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Behaviour Change Interventions For Energy Efficiency

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Question

How have energy efficiency initiatives incorporated behaviour change interventions to enhance impact? Where possible, focus on examples drawn from North Macedonia, the Western Balkans, or Eastern Europe.

Contents

1. Summary

Behavioural interventions are policies and programmes that incorporate insights from scientists who study human behaviour (such as psychology and behavioural economics), with the aim of encouraging socially desirable behaviours by removing barriers and creating incentives or disincentives (Cornago, 2021).

Very few behavioural interventions for energy efficiency have been documented in Eastern Europe and the Western Balkans, and none in North Macedonia. The limited experience that has been documented in the region consists of a few small trials which used behavioural principles to inform households about approaches to energy conservation, but none of these trials have demonstrated a significant effect on behaviour.

Behavioural interventions have been widely used elsewhere in the world, particularly in North America, Western Europe, and Australia, and there are many studies evaluating their impacts in these regions (Andor & Fels, 2018, p. 182). The following types of interventions are discussed in this rapid review:

- Providing households with feedback about their energy consumption is probably the most common behavioural intervention for influencing energy consumption (Sustainable Energy Authority of Ireland, 2019, p. 6). Multiple studies around the world agree that providing feedback on energy consumption often leads to significant savings, although the magnitude of the effect varies widely (Andor & Fels, 2018; Sustainable Energy Authority of Ireland, 2019, p. 6; Users TCP and IEA, 2020, p. 59).
- Energy efficiency labelling programmes give consumers easily-understandable information to inform purchases, and are widespread for many types of products. Many studies agree that labels influence consumer choice, although the amount of energy saved may be modest (Andor & Fels, 2018, p. 185; OECD, 2017, p. 57; Solà et al., 2021, p. 14; Users TCP and IEA, 2020, p. 25).
- Home energy audits, in which professional assessors evaluate the energy efficiency of a dwelling and make personalised recommendations to householders, encourage energy saving behaviour to a limited extent, but the number of programmes that have been evaluated appears small and their impacts have been limited. (Solà et al., 2021, pp. 16–17; Sustainable Energy Authority of Ireland, 2019, p. 7)
- Influencing consumers to shift energy use from peak to off-peak time periods is often successful but may not produce an overall reduction in energy consumption (Erhardt-Martinez et al., 2010, p. v; Sustainable Energy Authority of Ireland, 2019, p. 7).
- Challenging consumers to commit to energy-saving goals has shown highly variable results, with half of all sample groups in one systematic review showing no effect at all (Andor & Fels, 2018, pp. 184–185).
- Home retrofits – substantial investments in home improvements such as installing insulation or new heating systems – have rarely been addressed by behavioural interventions and the few documented cases show no significant impacts (Department of Energy & Climate Change, 2013; Users TCP and IEA, 2020, pp. 4, 22–25, 36).

- Fuel-efficiency labelling of motor vehicles is widely used to inform consumer choice, but multiple studies have found that labels have limited direct impact on purchasing decisions (Grünig et al., 2010, p. 41; Yang et al., 2015, p. 21).
- Encouraging fuel-efficient driving practices, either through training or through in-vehicle feedback devices, has produced significant fuel savings (Huang et al., 2018).
- Encouraging the use of public transport, walking, and cycling appears to be a significant challenge; there is limited evidence about the impacts of behavioural interventions in this area and several case studies show that it is quite difficult to change commuters' habits (Kirkman, 2019; Users TCP and IEA, 2020, pp. 73–76).
- Behaviour change programmes in workplaces can produce substantial energy savings, with one systematic review reporting savings ranging between 4% and 30%, with an average of around 10% (Sustainable Energy Authority of Ireland, 2019, p. 8).

This report focuses primarily on household energy efficiency, and particularly on the most widespread and well-documented interventions, which are those related to providing feedback on energy consumption and labelling consumer goods.

Although behavioural interventions have been shown to produce significant impacts and to be cost-effective in many situations, the available evidence has some limitations. Many examples that have been documented are small-scale trials or pilot projects; large-scale, institutionalised policy interventions based on behavioural insights are rare (Users TCP and IEA, 2020, p. 22). In many studies, experiments with small sample sizes and short durations show larger impacts than larger and longer-term studies, suggesting that pilot studies may over-estimate the savings that might be achieved by large-scale programmes (Andor & Fels, 2018, p. 182; Erhardt-Martinez et al., 2010, p. iv). The amount of energy saved by behavioural interventions is often fairly small and varies widely from one programme to another, suggesting that the effectiveness of these interventions may be highly dependent on local context and on details of design and implementation. Finally, many studies rely on participants reporting their intentions, and on hypothetical rather than actual purchasing decisions, and some studies have found a divergence between stated intentions and actual behaviour (Grünig et al., 2010, p. 41; Users TCP and IEA, 2020, pp. 75–76; Yang et al., 2015, pp. 21–22).

2. Policy context in North Macedonia

North Macedonia is developing a wide range of energy efficiency policies and programmes, driven in part by the need to adopt European Union energy legislation and standards as part of the EU accession process (Borozan et al., 2020, p. 3; Government of the Republic of North Macedonia, 2021, p. 1). The country has made good progress towards adopting relevant EU legislation through the passage of the 2020 Law on Energy Efficiency and by adopting or amending various rulebooks and other secondary legislation, although much work still remains to be done on various bylaws, rulebooks and regulations (Borozan et al., 2020, p. 47; Energy Community Secretariat, 2021, p. 12). A National Energy Efficiency Action Plan (the fourth in a series of such plans) was published in 2021 and describes planned activities for legislative and regulatory frameworks, public awareness campaigns and a network of energy efficiency information centres, and a range of measures to reduce energy consumption in buildings, public bodies, industry, transport, and the energy generation and distribution sector (Government of the Republic of North Macedonia, 2020, p. 11, 2021). The country has made good progress towards

implementing energy efficiency labelling regulations on most categories of household appliances, with the notable exception of household heating systems (Energy Community Secretariat, 2021, p. 13).

The Ministry of Economy, which is the lead agency for the national strategy for energy development and the National Action Plan for Energy Efficiency (Government of the Republic of North Macedonia, 2021, p. 66), suffers from a lack of institutional capacity, with only one energy efficiency expert on staff, but it has received technical assistance and financing from international donors to support policy development and drafting of legislation, rules, and regulations (Energy Community Secretariat, 2021, p. 12). Collaborating agencies include the German aid agency Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), the United Nations Industrial Development Organization (UNIDO) and United Nations Office for Project Services (UNOPS), the European Bank for Reconstruction and Development (EBRD), and the United States Agency for International Development (USAID) (Ministry of Economy, 2021, p. 7). A EUR 25 million Energy Efficiency Fund supported by a World Bank loan will invest in public sector energy efficiency projects including municipal buildings, central government buildings, and public lighting (Ministry of Economy, 2021, pp. 8–9; World Bank, 2020).

3. Case studies in the Western Balkans

Very few studies of behaviour change interventions for improving energy efficiency have been undertaken in the Western Balkans region. In the time available for this report, only two behaviour change studies were found in the region: one in Serbia and one in Kosovo. No case studies were found in North Macedonia. Some surveys of consumer attitudes (but not energy-saving behaviour) and one model seeking to predict consumer behaviour have been identified in North Macedonia and in Serbia.

One experiment in Belgrade, Serbia, in 2019 (Podbregar et al., 2021) concluded that providing information about energy conservation had no significant impact on consumer behaviour because the price of electricity was so low that there was insufficient incentive for change. The project studied 330 households in Belgrade, half of which were randomly selected to receive a brochure with information about the efficient use of home appliances and their energy consumption. Households were monitored for three months. The study did not find a statistically significant difference in energy consumption between households that received energy saving information and those that did not. The authors of the study attribute the lack of effect to the fact that Serbia has the lowest price of electricity in Europe, approximately one-third of the average price in European Union member states.

An experiment in Pristina, Kosovo, in 2020 and 2021 (Kuhn & Kutzner, 2021) found that delivering information about energy conservation along with energy bills was not sufficient to influence domestic electricity consumption. A randomised controlled trial covering 3,138 households tested the effect of information flyers aiming to encourage consumers to save energy on heating by reducing room temperatures, shift their electricity use to a cheaper night-time tariff, and improve timely payment of electricity bills. Four different versions of the flyers, containing graphical information and messages about saving money and/or caring for the environment, were distributed with electricity bills six times over seven months, while a fifth group of households received no additional information with their bills. The study found no statistically significant difference in electricity use between households that received the flyers and those that

did not, and conversely, households that had shown relatively high electricity consumption levels in the previous year showed a 'rebound effect' in which they were more likely to *increase* their electricity consumption if they received a flyer. Households that were already taking advantage of the lower night tariff showed mixed results, increasing their use of this tariff in response to two of the flyer designs and decreasing their use of the tariff in response to one design. The authors of the study conclude that 'even though knowledge about the low-tariff hours is a very likely bottleneck, removing knowledge deficits with information was… not sufficient to change behaviour' (Kuhn & Kutzner, 2021, p. 43). The authors speculate that the lack of impact could have been because the flyers were ignored, overlooked, treated as junk mail, not seen by recipients at a suitable time to take action, or that the messages were not sufficiently motivating.

Surveys in North Macedonia and Serbia suggest that some domestic energy consumers have positive attitudes towards energy conservation, but these studies did not attempt to observe or influence consumers' actual behaviour. One small-scale survey of attitudes towards environmental issues in North Macedonia in 2017, comprising 112 respondents, found that 63% of the respondents agreed or strongly agreed with the statements 'I pay attention to saving energy in my daily life' and 'I pay attention to the energy efficiency when purchasing home appliances' (Vasiljevic-Shikaleska et al., 2018, pp. 9, 13). A survey of 1,100 households in Serbia found that 38% of households expressed willingness to pay more for a more sustainable heating system, and found that barriers to adoption of improved heating systems included lack of funds, lack of interest, lack of information, and mistrust or uncertainty about the effectiveness, reliability, and complexity of new technologies (Pavlović et al., 2021).

Two studies in Serbia have examined energy efficiency choices with a focus on economic factors rather than behavioural factors. One project attempted to forecast rates of adoption of improved heating systems in households and concluded that subsidies would be necessary to incentivise the adoption of more sustainable heating systems (Pavlović et al., 2022). The project modelled consumer behaviour using different assumptions about subsidies, taxes, and prices for energy and heating systems, and incorporated some assumptions about social pressures but did not attempt to model different types of behavioural change initiatives. The authors concluded that 'restrictions on firewood and coal combustion alongside subsidies for buying more efficient heating' would incentivise households to adopt more efficient heating systems (Pavlović et al., 2022, p. 11). A second project examined energy consumption for heating in the city of Kragujevac, the fourth most populated city in Serbia. It found that the combination of low prices for electricity and widespread use of district heating, under which customers are charged based on the number of square metres of their property rather than on their energy consumption, created no incentive for customers to conserve energy (Lukić et al., 2015).

4. International experience

Households

Feedback on energy consumption

Providing households with detailed information about their energy consumption is probably the most common behavioural intervention for influencing energy consumption (Sustainable Energy Authority of Ireland, 2019, p. 6). These initiatives provide households with an overview of their energy use in an easy-to-understand format and usually incorporate an element of social

comparison by describing household energy consumption in relation to that of comparable households, such as the average for the neighbourhood (Sustainable Energy Authority of Ireland, 2019, p. 6; Users TCP and IEA, 2020, p. 59). In most cases, information is provided in the form of a personalised home energy report delivered either with energy bills or separately by mail, but technologies such as in-house displays and mobile phone apps linked to smart meters have also been tested.

Multiple studies around the world agree that providing feedback on energy consumption often leads to reductions in energy consumption, although the magnitude of the effect varies widely (Andor & Fels, 2018; Sustainable Energy Authority of Ireland, 2019, p. 6; Users TCP and IEA, 2020, p. 59). One systematic review found savings ranging from zero to 30% across 39 sample groups[1], as shown in Figure 1 (Andor & Fels, 2018, p. 182); a selection of programmes in the USA demonstrated savings of between 0.3% and 2.2% for home energy reports but a range of 1% and 15% for real-time feedback (Cornago, 2021); and an older review of programmes in the USA found electricity savings ranging from 3.8% to 12% (Erhardt-Martinez et al., 2010, p. iii). On the other hand, a significant number of studies have also shown no significant impact (Andor & Fels, 2018, p. 184). In many studies, experiments with small sample sizes and short durations show greater impacts than larger and longer-term studies, suggesting that pilot studies may over-estimate the savings that might be achieved by large-scale programmes (Andor & Fels, 2018, p. 182; Erhardt-Martinez et al., 2010, p. iv).

Figure 1: Estimated effects of feedback and social comparison interventions

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Note: IHD refers to in-home display
Source: Andor & Fels, 2018, p. 184

Factors contributing to the effectiveness of feedback about energy consumption include:

- using broadly understood, non-technical units such as expressing savings in terms of money rather than technical units like kilowatt-hours (kWh) (Schleich, 2013, cited in Sustainable Energy Authority of Ireland, 2019, p. 6);
- including information about services and advice for saving energy, rather than simply providing energy consumption data (Erhardt-Martinez et al., 2010, pp. iv–v; Schleich, 2013, cited in Sustainable Energy Authority of Ireland, 2019, p. 6);
- social comparisons amplify the effect of energy consumption information in almost all situations, with the exception of the boomerang effect noted above (see footnote 1) (Andor & Fels, 2018, pp. 182–183);
- frequent or real-time feedback and detailed information (even down to the level of individual appliances) tends to be more effective than delayed or aggregated information

[1] One study showed an increase in energy usage; in this case the study focused on users who had lower consumption levels than normal, who increased their consumption after learning that they were below-average users, a result sometimes called the 'boomerang effect' (Andor & Fels, 2018, pp. 182–183).

such as daily, weekly, or monthly reports on total consumption (Cornago, 2021; Erhardt-Martinez et al., 2010, pp. iii–iv, 39);

- information delivered online, by email, or using in-home display technologies tends to have more impact than letters delivered in the post (Andor & Fels, 2018, pp. 182–184; Erhardt-Martinez et al., 2010, p. iii); there is limited evidence available about the effectiveness of mobile phone apps compared with other technologies (Behavioural Insights Team, 2019) (see Case study 3 below);
- messaging that refers to civic concerns and altruistic motivations may be more effective than messaging that focuses entirely on self-interest (energy bill savings) (Asensio & Delmas, 2016; Erhardt-Martinez et al., 2010, pp. v–vi) (see Case study 4 below); and
- households with higher energy consumption tend to deliver greater savings, suggesting that it may be worth considering targeting such households (Commission for Energy Regulation, 2011, p. 8); this phenomenon also exists at the national level, such that countries with low average energy consumption are likely to achieve smaller savings than countries with high energy consumption (Andor et al., 2018).

Evidence about the optimal duration of an energy consumption feedback programme is mixed. There is some evidence that feedback may be increasingly effective when it is sustained over several months or even years, rather than being a one-off intervention (Allcott & Rogers, 2014; Sustainable Energy Authority of Ireland, 2019, p. 6; Users TCP and IEA, 2020, pp. 25, 59). On the other hand, a significant number of studies have found that long-term interventions produce delayed effects, inverse effects, or no effect at all, and the reasons for these disparate results are not clear (Andor & Fels, 2018, pp. 183–184).

Case study 1: Home energy reports (USA)

One study of home energy reports produced by the firm Opower in partnership with regional energy utilities in the USA, comprising 234,000 households between 2008 and 2013, shows that long-term programmes are more cost-effective than one-off interventions. The study examined the impact of personalised monthly reports on household energy consumption that included comparisons with neighbours' consumption patterns and information about energy conservation. When consumers began receiving energy reports, they reduced electricity use by 1.0% to 1.3% within one to two weeks of receiving the report, but this effect decays quickly and about half of their initial conservation actions soon disappear. Over time, the cyclical pattern of action and backsliding becomes less pronounced and energy savings continue to accumulate as habits become more established and customers adopt more energy-efficient appliances and home improvements; average savings in the second year of monitoring were around 3% of consumption. If energy reports are discontinued after two years, their effects decay by 10% to 20% per year, but if they continue after two years, energy use continues to decrease. The study finds that two-year interventions are 2.5 to 4.2 times as cost-effective as one-off interventions (Allcott & Rogers, 2014).

Case study 2: Home energy reports (Germany)

A large-scale randomised controlled trial comprising 11,630 households found that home energy reports in Germany reduced electricity consumption by 0.7%. In this study, households received quarterly letters over the course of a year providing electricity-saving tips, comparing households' consumption with their neighbours, suggesting individualised goals for reducing consumption, and offering rebates for the purchase of energy-efficient appliances. The authors argue that the low level of savings achieved in this programme, compared with experience from the USA such as in Case study 1 above, is influenced by the fact that electricity consumption and carbon intensity levels in the

USA are quite high compared with other OECD countries, and argue that experience from American programmes may not be transferable to countries with lower consumption levels (Andor et al., 2018).

Case study 3: In-home displays and mobile phone apps (United Kingdom)

In the United Kingdom, energy suppliers are obligated to offer households free smart meters and in-home displays to deliver real-time information on energy consumption. One study showed that consumers with smart meters and in-home displays used 1.5% less gas and 2.2% less electricity in 2011 than those with standard meters and no in-home displays. Another experiment in 2016-2017 comparing two types of in-home displays and two mobile phone apps across 9,786 customers and examining both gas and electricity consumption found that the conventional in-home displays were slightly more effective than the apps: app users consumed between 0.2% and 2.6% more energy, although the results for most of the study groups were so close to zero, and the variation within the samples was large enough, that they were not statistically significant except for one group of gas consumers (Behavioural Insights Team, 2019).

Case study 4: Real-time energy monitors (USA)

A study of 118 households in Los Angeles, California, provided highly detailed real-time electricity consumption information at the level of individual appliances over a period of 14 weeks after establishing baseline consumption patterns. The study tested two alternative messaging approaches, one focusing on cost savings and the other on pollution reduction and environmental health, and found immediate reductions in energy consumption within one or two days among households receiving both cost and environmental health messages, with peak savings of up to 15.7% and 21.7% respectively. However, this effect disappeared entirely among households receiving cost savings messages by the end of the 14-week monitoring period, while households receiving environmental health messages showed their energy-saving behaviour to be more stable, with reductions of 8% to 10% persisting by the end of the experiment (Asensio & Delmas, 2016).

Energy-efficiency labelling of consumer goods

Energy efficiency labels give consumers easily-understandable (often graphical), consistent, and comparable information to help them take energy consumption into account. Labelling programmes may follow voluntary industry standards or may be mandated by governments, and exist in many countries for household appliances, cars, and houses (Andor & Fels, 2018, p. 180).

Many studies agree that simple, well-framed labels influence consumer choice (Andor & Fels, 2018, p. 185; OECD, 2017, p. 57; Solà et al., 2021, p. 14; Users TCP and IEA, 2020, p. 25). For example, studies have found that consumers are willing to pay between 8% and 19% more for energy-efficient washing machines in Spain (Galarraga et al. 2012, cited in Solà et al., 2021, p. 14), and 30% more for energy-efficient washing machines in Switzerland (Sammer & Wüstenhagen, 2006, p. 195), and potentially as much as 44% more[2] for refrigerators rated A+++ compared with those rated A- (Waide et al., 2013, p. 1690). However, other studies have found mixed results. For example, one study in the USA found that labelling had no significant effect on the probability of shoppers choosing energy-saving lightbulbs (Allcott and Taubinsky, 2015, cited in Andor & Fels, 2018, p. 185).

[2] This study was a hypothetical purchase experiment, rather than examining actual purchasing decisions, so may overestimate willingness to pay.

However, although energy-efficiency labels do seem to influence consumer choice, the amount of energy saved as a result of labelling programmes may be is modest. For example, consumers choosing air conditioners in the USA were shown to save an average of $10.12, or slightly less than 1% of the total lifetime cost of the product, based on the cues given by energy efficiency labels (Davis & Metcalf, 2016, pp. 607–68). Another study, in Australia, testing the impact of labels affixed to appliances in peoples' homes on the consumption of both water and energy, found no effect on energy use despite people self-reporting that they believed they had changed some of their energy-use behaviours, while water consumption decreased by 23% (Kurz et al., 2005).

Energy-efficiency labels appear to be more effective when they use simple letter-based scales and incorporate cost information. Letter-based scales (such as the A to G scale used in European labels) are more readily understood than numerical scales or more complex scales (that incorporate grades such as 'A+' and 'A++'), and lead to more consumers choosing energy efficient products (London Economics, 2014; Ölander & Thøgersen, 2014, pp. 345–349; Lucas and Galarraga, 2015, cited in Solà et al., 2021, p. 15). Multiple studies have also demonstrated that adding information about operating costs to energy labels (rather than only stating energy consumption) influences consumer choice, especially when the total lifetime or multi-year costs are presented (Heinzle, 2012, and Andor et al., 2017, both cited in Andor & Fels, 2018, p. 185; DECC and the Behavioural Insights Team, 2014, p. 7; OECD, 2017, p. 58).

Another approach that has been used to promote energy-efficient appliances is to sell appliances through partnerships with utility companies. An online marketplace branded in association with energy utility companies allows the utility to showcase energy efficient products to their customers, directly nudging them towards energy-saving purchases and helping to overcome consumer confusion and choice overload (Users TCP and IEA, 2020, pp. 34–35). An assessment of one such marketplace, operated by AEP Ohio in the USA, found that customers in 2018-2019 made more than 42,000 purchases, leading to more than 92,000 MWh in estimated gross lifetime energy savings (Opinion Dynamics, 2020, cited in Users TCP and IEA, 2020, p. 35).

Home energy audits

Home energy audits involve home visits by professional assessors who evaluate the energy efficiency features of a dwelling and make personalised recommendations to householders. Participation in such programmes is voluntary and involves a high degree of self-selection.

There is some evidence that home energy audits encourage energy saving behaviour, but the number of programmes that have been evaluated appears small and their impacts have been limited. For example, one study in the state of Maryland, USA, found that a programme offering free one-hour home energy audits (examining features such as insulation levels, air leakage, heating and cooling systems, windows and doors, lighting and appliances, and water heating equipment) led to a 5% reduction in electricity use among participating households (Alberini & Towe, 2015, p. S31). A programme of energy audits in New York City, USA, from 2011 to 2016, demonstrated energy savings of approximately 2.5% for multi-family residential buildings and 4.9% for office buildings (Kontokosta et al., 2020, pp. 309–310). On the other hand, a similar programme in Ireland, which sought to leverage social pressure by encouraging householders to involve neighbours, family, and friends in the audits, was perceived positively by participants who indicated that they were likely to proceed with home improvements but later follow-up found that

only three out of 82 participating households (4%) carried out any improvements (Sustainable Energy Authority of Ireland, 2020).

Home energy audits appear to be most effective when they are provided for free, they are voluntary rather than mandatory, results are explained in simple terms, energy-saving devices can be installed during the visit, and recommendations for improvements have short payback periods and low initial costs (Solà et al., 2021, pp. 16–17; Sustainable Energy Authority of Ireland, 2019, p. 7).

Shifting energy use by time of day

Time-of-use tariffs charge different rates for energy at different times of the day and are primarily used to incentivise customers to shift energy use from peak demand times to off-peak times.

Time-of-use tariffs are often successful in shifting demand from peak to off-peak periods, but may not produce an overall reduction in energy consumption (Erhardt-Martinez et al., 2010, p. v; Sustainable Energy Authority of Ireland, 2019, p. 7). One trial in Ireland in 2011 found that households shifted energy use from peak periods by 11.3% and reduced overall energy consumption by 3.2% when they used in-home displays in combination with energy-use statements and time-of-use tariffs (Sustainable Energy Authority of Ireland, 2019, p. 7). A trial in Australia in 2017 used competitions, goal setting and reward points that could be donated to charity or redeemed for gift cards to encourage customers to participate in ‘challenges’ to reduce energy consumption for three-hour periods; the programme produced savings of 26% to 42% during six challenge periods (Users TCP and IEA, 2020, p. 40). Another Australian trial in 2018-2019 offered participants an AUD 10 discount on their energy bills and tested four other approaches, the most effective being a lottery offering prizes worth up to AUD 5,000, which motivated households to reduce energy consumption by 6% (Users TCP and IEA, 2020, p. 41)

Time-of-use tariffs appear to be most effective in encouraging energy savings when they are simple to understand (for example, when there is just one peak period and one off-peak period); when households are given in-home displays or receive prompts that signal when it is expensive to use energy; when households are given devices that can automatically reduce demand at peak times; and when they are automatically enrolled into the tariff rather than being invited to opt in (Sustainable Energy Authority of Ireland, 2019, p. 7).

Commitment devices and goal setting

Commitment devices are actions that a person can take to ‘lock in’ a decision or a course of action and make it difficult or costly to change one’s mind later; in this context, these are public or private pledges to conserve energy, with a specific target for the amount to be saved chosen by households themselves or set by some external organisation (Andor & Fels, 2018, p. 179).

Evidence on the effectiveness of commitment devices and goal setting is limited. One systematic review identified ten studies of such programmes, some of which demonstrated reductions in energy consumption ranging between 4% and 22%, but in half of the sample groups studied, the results were either indistinguishable from zero or could not be rigorously evaluated (see Figure 2) (Andor & Fels, 2018, pp. 184–185). For example, in one study, households in Chicago, USA, were invited to subscribe to an energy efficiency programme which offered detailed information about energy consumption, recommendations for energy saving actions, and reward points that

could be exchanged for coupons at local retail shops, and were asked to set energy-saving goals at the beginning of the programme. On average, participating households achieved energy savings of 4.4%, but those who set modest, realistic goals (0% to 15%) achieved savings of 11% while those who set unrealistically high goals (either zero or more than 15%) achieved no statistically significant saving; the reward points did not appear to incentivise households (Harding & Hsiaw, 2014). In another case, in Canada, an electrical utility invited customers to participate in an energy saving challenge in which participants who achieve 10% energy savings over the course of a year are rewarded with a prize of CAD 75 if they succeed. Participants can also join contests, receive special communications, receive offers and vouchers for stores and member events, and share stories with other members. Approximately 70,000 challenges were completed from 2009 through 2013, in some cases by households that saved 10% in one year and then a further 10% in one or more subsequent years (Kassirer et al., 2014; Users TCP and IEA, 2020, p. 46).

Setting energy saving goals and making commitments to save energy appear to be most effective when the commitments are public and realistic and when households receive energy saving tips and are provided with regular feedback on their progress (Sustainable Energy Authority of Ireland, 2019, p. 6).

Figure 2: Impacts of commitment devices and goal setting

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Source: Andor & Fels, 2018, p. 185

Promoting home retrofits

Investment in larger home improvement projects such as installing loft and wall insulation, replacing windows and heating systems, or installing renewable energy systems is hindered by behavioural barriers such as inertia, choice overload, and weighting up-front costs more heavily than future benefits (Users TCP and IEA, 2020).

Very few behavioural interventions have aimed to encourage these kinds of larger investments, but the limited available evidence suggests that behavioural interventions have not been very successful in this area (Users TCP and IEA, 2020, pp. 4, 22, 25). In one experiment in London, the ‘hassle factor’ of removing items stored in the loft of a house was identified as one of the barriers to the installation of loft insulation, so researchers sent offers by mail to 72,480 households with offers of loft insulation with or without a loft clearance service at varying prices; only 28 households took up any of the offers (a 0.04% response rate), which was too few to reliably determine whether the offer had any impact (Department of Energy & Climate Change, 2013). Another experiment in Ireland in 2019 sought to promote heat pumps through a national communications campaign with simplified, personalised, targeted messaging. Approximately 32,000 homes were randomly selected to receive various messages using different behavioural cues, and while messages that used ideas of exclusivity (‘you have been selected as being eligible for a heat pump grant’) were most effective in attracting interest, none of them had a statistically significant effect on actual heat pump installations (Users TCP and IEA, 2020, p. 36).

Transportation

Individuals, households and businesses make many transport-related decisions that have important energy implications, ranging from recurring habitual choices such as the timing, routes and means of commuting and making other regular trips, to less-frequent choices with long-term implications such as decisions about obtaining a driver's licence, buying a car, and even choosing a location to live (Users TCP and IEA, 2020, p. 61).

Fuel-efficiency labelling of vehicles

Fuel-efficiency labelling is widely used to inform consumer choices when purchasing motor vehicles. Fuel-efficiency labels contain information about fuel consumption, often expressed in comparison with other vehicles, and may also contain information about fuel costs, vehicle operating costs, and pollution emissions (Users TCP and IEA, 2020, pp. 67–68).

Multiple studies have found that fuel efficiency labels have limited direct impact on purchasing decisions (Yang et al., 2015, p. 21). Although consumers state that they value fuel efficiency, there is often a divergence between their stated intentions and their actual purchasing behaviours. For example, surveys in the USA found that people state that fuel economy is among the top three factors that will inform an upcoming purchasing decision, but after the fact, fuel economy ranks 10th to 20th in the list of factors that actually influenced their purchasing decision (Yang et al., 2015, pp. 21–22). A study across ten European countries similarly found 'a gap between what consumers state they consider and how they act… consumers make little effort to include fuel consumption in purchasing decisions or assume that increased fuel consumption is only obtained when sacrificing other qualities' (Grünig et al., 2010, p. 41)

Labels appear to be more effective in influencing consumer choice when they include information about the cost of fuel and the total cost of ownership, make comparisons with other vehicles, and include information about pollution emissions and related environmental benefits, rather than just providing fuel consumption data; they are also more effective when presenting information in simple and easy to understand ways such as using visual and comparative scales such as colour-coding, stars, letters, or numbers (Grünig et al., 2010, p. 41; Users TCP and IEA, 2020, pp. 64, 68). A Canadian study suggests that the vehicle research and purchase process is likely to be very different for each individual consumer, and that policy interventions should be highly customisable to accommodate consumer diversity (Natural Resources Canada and Environment and Climate Change Canada 2020, cited in Users TCP and IEA, 2020, p. 67).

Recent studies focusing on electric vehicles suggest that purchasing decisions may be influenced by improved labelling or other approaches to providing information to better explain running costs and total ownership cost over multi-year time periods, leveraging loss aversion[3] by expressing benefits in terms of avoiding losses rather than as gaining savings, and addressing concerns about range, the availability of charging stations, and charging times (Brannigan et al., 2021, p. iv; Ministry for the Environment, 2018; Users TCP and IEA, 2020, p. 69).

[3] The phenomenon that people tend to perceive the psychological 'pain' of a loss more severely than the 'pleasure' of an equivalent gain.

Encouraging fuel-efficient driving

Fuel-efficient driving techniques (sometimes called eco-driving or in an extreme version of the practice, hypermiling) include maintaining constant speed, accelerating and decelerating smoothly, avoiding idling, choosing routes carefully, and paying attention to factors like air conditioning, vehicle weight, tire pressure, and vehicle maintenance (Huang et al., 2018).

Training drivers in fuel-efficient driving techniques and providing real-time in-vehicle feedback generally produce substantial improvements in fuel efficiency. One large review found fuel savings of 2% to 15% across a range of 16 training programmes, and savings of approximately 1% to 8% for real-time in-vehicle feedback systems over long term trials; both approaches tended to show large immediate effects that decreased over time (Huang et al., 2018, pp. 602–605). A pilot programme in Japan in 2017 using a mobile phone app that provides driving tips and rewards drivers with points and icons for efficient driving practices found that the app reduced fuel consumption among users by more than 8% (Users TCP and IEA, 2020, p. 77).

Encouraging the use of public transport, walking, and cycling

Studies have identified a range of behavioural obstacles to public transport use. For example, a study in Vancouver, Canada, identified behavioural barriers to public transport use that tend to keep people entrenched in their established habits including the cognitive effort required to plan a trip; tendencies to accept the status quo and default options; preference for facing known and familiar risks rather than unknown risks; perceptions that public transport is unreliable; and other factors that influence decision-making (Alta Planning + Design and the Behavioural Insights Team, 2017, pp. 11–14).

Interventions to encourage the use of public transport typically involve providing information, often through travel planning and mapping tools, to overcome unfamiliarity, uncertainty, and negative perceptions (Users TCP and IEA, 2020, pp. 64, 71). However, solid evidence of successful behavioural interventions is difficult to find. Several case studies illustrate the difficulty of changing established habits:

- A series of randomised controlled trials involving businesses at Heathrow Airport in the UK tried several approaches to encouraging employees to change their commuting behaviour. One intervention tested different letters promoting the airport's car-sharing scheme, but less than 1% of the people receiving the letters registered for the scheme, regardless of the different versions of the letters. A second intervention sent letters to people already registered in the scheme to try to increase their participation, but had no impact. A third sent employees information about public transport and a free one-week travel card, which led to 2.2% of recipients registering for travel cards; varying approaches to messaging and sending reminder letters made no significant difference. Another intervention sent employees personalised commuting plans and information about the costs of travel options, and invited them to sign up for one-on-one personalised travel planning sessions; this produced a take-up rate of 2.7% for the planning sessions, but no statistically significant impacts on eventual commuting behaviour were detected. These experiments also highlighted a substantial difference between stated preferences and actual behaviours: while 61% of Heathrow employees driving to work declared in a 2013 survey that they would consider carsharing as an alternative commuting option, the intervention prompted only minimal uptake (Users TCP and IEA, 2020, pp. 75–76).

- A municipal bike sharing programme in Portland, Oregon, USA, in 2016 sent coupons to potential new users with two different messages, one describing the offer as free and the other describing it as a discount. People who had recently moved into a new residence (and were therefore in a position to reconsider their travel habits) were found to be more responsive to the offer, redeeming their coupons four times as often as other recipients, and people living close to newly-installed bike-sharing stations were more responsive to the offer when it described the ride as free rather than discounted. However, overall take-up of the offer was low, with just 0.59% of people redeeming their coupons (Kirkman, 2019).
- In Australia in 2018, a programme to incentivise walking among target audiences including schoolchildren and train commuters used various approaches. Train commuters were targeted with posters, a trip-planning website, and small rewards for travellers walking to the station, but the programme did not lead to a significant overall increase in walking; the authors of the study speculate that the programme's impact may have been reduced by cold winter weather. The programme involving schoolchildren was built around maps of local footpaths, worksheets for parents to plan the daily trip to school, games to track opportunities, and rewards for children and schools; it produced a 34% increase in active mobility including walking, cycling and riding scooters (Woodruff, 2018, cited in Users TCP and IEA, 2020, p. 73).

Businesses

Multiple studies show that behaviour change programmes in workplaces can produce substantial reductions in energy consumption. One systematic review of workplace energy-saving initiatives found that competitions and publicly visible feedback comparing performance against others produced energy savings ranging between 4% and 30%, with an average of around 10% (Sustainable Energy Authority of Ireland, 2019, p. 8). For example, one programme in a Canadian company demonstrated energy savings of 5% over one year by using techniques that included volunteer 'floor captains' to provide leadership, competition between floors in office buildings, energy audits of employees' workstations, and stickers, posters, and emails to reinforce energy-saving messages (Bin, 2012, pp. 7, 11); another Canadian programme produced energy savings of 3.9% in its first year and 4.2% in its second by encouraging employees to turn off office equipment and lights when not in use through stickers, posters, emails, meetings, and peer champions (Bin, 2012, pp. 9–11). Eco-driving programmes, in which commercial drivers are trained and/or encouraged to drive more efficiently, have been observed to produce savings ranging from 3.5% to 7%; these programmes seem to be most effective when they include savings targets, offer non-financial rewards, and make management responsible for drivers meeting targets (Sustainable Energy Authority of Ireland, 2019, p. 8).

Effective behavioural approaches to encourage workplace energy-saving include setting goals and making pledges, creating competition or providing comparative feedback between organisational units (such as teams, departments, or buildings), using a range of media to communicate energy-saving advice and reminders, selecting individuals as energy champions to lead and encourage colleagues, and linking energy efficiency improvements to other corporate performance indicators (Sustainable Energy Authority of Ireland, 2019, p. 8; Users TCP and IEA, 2020, pp. 26, 91–92).

There is some evidence to suggest that workplace energy audits may help employees identify personal behaviours they can use, and may encourage businesses to invest in energy efficient technologies, but there have been few robust evaluations of these types of interventions (Sustainable Energy Authority of Ireland, 2019, p. 8; Users TCP and IEA, 2020, pp. 91–92). In a workplace context, ensuring support and commitment from senior management will be important for the success of any energy-saving initiative (Users TCP and IEA, 2020, pp. 96–97).

However, in some cases it has been observed that ‘green defaults’ can be more effective than behaviour change: for example, at Portland Community College in the USA, all employees’ computers are set to shut down overnight by default, which ‘has proven more effective than sending prompts to employees or informing them of aggregate energy consumption due to idle computers’, leading to energy savings of several thousand kWh per year (Users TCP and IEA, 2020, p. 94).

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