

# Making energy behaviour research relevant to policy: a tale of two studies

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## Abstract

Within a context of shrinking government resources and greater pressure on academics and other researchers to generate ‘impact’ from (publically funded) research there is a greater need than ever to ensure that published research is readily usable by and relevant to policy end-users. Through examining and comparing two energy related evidence reviews commissioned by the UK government, this paper presents a set of recommendations for those researchers who seek to make their publications (in both the white and grey literature) more accessible, usable and relevant to those working in policy and practice domains.

## Introduction

“It was the best of research, it was the worst of research ...”<sup>1</sup>  
or “How insightful and important research can be made irrelevant to policy through poor design and presentation”.

This paper discusses the experiences of two evidence reviews undertaken for the UK government into aspects of energy behaviour.<sup>2</sup> The reviews were carried out, firstly for the De-

partment of Energy and Climate Change (DECC) in 2012, and secondly for its later incarnation as part of the Department of Business, Energy and Industrial Strategy (BEIS) in 2016. The two reviews took very similar approaches based on the principles of Rapid Evidence Assessments (REA) to systematically gather, review and synthesise published literature on a topic in response to specific requests from a policy organisation (Government Social Research Service, 2014). Both reviews identified a considerable number of reports and papers, but concluded that only a small proportion collected or presented evidence in a way that was useful to the policy end-user<sup>3</sup>.

Within this paper, we will briefly outline the two studies, their purposes and their conclusions before drawing together a set of key recommendations for researchers who are interested in making their research more useful, and useable, in policy.

## The two studies

### STUDY ONE: WHAT WORKS IN CHANGING ENERGY USING BEHAVIOURS IN THE HOME? A RAPID EVIDENCE ASSESSMENT

The main objective was to answer the question “What Works in Changing Energy Using Behaviours in the Home?” by systematically reviewing the evidence around the effectiveness of domestic behaviour change interventions. The review consid-

1. The title and subtitle here are a play on the title and first line of a book by Charles Dickens.

2. Here we use the term ‘behaviour’ as a catch-all term that can be understood as observable actions, whether this relates to psychologically driven actions, or as the performance of social practices. For further discussion, see Wilson and Chatterton (2011).

3. We use the term ‘policy end-user’ in contrast to the term ‘policymaker’ which is frequently used by academics, as not everyone who works in a policy organisation sees themselves as ‘policymakers’. In addition to ministers and Members of Parliament, and policy development teams who can be seen as being directly involved in making policy, there are a wide range of other roles such as analysts, and programme (deployment) teams who do make policy, yet work within the overarching ‘policy’ (rather than academic) organisations.

ers interventions that seek to influence energy users through, among others, changing situational conditions to make a desirable behaviour easier to do, informing them on the extent and/or the consequence of a behaviour, and comparing their usage with their peers. The interventions were applied in small scale targeted community-based programmes as well as broad universal initiatives that have been rolled out across large segments of the population. Some examples include:

- Opower's Home Energy Reports: The software company Opower, in collaboration with utility providers, sent "Home Energy Reports" to households, to give them feedback on past energy use, compare their usage to neighbours, and provide energy saving tips (Allcott, 2011).
- Ecoteams: This program brought together small groups of about four to ten neighbours and friends to engage in facilitated discussions about environmental behaviour in the household (Global Action Plan, 2008).
- Green Streets UK: Green Streets was a community-(street-) based competition, run by British Gas. It was unique in that it featured a prize of £50,000 for the winning street. Additionally, at the start of the project, £30,000 of energy savings and renewable energy measures (ranging from solar photovoltaic panels or solar heating down to energy saving lightbulbs) were offered to each of the participating streets on the basis of energy assessments under the guidance of British Gas energy efficiency experts (Lockwood and Platt, 2009).

In order to identify relevant studies, and avoid overlap with other previous evidence reviews, a set of inclusion criteria was established. For inclusion, studies had to:

- Target energy-using behaviours in the home.
- Consider at least one intervention.
- Go beyond the use of direct feedback on past energy use and pricing strategies to shift or reduce demand; and consider behaviour beyond one-off purchasing decisions (such as the installation of insulation or the purchase of energy-efficient appliances).
- Measure a behaviour change in a real-world setting, either observed or self-reported. Modelling or simulation studies are excluded from this review.
- Make a comparison between groups (e.g. between treatment and control groups), or across different time periods.

No restrictions were applied regarding sample size; and both quantitative and qualitative studies were included.

Full details of this study are reported in Tsang et al. (2012).

## STUDY TWO: HEATING CONTROLS – INTERNATIONAL EVIDENCE BASE AND POLICY EXPERIENCES

This second study consisted of two parts. Part 1 involved a systematic scoping review of the international evidence base on the energy savings, cost-effectiveness and usability of heating controls in the domestic sector. Part 2 contains the findings from an analysis of the policy experiences of other countries in implementing legislation or regulations concerning heating controls. Here, we will focus on Part 1 only.

The review (which built on a previous study of UK only evidence (Lomas et al., 2016)) considered a wide range of heating control types: Weather compensation (also known as outdoor reset), Time Proportional and Integral (TPI) controls, Zonal control, Programmable Thermostatic Radiator Valves (TRVs), Manual TRVs, Learning algorithms, Automation, Optimisation, Modulating room (or load compensating) thermostats, Communication protocols, Remote control (such as via an App), Occupancy sensors, Programmable thermostats, On/off switches, Boiler thermostats, Central timers, Room thermostats, Geolocation, Geofencing, and Hot water controls.

Full details of this study are reported in Oliveira et al. (forthcoming).

## Similar methodologies

Within both studies, a similar methodology was used. The starting point was the development of a "search protocol" in which the search terms to be applied and the databases to be searched were specified<sup>4</sup>. It was important to develop the search protocol with care so as to avoid missing relevant studies or collecting a potentially biased set of literature. Also, the search protocol was an essential part of the REA method which ensured the transparency and replicability of the reviews. Additional studies were identified by "snowballing", i.e. hand-searching bibliographies of relevant papers that met the relevance inclusion criteria, and performing citation searches on included full text studies to identify additional articles. Other relevant published and unpublished studies were sought out by making direct contact with experts in the field through key informant interviews or email survey.

Both studies set time periods for the research analysed, with Study One searching for evidence published between 2000 and 2012, and Study Two searching between 2010 and 2016. Both studies also specified a focus on research from countries with similar climatic conditions to the UK.

The studies used similar tiered screening processes (see Figure 1) which consisted of an extensive search of databases, followed by a rapid screening for relevance based on abstracts, and by a second screening based on the full paper. For Study

4. The following sources were searched for each review:

### Study one:

**Databases:** Web of Knowledge, EBSCO (which includes: EconLit, PsycInfo, GreenFILE, Academic Search Elite, Business Source Premier, Social Science Abstracts, Energy Citations Database).

### Institutions and organisations for grey literature

**UK:** DECC, Energy Saving Trust, NESTA, The Scottish Government's Built Environment Research.

**USA:** Opower, The Precourt Energy Efficiency Centre at Stanford, The Behaviour, Energy and Climate Change Conference (BECC), American Council for an Energy-Efficient Economy (ACEEE).

**Other countries:** Électricité de France, European Council for an Energy-Efficient Economy (ECEE), IEA policies and measures database, The MURE Database.

### Study two:

**Databases:** Scopus, Compendex, Proquest, Google Scholar, Energy Citations, Academic Search Elite, Science Direct.

**Institutions and organisations for grey literature** The Precourt Energy Efficiency Centre at Stanford, Berkley and Opower; in Portugal - ADENE Agência para a Energia-Portuguese Energy Agency and in Germany the EnergieWende.

**Conference Proceedings:** American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), Chartered Institution of Building Services Engineers (CIBSE), European Council for an Energy Efficient Economy (ECEE), American Council for an Energy-Efficient Economy (ACEEE), Behaviour, Energy & Climate Change (BECC) and European Conference on Behaviour and Energy Efficiency (Behave).

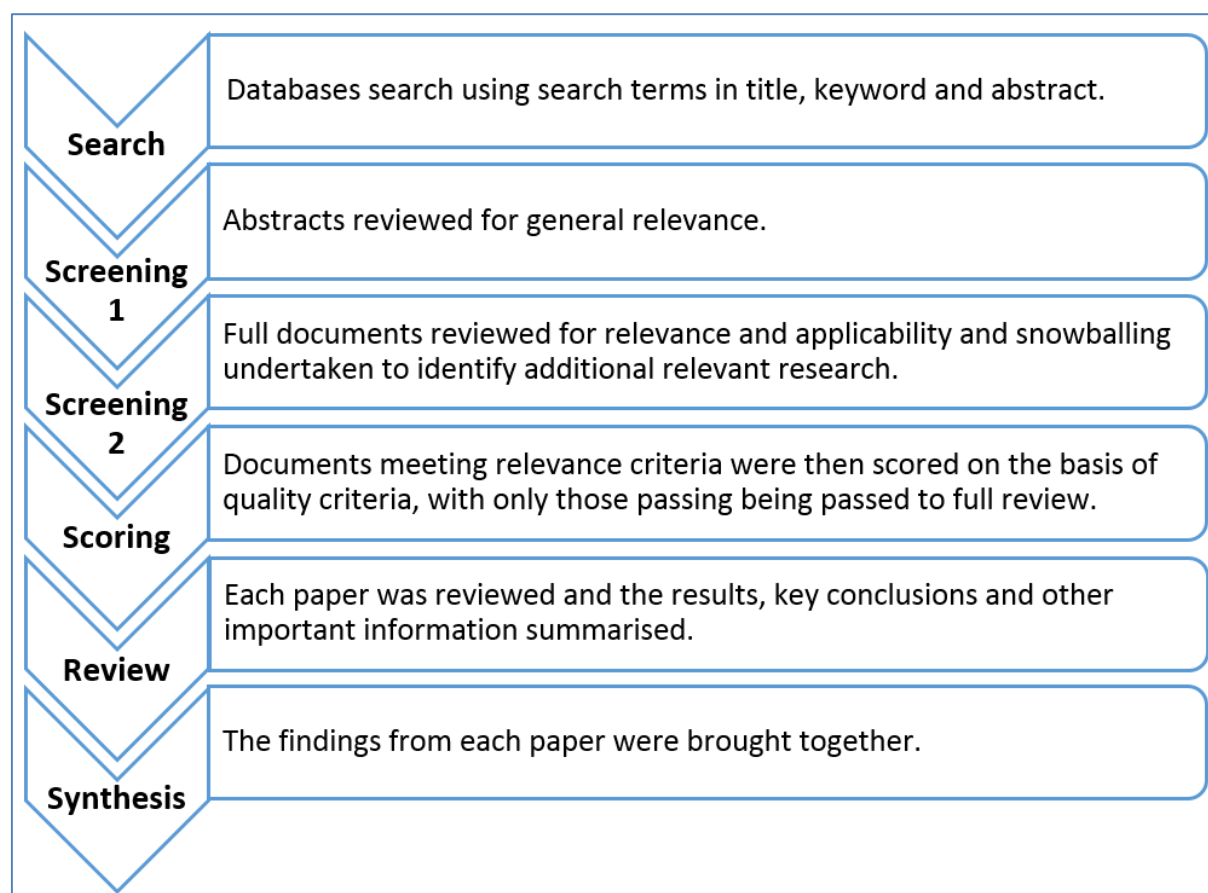


Figure 1. Basic outline of review process used in both studies.

Table 1. BEIS's quality assessment scale (from Oliveira et al., forthcoming).

<b>Reporting quality</b> 2 points: Are the rationale and research questions clear and justified? 2 points: Does the document acknowledge resource contributions and possible conflicts of interest? 1 point: Are the methods used suitable for the aims of the study?
<b>Research quality</b> 2 points: Has the document been peer reviewed or independently verified by one or more reputable experts? 1 point: Do the conclusions match the data presented? 1 point: Does the author/publishing organisation have a track record in the area?

Two, documents were screened against the BEIS quality assessment scale (see Table 1). Documents were passed or failed based on scoring 6 or more out of 9 points. In Study One, no such scoring was used. Instead, a qualitative “strength of evidence” scale was used to assess the findings of the studies identified. Under this scale, evidence based on studies that met the criteria for randomised control trials (RCT) were noted in the review as strong. In Study One, only 8 RCTs were available in the published literature. A further 24 studies were considered to be well-designed quantitative studies i.e. non-randomised studies with treatment and control groups or single group pre-post studies. Of the qualitative, non-experimental studies identified, 13 were also included in the findings, with the report's authors making a case for their inclusion on the basis that they are able to provide important insights into better behavioural programme design, even though they do not necessarily satisfy policy end-user's desires for numbers.

### Identified papers and reports

Perhaps the most surprising finding arising from both reviews, was how few relevant papers and reports were identified that passed through to the detailed review stage. Table 2 shows the number of papers or reports passing through each stage of the selection process.

The stage one screening predominantly screens out papers that have no direct relevance to the subject in question (e.g. non-domestic energy consumption for Study One, and papers focussing on purely technical and not usage aspects of heating controls for Study Two). However, for complete transparency all details of these papers were retained. The second screening returns only those papers that specifically report information that is suitable for contribution to the synthesis, although in some cases this may be a minor element of the paper, or may be only quite peripheral in terms of the intended scope of the evidence review. This latter issue is explored more closely below

Table 2. Number of reports/papers passing each stage of selection process.

	Study One	Study 2
Database Query Following a Pre-specified Search Protocol	>4,000	1,167 (following initial title screen)
Passed Screening One	>80	151
Passed Screening Two	48 studies reported in 45 papers	138
Passed Scoring	N/A	38

in the discussion, with regard to the extent to which the apparent aims and objectives of papers consider any sort of policy context or not.

### Key findings from the studies

Here we present very brief summaries of the key findings from the two studies to provide some context as to the type of information that the policy end-users were interested in, and what was found in the papers and reports analysed. These are only the briefest headline results derived from the synthesis and the interested reader is recommended to investigate the full reviews (each totalling over 120 pages) for further details of the findings and the papers and reports which have led to the conclusions. Size and complexity of the summary tables have prevented their full reproduction here.

#### FINDINGS: STUDY ONE

Finding #1: Behaviour change programmes that combined social comparison with provision of energy efficiency advice have led to small (around 1 to 3 %) but consistent reductions in energy use in the home. The evidence identified was strong, coming from a series of well-designed randomised controlled trials of Home Energy Reports (Allcott, 2011). It should be noted though that equivalent size changes in use have been attributed to the Hawthorne Effect<sup>5</sup>, and thus the mechanism, success and longevity of these sorts of study may be open to question (Tiefenbeck, 2016).

Finding #2: Team-based approaches, which use peer support (and pressure) as a way to encourage changes in behaviour, have led to fairly large energy savings and behaviour change in a number of programmes. The EcoTeam programme was able to encourage fairly large savings – in Staats et al. (2004), 8 % from electricity and 17 % from gas; and in Nye and Burgess (2008) 7 % in energy savings (from unspecified fuel type). The Energy Neighbourhoods competition (Merziger and Neumann, 2010) was able to encourage an energy savings of 11 % (from a mix of gas and electricity). However, wide scale implementation of such programmes may be limited by the requirement for highly tailored instructions and coaching for each household or team.

Finding #3: Baseline consumption or pre-intervention behaviours have been shown to influence the level of savings that can be achieved. The Home Energy Reports randomised controlled trial also found that the high energy consumption group made larger reductions in energy consumption after receiving Home Energy Reports than other groups. Those in the highest

decile of pre-treatment consumption decreased usage by 6.3%, whereas those in the lowest decile of pre-treatment decreased usage by only 0.3 % (Allcott, 2011). This may be explained by the fact that higher energy users had more existing wasteful habits to cut back.

Finding #4: Understanding what behaviours households have already taken up is important for targeting behaviours appropriately and identifying the scope for change. In the quantitative studies examined, there was very limited research in terms of attributing energy savings to specific actions (e.g. Allcott, 2011). Nevertheless, based on a synthesis of the 13 qualitative studies reviewed, the authors found that the most common behaviours taken up across the different interventions were: turning off lights or replacing traditional light bulbs with energy efficient light bulbs; reducing standby consumption and turning off appliances; and changes in water use. This finding was consistent with research on other pro-environmental behaviours (e.g. recycling and waste food) that finds that people find it much easier to take up behaviours that do not cost much and can be done without any impact on lifestyle. The scale of potential change can be limited by the extent to which households participating in programmes have already adopted some of the targeted behaviours prior to joining (or indeed have already made more infrastructural or other material changes to their domestic arrangements).

Finding #5: There are numerous barriers that prevent or limit changes in behaviour (e.g. comfort, aesthetics and the physical layout of homes). For example, in the Energy Hunt Program in Sweden (Palm, 2010), the authors found that many of the energy saving measures suggested were not implemented due to design or aesthetic grounds, since the participants judged that the changes would look out of place in their homes. This finding was corroborated by an in-depth qualitative study into compact fluorescent light bulbs (Crosbie and Baker, 2010), in which they identified that barriers to adoption included aesthetics, style and the quality of light produced by these bulbs. Interventions therefore need to be targeted in different ways for different groups.

Finding #6: Some, but not all, behaviour change programmes lead to durable energy reductions. The evidence from well-designed evaluations of Home Energy Reports (Allcott, 2011; Navigant Consulting, 2011) and team-based interventions (e.g. Staats et al., 2004; Global Action Plan, 2008) has shown that energy reductions can be sustained over periods of two years or more. Whilst competitions can raise awareness and lead to large (sometimes radical) short-term changes, the quality of evidence on their durability is significantly weaker than that of Home Energy Reports and team-based interventions.

Finding #7: There was limited evidence on the differences in the effectiveness of interventions in relation to the target-

5. The Hawthorne Effect refers to a number of ways in which the behaviour of participants in a study can be changed through the very process of being studied, independent of the actual core mechanism for change that is being tested.

ing of gas vs. electricity use. Of the 22 studies that sought to quantify energy savings, five failed to distinguish between gas and electricity usage (Abrahamse et al. (2007); Ayres et al. (2009); Benders et al., 2006); Merziger et al., 2010; Palm, 2010). Only three studies reported quantified savings for both gas and electricity (Lockwood and Platt, 2009); McMakin et al., 2002); Staats et al., 2004). Of these three, two reported greater savings for gas than for electricity.

Finding #8: Only four studies (Home Energy Reports (Alcott, 2011), Off. Really Off? (Wortmann et al., 2003); Transition Streets (Ward et al., 2011); Green Streets UK (Lockwood and Platt, 2009)) sought to calculate the cost effectiveness of the programme. However, the type of measurement and units vary considerably and are subjected to a number of caveats. The calculations in these were, however, very sensitive to the assumptions made, for example, the period over which the behaviour changes were assumed to be sustained. Much more detail is available in the main report (Tsang et al, 2012).

#### FINDINGS: STUDY TWO

Out of the total sample of 38 relevant papers and reports identified in the second review on heating controls, 19 documents reported energy savings potential of heating controls, two demonstrated cost-effectiveness and 17 examined usability. Energy savings were determined differently across the various countries covered by the research and were measured primarily through simulated modelling studies with only a very limited number of large-scale field trials. Field trials were mostly reported in the USA and primarily with a focus on the potential energy savings impact of 'smart' thermostats. Out of 19 documents reporting energy savings, three came from large scale field trials (one in the EU and two in USA). In the two USA field trials, retrofitting TRVs in one study did not show any savings, whilst in the other, replacing boiler controls showed overall weather adjusted reduction in gas consumption of up to 15 %.

Twelve documents included modelling of impacts of programmable or smart thermostats. In one report, modelling effects of occupancy detection in 108 homes in the USA reported potential daily electricity savings of 0.2 kWh to 1.0 kWh for heating and cooling. In another, where energy saving potential of heating optimisation had been modelled across the EU, suggested savings of 1–19 % were reported dependent on dwelling type, location, age and initial heat consumption.

As with Study One, cost-effectiveness was rarely researched or estimated, particularly in terms of a full cost benefit analysis of the likely costs of installation against the predicted savings in energy (or carbon emissions). Cost savings without reference to installation costs were also rarely reported, and when they were it was primarily in the context of heating controls working in tandem with specific dual-tariff electricity models, and thus the results were highly specific to that particular context.

Usability was examined mainly through modelling scenarios rather than trials. The majority of reports and papers related to the USA (nine documents) and the rest (eight documents) were conducted in EU. From the EU research, four documents used data from UK case-studies. Five reported large scale field trials: two in the Netherlands and three in the USA. Two studies conducted in the Netherlands examined user behaviour with both manual and programmable thermostats, showing no statistical differences in hours of use. The US studies focussed on user

behaviour with manual and programmable thermostats and suggested that increased energy savings could be potentially be achieved by motivating users through other non-infrastructure means such as other policies or education interventions, or potentially by redesign of user interfaces. It was also suggested that automation (through smart house control systems or presence sensors in rooms) may be another means to circumvent the tendency for users not to use controls in an optimal manner.

Overall, based on the documents included in the review, the (limited) evidence base suggests that better heating controls can save energy, though this is very dependent on the types of controls and the baseline conditions for their deployment. However, it is very hard to quantify likely reductions, principally because of substantial variations in the baseline conditions and due to a paucity of studies carried out in real occupied homes that consider householder heating behaviours.

#### Discussion and recommendations

The main observation from these reviews is the discrepancy between the limited, actual evidence of impacts identified in the literature and the hopes (though not necessarily expectations) of the policy end-users who commissioned the reviews in terms of the information that is needed to inform the difficult decisions that they are faced with regard to formulating new policies or in shaping the implementation of decided policies to maximise their likely return. This mismatch can often be attributed to a number of factors. An overarching issue is simply whether the paper/report authors made any attempt to undertake and present their work in a way which would either a) address policy concerns, or b) allow it to be used within a policy context. Within the setting of an increasing emphasis on generating 'impact' in research environments there is growing attention on how, or indeed whether, researchers should be engaging with 'policymakers'. Here, however, we are concerned more fundamentally with issues around the design and presentation of research so as to make it of use in a policy context. In an extremely insightful paper written by an ex-Chief Scientific Adviser for the UK Department of Health (Whitty, 2015), the point is made that making a paper suitable for policy uses does not *require* it to consider 'policy implications' (and *arguably* should not as these will be self-evident to a policy end-user from a well written paper). Whitty's primary point though is that a good, policy relevant paper should explicitly state the policy problem, or aspect of the problem, that the research seeks to tackle. Only by doing this, will it be possible to ensure that the paper is framed in a way that provides useful and relevant information in a useful and relevant manner. It perhaps goes without saying that the ability to produce a policy relevant paper will be improved the more academics and researchers directly engage with policy end-users and policy discussions. We acknowledge here though that there are significant challenges to doing this. Three that are commonly cited are limited availability of resources for researchers to undertake these sorts of activities (particularly in the context of the 'long game' that is often necessary for achieving real policy impact); lack of encouragement, training and support from academic institutions compared to pressure for producing journal papers; and lack of capacity for engagement and rapid circulation of staff within the civil service making it difficult to both find and

**Box 1. Summary of key points for consideration by academics and researchers to help make research policy relevant.**

Consideration of local, national and international policy contexts.

Reporting of baseline conditions, including climate, housing properties, socio-demographics and key behavioural patterns (and assessing the representivity of these).

Making clear distinctions between fuel types and uses, and information on standard consumption patterns (including seasonal variability).

Providing quantitative data on both baseline and changes to energy consumption.

Recording of changes in both energy consumption and related behaviours, and making links between them to identify the mechanisms for change.

Assessing the likely long-term durability of any effects observed.

Estimating the cost-effectiveness of interventions.

maintain policy contacts. Whilst we encourage greater engagement where appropriate, this is a very different level and quality of activity to simply making research papers and reports irrelevant and usable. It is quite possible of course that a researcher may not consider their work to be relevant to policy, or they may seek to address a particular piece of work to a specifically academic (or other non-policy) audience. The experiences of the reviews described here however, have shown that many research studies that could be policy relevant are not taking sufficient account of the policy context and this is preventing them from being of use. This is often reflected in shortcomings in the way that many are reported, and for some, how the research is fundamentally framed. Some of the key issues which were frequently poorly considered or reported in the research we reviewed, but that are strongly relevant to the policy context are outlined below. They are also summarised in Box 1.

From a policy end-user perspective it is crucial to understand the particular local or national contexts that underpinned the research in order to make the work transferable to other settings. This is even more important when one considers that published studies are drawn upon by an international research and policy audience. Providing greater information on aspects of the study context such as the basic heating types being considered, fuel mix, housing types, climate etc. allows the reader to have a more nuanced understanding of the setting from which the conclusions have been drawn, and allows them to appreciate caveats that may (or in some cases, may not) apply when transferring to their own policy setting. Ambiguity around these aspects, presumably from an author's assumption that the reader has the same frame of reference as themselves, can seriously limit the interpretability of the studies.

A particular subset of information that is crucial, but again was often lacking in the papers we reviewed, is clarity on the

energy type (gas or electric) being discussed and whether any savings reported (often in percentage terms) relate to a household's overall budget or, for example, just heating costs.

Few of the studies we reviewed appeared to collect, and certainly did not report, good quality information about the level and variability of energy use in their study samples. This is particularly important as we know from many of the studies that have collected such data that a strong relationship exists between baseline energy consumption and likely achievable reductions. It is recognised that collecting energy use information, and particularly baselining this prior to applying an intervention, can add a level of complication to a study. However, the omission of such data seriously weakened many of the studies and limited the ability to draw strong conclusions from them. In the absence of such data, studies often sought to infer energy use, but the assumptions required to do so were open to challenge. Particularly as studies are usually seeking to identify relatively small intervention effects, this introduces a level of approximation that is not helpful.

In addition to baseline energy use, further contextual information about baseline housing conditions (e.g. basic physical properties) as well as occupant behaviours (e.g. do they tend to spend the day in the home or out at work or doing other activities) was often left unreported. Such factors clearly impact on the results being reported, and their omission from the reporting when the study sample is homogeneous, or from the analysis when the study sample is heterogeneous, makes it difficult for the policy end-user to interpret and apply the findings within their own setting.

Similar issues apply to the reporting of the socio-demographic characteristics of the study samples. However, this is further confounded by the fact that many studies in this area are known to not have samples that are representative of the general population, and in many cases the participants reported in the studies were likely to be biased due to self-selection. How this might affect results and conclusions is rarely discussed or indeed whether there are differences in the effectiveness of measures between different socio-demographic groups. One might hypothesise that self-selecting samples are more motivated and likely to be responsive to an intervention than the general population, yet at the same time their baseline energy consumption may also already be lower and there may or may not be scope for greater impact than that observed if a given intervention were able to gain traction with the general population. However, such hypotheses require evidence to test, and unfortunately such aspects seem to be rarely considered by study authors.

From a policy end-user perspective it is useful to understand the mechanisms underpinning observed changes, through linking reductions in energy use to specific changes in behaviour. For example, the large Opower studies found that very robust, but limited, energy savings were possible, but due to the way the studies were constructed there was no way of identifying exactly what users were changing in terms of behaviour to achieve these savings.

From our review of the current evidence base it was apparent that very few studies have sought to examine the extent to which energy savings from measures and interventions are likely to be durable in the long-term, particularly beyond the life-time of supported interventions. This is important from the perspective of the policy end-user as it is necessary to under-

stand whether policy interventions need to be designed, and funded, on a one-off or an ongoing basis.

Finally, from the experience of the two evidence reviews, cost-effectiveness is of great importance to policy end-users and in framing our reviews we were asked to summarise the evidence available. However, amongst all the studies considered, almost none took this into consideration. Whilst the majority of studies reported outcomes in ways amenable to quantification, very few estimated the costs of implementing the intervention reported. Without such information, it is very difficult for the policy end-user to assess the likely cost-effectiveness and therefore make compelling arguments for adopting particular approaches or compare the relative impact that may result from different courses of action.

The issues outlined above cover a range of problems that can be attributable at one end of the spectrum simply to poor reporting, and at the other fundamentally flawed research design (and in some cases potentially application of inadequate or erroneous theoretical approaches). To some extent, though, the paucity of studies relevant to the reviews were also due to a misalignment between the questions that are framed from a policy perspective, and those that structure academic research agendas. Through reporting these findings from our reviews, we hope to contribute to a better alignment of the interests and practices of both research and policy. We have admittedly focussed in this paper on the role of the academics and researchers in making their research usable, however we are also well aware that there is much that could be done on the policy side to promote a better interface with research. This might involve aspects such as encouraging civil servants to spend more time in one department to help ensure retention of knowledge, the creation of more posts that have a specific remit to liaise with the research community, or even providing more scope for refinement of research questions or contract specification within tenders such as these. Part of the challenge here is not only to better link the research community with the policy end-user, but also the linking of the policy end-user with research funders. Such linkages are necessary if we are to identify promising opportunities, recognise gaps in the evidence base that limit the opportunities to apply or generalise findings to inform policy formation or implementation, and seek to commission the research necessary to fill these gaps and subsequently better support the policy end-user. It would also provide funders with the ability to gauge what timescales and levels of funding might be necessary to carry out work, particularly with regard to extensive follow-up studies on durability of interventions. This might help reduce the number of calls that request ambitious and extensive work on shoestring budgets and overly short timescales. Due to limited funding opportunities, researchers often feel it necessary to downscale their work to fit these opportunities, but in doing so risk being unable to undertake some of the elements that would make the work really useful to policy.

## Conclusions

Within this paper, we hope we have been able to demonstrate that there is a very important space to be filled by policy relevant research into 'energy behaviours'. As we have indicated above, not every academic or researcher necessarily has an interest in making their research policy relevant, however, given

the nature of energy research and the urgent need to reduce or at best significantly modify patterns of energy consumption, it can be argued that there is a strong moral driver for researchers in this field to do so (particularly where research is funded from the public purse).

The recommendations that we put forward here, based on our experience of the two evidence reviews, give a strong push towards the need for more, and better, interdisciplinary and mixed methods research. In short, this might be summarised as the need for much social science work to contain better quantification of baseline and in-use conditions and changes, and for more technical work to demonstrate a greater awareness and insight into policy and behavioural contexts.

The two studies discussed here, hopefully, provide a good indication of the sorts of information that energy policy end-users seek from the research community beyond the two specific topics considered within the reviews. It is common within the research community for there to be a degree of frustration at the workings of the policy domain. However, within the policy domain, there is similar frustration expressed about the academic community's ability to provide high quality and relevant evidence to support policy. As the capacity of the governmental public sector is increasingly squeezed by budget cuts and calls for smaller government, the capacity for policy organisations to both undertake their own research and to analyse and interpret others' research is becoming more and more limited. It is therefore increasingly important for academics and researchers to understand how they can support better policy making through making their work more accessible and relevant. To this end, we believe that the policy relevance checklist we recommended here can provide some simple steps to ensuring that the value of energy research to policy end-users can be improved.

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