips, problems and advice. Participants will be encouraged to upload their energy-saving ideas and stories of their successes, and there will be a series of competitions with energy-efficient appliances as incentives.

Overview of behaviour change integration

Figure 3 below presents a graphical overview of how behaviour change is to be integrated into the various engagement activities within the EnergyMeasures project.

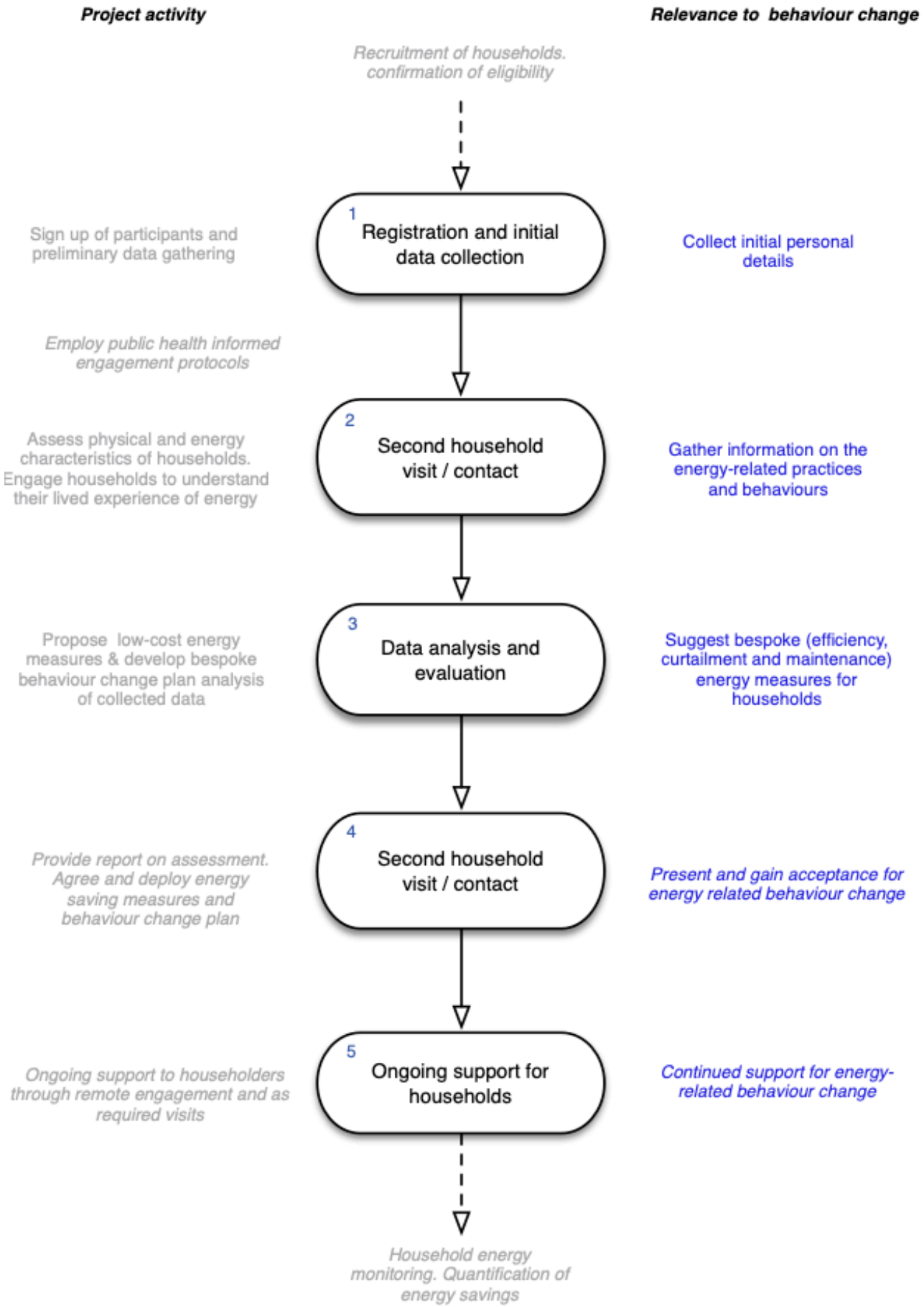

Figure 3: Overview of integration of behaviour change activities into the EnergyMeasures engagement process

6 Conclusion

The guidelines presented here (and summarised in Figure 3 above) detail how behaviour change will be integrated into energy poor household engagement within EnergyMeasures. As examples of what might be contained in a household behaviour change plan, Appendix 1 comprises a list of potential energy efficiency, energy curtailment and energy maintenance behaviours, all of which would result in reduced energy consumption. These proposed behaviour changes are quite varied, and are grouped under a number of headings, namely: laundry; food storage; food preparation; washing and bathing; heating; lighting; and general. Appendix 2 comprises a complementary list of indicative low-cost energy measures, which could be deployed, these are grouped under the same headings.

This deliverable is intended as a basis for partners to implement household engagement and accordingly will feed directly into Task 2.1 Internal capacity building. This capacity building will include:

- Training workshops for the staff of partners involved in engagement, a mixture of instructor-led classroom training (albeit delivered remotely due to current circumstances), with hands-on interactive role play and group activities;
- Co-creation of locale-specific action plans for each of the seven engagement countries (BE, BG, NL, IE, PL, UK), based on these guidelines;
- Development of, and training in use of, detailed step-by-step engagement protocols and checklists based on these action plans[44].

The guidelines will be iteratively developed and expanded upon taking account of on-the-ground experiences (and where relevant experiences of cognate projects). Accordingly, a revised version of the guidelines will be included as an appendix to the report on report on internal capacity[45].

[44] Additionally, ongoing support will be given as required during the implementation of the guidelines .
[45] D2.1 Report on internal capacity building for staff engaging with energy poor

7 References

Abrahamse, W. *et al.* (2005) 'A review of intervention studies aimed at household energy conservation', *Journal of Environmental Psychology*, 25(3), pp. 273–291. doi: 10.1016/j.jenvp.2005.08.002.

Abrahamse, W. and Shwom, R. (2018) 'Domestic energy consumption and climate change mitigation', *Wiley Interdisciplinary Reviews: Climate Change*, 9(4), pp. 1–16. doi: 10.1002/wcc.525.

Ajzen, I. (1991) 'The theory of planned behavior', *Organizational Behavior and Human Decision Processes*, 50, pp. 179–211.

Attari, S. Z. *et al.* (2010) 'Public perceptions of energy consumption and savings', *Proceedings of the National Academy of Sciences of the United States of America*, 107(37), pp. 16054–16059. doi: 10.1073/pnas.1001509107.

Axon, S. *et al.* (2018) 'The human factor: Classification of European community-based behaviour change initiatives', *Journal of Cleaner Production*. Elsevier Ltd, 182, pp. 567–586. doi: 10.1016/j.jclepro.2018.01.232.

Barr, S. and Prillwitz, J. (2014) 'A smarter choice? Exploring the behaviour change agenda for environmentally sustainable mobility', *Environment and Planning C: Government and Policy*, 32(1), pp. 1–19. doi: 10.1068/c1201.

Blake, J. (1999) 'Overcoming the "value-action gap" in environmental policy: Tensions between national policy and local experience', *Local Environment*, 4(3), pp. 257–278. doi: 10.1080/13549839908725599.

Boardman, B. (2010) *Fixing Fuel Poverty: Challenges and Solutions*. London: Earthscan.

Bouzarovski, S. (2014) 'Energy Poverty in the European Union: landscapes of vulnerability', *WIREs Energy and Environment*, 3, pp. 276–289. doi: 10.1002/wene.89.

Bouzarovski, S. *et al.* (2020) *Towards an inclusive energy transition in the European Union : Confronting energy poverty amidst a global crisis. Third pan-EU energy poverty report of the EU Energy Poverty Observatory*. Luxembourg: Publications Office of the European Union. doi: 10.2833/103649.

Bouzarovski, S. and Petrova, S. (2015) 'A global perspective on domestic energy deprivation: Overcoming the energy poverty-fuel poverty binary', *Energy Research and Social Science*. Elsevier Ltd, 10, pp. 31–40. doi: 10.1016/j.erss.2015.06.007.

Chatterton, T. (2011) *An introduction to thinking about 'energy behaviour': A multi-model approach*. London. Available at: http://eprints.uwe.ac.uk/17873.

Crivits, M. and Paredis, E. (2013) *Designing an explanatory practice framework: Local food systems as a case*, *Journal of Consumer Culture*. doi: 10.1177/1469540513484321.

Darnton, A. *et al.* (2006) *Promoting Pro-Environmental Behaviour: Existing Evidence to Inform Better Policy Making*. London.

Dietz, T. *et al.* (2009) 'Household actions can provide a behavioral wedge to rapidly reduce US carbon emissions.', *Proceedings of the National Academy of Sciences of the United States of America*, 106(44), pp. 18452–6. doi: 10.1073/pnas.0908738106.

Dubois, U. (2012) 'From targeting to implementation: The role of identification of fuel poor households', *Energy Policy*. Elsevier, 49, pp. 107–115. doi: 10.1016/j.enpol.2011.11.087.

Dunphy, N. P., Revez, A., Gaffney, C., Lennon, B., Ramis Aguilo, A., *et al.* (2017) *Intersectional Analysis of Energy Practices. Deliverable 3.2 of the ENTRUST H2020 Project*. Cork: University College Cork. doi: 10.5281/zenodo.3479295.

Dunphy, N. P., Revez, A., Gaffney, C., Lennon, B., Sanvicente, E., *et al.* (2017) *Synthesis of socio-economic, technical, market and policy analyses Deliverable 3.4 of the ENTRUST H2020 Project*. Cork: University College Cork.

Gardner, G. T. and Stern, P. C. (2002) *Environmental Problems and Human Behavior*. Boston: Pearson.

Gilligan, J. *et al.* (2010) 'The behavioural wedge: reducing greenhouse gas by individuals and households', *Significance*, 7, pp. 17-20.

Goldemberg, J. (2012) *Energy: What Everyone Needs to Know*. Oxford, UK: Oxford University Press.

Gram-Hanssen, K. (2011) 'Understanding change and continuity in residential energy consumption', *Journal of Consumer Culture*, 11(1), pp. 61–78. doi: 10.1177/1469540510391725.

Halkier, B., Katz-Gerro, T. and Martens, L. (2011) 'Applying practice theory to the study of consumption: Theoretical and methodological considerations', *Journal of Consumer Culture*, 11(1), pp. 3–13. doi: 10.1177/1469540510391765.

Hargreaves, T. (2011) 'Practice-ing behaviour change: Applying social practice theory to pro-environmental behaviour change', *Journal of Consumer Culture*, 11(1), pp. 79–99. doi: 10.1177/1469540510390500.

Hayles, C. S. and Dean, M. (2015) 'Social housing tenants, Climate Change and sustainable living: A study of awareness, behaviours and willingness to adapt', *Sustainable Cities and Society*. Elsevier B.V., 17, pp. 35–45. doi: 10.1016/j.scs.2015.03.007.

Healy, J. D. (2003) *Fuel Poverty and Policy in Ireland and European Union*. Dublin: Policy Institute, Trinty College Dublin.

Heimlich, J. E. and Ardoin, N. M. (2008) 'Understanding behavior to understand behavior change: a literature review', *Environmental Education Research*, 14, pp. 215–237. doi: 10.1080/13504620802148881.

Hogg, M. A. and Vaughan, G. (2009) *Essentials of social psychology*. Melbourne / Sydney: Pearson Education, Australia.

Hunt, L. and Ryan, D. (2014) *Economic Modelling of Energy Services: Rectifying Misspecified Energy Demand Functions' Discussion Paper, SEEDS No. 147*.

Jackson, T. (2005) 'Motivating Sustainable Consumption. A review of evidence on consumer behaviour and behavioural change. A Report to the Sustainable Development Research Network.' Guildford: University of Surrey.

Karlin, B. *et al.* (2014) 'Dimensions of Conservation: Exploring Differences Among Energy Behaviors', *Environment and Behavior*, 46(4), pp. 423–452. doi: 10.1177/0013916512467532.

Kok, G. *et al.* (2011) 'Changing energy-related behavior: An Intervention Mapping approach', *Energy Policy*. Elsevier, 39(9), pp. 5280–5286. doi: 10.1016/j.enpol.2011.05.036.

Kurz, T. *et al.* (2015) 'Habitual behaviours or patterns of practice? Explaining and changing repetitive climate-relevant actions.', *WIRES Climate Change*, 6, pp. 113–128.

Lopes, M., Antunes, Carlos Henggeler and Janda, K. B. (2019) 'Energy and behavior: Challenges of a low-carbon future', in Lopes, M., Antunes, Carlos H, and Janda, K. B. (eds) *Energy and Behaviour: Towards a Low Carbon Future*. London: Academic Press, pp. 1–15.

Lucas, K. *et al.* (2008) 'Promoting pro-environmental behaviour: existing evidence and policy implications', *Environmental Science and Policy*, 11(5), pp. 456–466. doi: 10.1016/j.envsci.2008.03.001.

Maréchal, K. (2009) 'An Evolutionary Perspective on the Economics of Energy Consumption: The Crucial Role of Habits', *Journal of Economic Issues*, 43(1), pp. 69–88. doi: 10.2753/JEI0021-3624430104.

Maréchal, K. (2010) 'Not irrational but habitual: The importance of "behavioural lock-in" in energy consumption', *Ecological Economics*. Elsevier B.V., 69(5), pp. 1104–1114. doi: 10.1016/j.ecolecon.2009.12.004.

Martiskainen, M. (2007) *Affecting consumer behaviour on energy demand: Final report to EdF Energy*. Brighton.

Meyer, S. *et al.* (2018) 'Capturing the multifaceted nature of energy poverty: Lessons from Belgium', *Energy Research and Social Science*. Elsevier, 40(April), pp. 273–283. doi: 10.1016/j.erss.2018.01.017.

Michie, S., Atkins, L. and West, R. (2014) *The Behaviour Change Wheel: A Guide To Designing Interventions*. Silverback Publishing.

Michie, S. and Johnston, M. (2012) 'Theories and techniques of behaviour change: Developing a cumulative science of behaviour change', *Health Psychology Review*, 6, pp. 37–41. doi: 10.1080/17437199.2012.654964.

Michie, S., van Stralen, M. M. and West, R. (2011) 'The behaviour change wheel: A new method for characterising and designing behaviour change interventions', *Implementation Science*, 6(1), p. 42. doi: 10.1186/1748-5908-6-42.

Moloney, S., Horne, R. E. and Fien, J. (2010) 'Transitioning to low carbon communities—from behaviour change to systemic change: Lessons from Australia', *Energy Policy*. Elsevier, 38(12), pp. 7614–7623. doi: 10.1016/j.enpol.2009.06.058.

Morrissey, J. E. *et al.* (2016) *Identification and Characterisation of Energy Behaviour Change Initiatives. Deliverable 4.4 of the ENTRUST H2020 project*. Cork: University College Cork.

Mullally, G., Dunphy, N. and O'Connor, P. (2018) 'Participative environmental policy integration in the Irish energy sector', *Environmental Science & Policy*. Elsevier, 83, pp. 71–78. doi: 10.1016/j.envsci.2018.02.007.

Ockwell, D., Whitmarsh, L. and O'Neill, S. (2009) 'Reorienting Climate Change Communication for Effective Mitigation: Forcing People to be Green or Fostering Grass-Roots Engagement?', *Science Communication*, 30(3), pp. 305–327. doi: 10.1177/1075547008328969.

Owens, S. and Driffill, L. (2008) 'How to change attitudes and behaviours in the context of energy', *Energy Policy*, 36(12), pp. 4412–4418. doi: 10.1016/j.enpol.2008.09.031.

Pachauri, S. and Spreng, D. (2011) 'Measuring and monitoring energy poverty', *Energy Policy*, 39(12), pp. 7497–7504. doi: 10.1016/j.enpol.2011.07.008.

Palmer, G., Macinnes, T. and Kenqay, P. (2008) *Cold and Poor : An analysis of the link between fuel poverty and low income*. London: New Policy Institute.

Pink, S. (2012) *Situating Everyday Life: Practices and Places*. London: Sage Publications.

Pink, S. and Mackley, K. L. (2012) 'Video and a sense of the invisible: Approaching domestic energy consumption through the sensory home', *Sociological Research Online*, 17(1). doi: 10.5153/sro.2583.

Schatzki, T. R. (2001) 'Introduction: Practice Theory', in Schatzki, T., Knorr Cetina, K., and Von Savigny, E. (eds) *The Practice Turn in Contemporary Theory*. London: Routledge, pp. 1–14.

Schatzki, T. R., Cetina, K. K. and Savigny, E. von (eds) (2001) *The Practice Turn in Contemporary Theory*. London: Routledge.

Schüle, R. *et al.* (2011) *Improving national energy efficiency strategies in the EU framework: Findings from energy efficiency watch analysis (EEW-Publication No. 1/2011).*

Schwartz, S. H. (1977) 'Normative influences on altruism', *Advances in Experimental Social Psychology*, 10(C), pp. 221–279. doi: 10.1016/S0065-2601(08)60358-5.

Shi, D., Wang, L. and Wang, Z. (2019) 'What affects individual energy conservation behavior: Personal habits, external conditions or values? An empirical study based on a survey of college students', *Energy Policy*, 128(November), pp. 150–161. doi: 10.1016/j.enpol.2018.12.061.

Shove, E. (2003) *Comfort, Cleanliness and Convenience.* Oxford, UK.: Oxford International Publishers.

Shove, E. (2010) 'Beyond the ABC: climate change policy and theories of social change', *Environment and Planning A*, 42(6), pp. 1273–1285. doi: 10.1068/a42282.

Soaita, A. M. and McKee, K. (2020) 'Researching Home's Tangible and Intangible Materialities by Photo-Elicitation', *Housing, Theory and Society*. Routledge, 00(00), pp. 1–21. doi: 10.1080/14036096.2020.1738543.

Sovacool, B. K. *et al.* (2019) *Decarbonization and its discontents: a critical energy justice perspective on four low-carbon transitions*, *Climatic Change*. doi: 10.1007/s10584-019-02521-7.

Stern, P. C. (2000) 'Toward a coherent theory of environmentally significant behavior', *Journal of Social Issues*, 56(3), pp. 407–424. doi: 10.1111/0022-4537.00175.

Storm-Mathisen, A. (2018) 'Visual Methods in Ethnographic Fieldwork–On Learning from Participants Through their Video-accounts', *Forum for Development Studies*. Taylor & Francis, 45(2), pp. 261–286. doi: 10.1080/08039410.2018.1450287.

Sweeney, J. C. *et al.* (2013) 'Energy saving behaviours: Development of a practice-based model', *Energy Policy*, 61, pp. 371–381. doi: 10.1016/j.enpol.2013.06.121.

Thomson, H., Snell, C. and Liddell, C. (2016) 'Fuel Poverty in the European Union: a concept in need of definition?', *People; Place and Policy*, 10(1), pp. 5–24. doi: 10.3351/ppp.0010.0001.0002.

Verplanken, B. (2011) 'Old habits and new routes to sustainable behaviour', in Whitmarsh, L., O'Neill, S., and Lorenzoni, I. (eds) *Engaging the Public with Climate Change: Behaviour Change and Communication*. London: Earthscan, pp. 17–30.

Verplanken, B. and Roy, D. (2016) 'Empowering interventions to promote sustainable lifestyles: Testing the habit discontinuity hypothesis in a field experiment', *Journal of Environmental Psychology*, 45, pp. 127–134.

Warde, A. (2005) 'Consumption and Theories of Practice', *Journal of Consumer Culture*, 5(2), pp. 131–153. doi: 10.1177/1469540505053090.

Warde, A. (2013) 'What sort of a practice is eating', in Shove, E. and Spurling, N. (eds) *Sustainable practices: social theory and climate change*. London: Routledge, pp. 17–30.

Wilhite, H. (2005) 'Why Energy Needs Anthropology', *Anthropology Today*, 21(3), pp. 1–2.

Appendix 1 – Potential energy-related behaviour change measures

Laundry

1. Reduce number of washing machine loads, though airing garments to refresh and only washing when necessary, and washing full loads only.
2. Reduce washing machine operating temperatures by using longer but more economical so-called eco-programmes.
3. When possible put clothes out to air dry rather than tumble drying

Food storage

1. Set fridge and freezer to appropriate temperatures, 3°C to 5°C & -15°C to -18°C respectively. Use Appliance thermometers to check.
2. Regularly defrost freezers (*c.* every six months) to prevent frost build-up, which increases energy demand (keep build up to less than 5mm).
3. Cool hot food to room temperature before storing in fridge or freezer, reducing the amount of cooling required and thereby reducing energy consumption.
4. Cover liquids and wrap foods in the fridge to prevent release of moisture which make the fridge work harder.
5. Clean coils behind fridge to provide for better circulation of air and reduce the energy demand of the compressor.
6. Keep freezer full as it will use less energy – use newspaper to prevent having large voids. (also keep fridge full for similar reason – however do not prevent air circulation)

Food preparation

1. Do not over-fill the kettle, boil only as much as you need at one time. Consider saving boiled water in thermos flask for future use.
2. Optimise oven use by planning meals in advance, cooking different foods at the same time and by cooking larger batches of foods.
3. Do not open the oven door during cooking unless absolutely required.
4. Use lids on pots and pans to increase speed of cooking and reduce energy use.
5. Match the size of pots and pans to cooking hob rings.
6. While nearing completion, switch off oven (or cooking hob rings), use residual heat to finish cooking.
7. Keep oven clean and replace door seals as required.
8. Do not toast bread on the grill – use a toaster.
9. Using microwave to heat smaller quantities rather than oven or cooking hob rings.
10. Use slow cookers to produce meals using far less energy.

Washing and bathing

1. To prevent overheating and waste, adjust your hot water setting to 60 to 65°C
2. Reduce the time of shower by 3 minutes to reduce energy use by one-third.
3. Have fewer warm showers in summer time, just as refreshing but less energy intensive.
4. Use water aerator or flow restrictors to reduce flow of hot water in taps
5. Do not let hot water run when shaving.

Heating

1. Move furniture from in front of radiators and put curtains behind them to optimise heating of rooms.
2. Using a heating timer to ensure optimal heating times. Do not forget to adjust for changes in routines.
3. Set thermostat at appropriate settings *e.g.,* 19 to 20°C is sufficient for living space, while 15 to 16°C works for bedrooms.
4. Close doors in, and turn radiators off in rooms not in use.
5. Use curtains or shades wisely – in winter open them to make use of sun during the day, but close them at night to provide additional insulation.
6. In summer, prevent overheating by closing curtains or shades to stop the sun then heating rooms.
7. If your heating system is hot-water based, bleed radiators regularly, to expel trapped air.

Lighting

1. Only turn on lights when they are required and switch them off when they are no longer needed.
2. Ensure windows are clean, and not cover by blinds *etc.* to allow daylight to enter.
3. Clean light bulbs and shades to get full benefit of light.
4. Organise rooms such that daylight reaches where most needed *e.g.,* desk in a study should be near a window.
5. Use task lighting to avoid having to light the whole room – but not use it in addition to the main light!

General

1. Read your energy bills (and if possible also read your utility meters).
2. Understand what tariff applies and assess if that suit your needs.
3. Wash small amounts of plates by hand. Only consider using a dishwasher if there is a full load.
4. If using a dishwasher, rinse dishes beforehand and use a low temperature eco-setting.
5. Use energy savings mode on computer and similar equipment – but so turn off at end of day.
6. Turn off all appliances when not in use, do not leave on standby. Use a ‘standby killer’ for even more savings.
7. Decide to use less energy and set yourself a target

Appendix 2 – Prospective low-cost energy measures

Laundry

1. Dryer rack
2. Wool dryer balls (if you must use a tumble dryer)

Food storage

1. Thermometers
2. Rubber seals for doors
3. Ice scrapper
4. Dredging and drainage tools

Food preparation

1. Thermos flask
2. Oven door seal

Washing and bathing

1. Timer switches for smaller hot-water boilers
2. Hot water cylinder lagging jacket
3. Shower timer
4. Aerator taps and restricted flow shower heads

Heating

1. Radiator reflector foil
2. Radiator key
3. Draught excluders
4. Secondary glazing film
5. Chimney 'balloon'

Lighting

1. Energy saving light bulbs
2. LED lighting

General

1. Timer sockets
2. Standby 'killers'
3. Switchable multiple sockets