Promoting demand flexibility and the uptake of smart energy services – recommendations from behavioural science

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Background

Electricity demand flexibility, where energy users adjust their electricity consumption in response to supply fluctuations, offers a solution to alleviate strain on the grid and reduce reliance on fossil fuels. This is especially pertinent given both Ireland's climate strategy of increasing electrification of heating and transport and transitioning to renewable energy sources, which can be unpredictable, and the broader context of increasing demand from large energy users, such as data centres.

Strategies to induce demand flexibility among energy users tend to be drawn from classical economic models of human behaviour and have largely focused on creating smart energy services structured around financial incentives to shift electricity consumption away from times of peak demand (e.g. through time-of-use tariffs or demand flexibility reward programmes). While financial incentives can play a useful role, they are at times neither necessary nor sufficient to induce behaviour change. There is a wide range of other factors that needs to be considered if policies and interventions are to succeed.

Research undertaken

Over the last two years, SEAI's Behavioural Economics Unit has undertaken a programme of research looking at behavioural factors underpinning demand-side flexibility, including:

1. An online experiment run in 2024 looking at factors influencing engagement and intentions related to demand flexibility and smart energy services with a sample of 1,500 participants.[1]
2. A comprehensive literature review, which was used to generate a detailed "taxonomy" of behaviours relevant to demand flexibility and behaviour change roadmaps for different types of behaviour.[2]
3. A time-of-use analysis of 2023 data from our Behavioural Energy and Travel Tracker (BETT) survey looking at the timing of electricity-consuming activities in Irish homes and factors affecting this.[3]
4. A survey/field experiment embedded in BETT in 2024, which pre-tested a simple intervention telling people about the environmental benefits of reducing peak consumption with an option to pre-commit to specific actions, looking at how this affected their activity during the evening peak in the next survey wave compared with a control group.[4]

Below we outline some of the main recommendations emerging from the findings of these studies, with a brief justification for each. Further detail and additional recommendations can be found in the specific outputs for each piece of research.

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[1] SEAI (2025). User engagement with demand flexibility and smart energy services: Results from an online experiment.

[2] SEAI (2025). Behavioural insights for electricity demand flexibility: Barriers and enablers to behaviour change and engagement with smart energy services.

[3] Lavin, C & Julienne, H (2025). Household activities underlying residential electricity demand: who does what during the evening peak? *Energy Efficiency, 18(43).* https://doi.org/10.1007/s12053-025-10322-4

[4] Slide deck with results of the BETT survey/field experiment available on request.

Recommendations based on research findings

Communication campaigns

- **Use communication campaigns to educate people about the environmental benefits of demand flexibility as well as the financial benefits.**
  In our online experiment, the framing the topic of smart energy in terms of the ability to monitor and control bills was best at attracting attention and making people want to learn more, but an individual's awareness of the environmental benefits of demand flexibility had a much stronger relationship with their intentions to reduce consumption during the evening peak than awareness of financial benefits.[1] However, only a quarter of people are aware of these environmental benefits. Further support for this comes from the survey/field experiment we ran through BETT – informing people about the environmental benefits of reducing peak use (and giving them some concrete actions to commit to) led to a measured reduction in some peak period activities three months later.[4]
- **Focus on behaviours with the most potential for reducing peak demand – i.e. behaviours that consume a lot of electricity, are easier to change and are common during periods of peak demand. Cooking behaviours are some of those with the highest potential due to their high prevalence during the evening peak.**
  In our time-of-use analysis of BETT data we found that cooking is by far the greatest contributor to residential evening demand – accounting for almost half the demand of the activities we measure.[3] Other significant contributors include space heating, the immersion and tumble dryers, with a smaller proportion being attributable to washing machines and dishwashers. In our online experiment we found that, while people are more willing to time shift laundry and dishwasher use compared with cooking, people cook at peak far more often and still show a willingness to time-shift at least some of this or reduce consumption through other means (e.g. cooking in batch or using an air fryer).[1]
- **Take care to retain messaging about the need for overall demand reduction in communications – prioritise peak *shaving* over peak *shifting*.**
  An unexpected result of our online experiment was that those who were shown an information page about smart energy and demand flexibility reported *lesser* intentions to reduce their peak consumption by doing fewer activities than those in a control group.**[1]** There is a risk that giving people tips about time-shifting may lessen the perceived importance of reducing overall consumption, so the benefits of reducing consumption at all times should continue to be a headline.
- **Bear in mind the importance of perceived fairness when asking people to change their behaviour. Give a range of effective options to choose from, highlight the efforts of others and show how other sources of stress on the grid (e.g. data centres, ageing infrastructure) are being addressed.**
  In our online experiment, the factor by far most strongly related to intentions to reduce peak electricity use was the perceived fairness of being asked to do so.**[1]** The literature review also identified lack of perceived fairness as a barrier to behaviour change – most people are "conditional co-operators" in collective action problems such as the climate crisis, meaning that they will do what they perceive to be their fair share so long as they believe other actors are doing so too.[2,5,6]

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[5] Becchetti, L, Conzo, G & Salustri, F (2025). What about the others? Conditional cooperation, climate change perception and ecological actions. *Ecological Economics, 227*, 108371.

[6] EPA (2024). Encouraging Cooperation in Climate Collective Action Problems. https://www.epa.ie/publications/monitoring--assessment/climate-change/EPA-BI-Series-No-3-(2024)-Encouraging-Cooperation-in-Climate-Collective-Action-Problems.pdf

Consumer tools and supports

- **Promote the development of tools to give consumers real-time feedback on their consumption and signals of when to use electricity via in-home displays or apps.**
  Findings from the literature highlight that feedback is important for helping people build an understanding of what electrical appliances consume the most in the first place, but also in maintaining motivation to engage with demand flexibility, especially if combined with gamification.[2] In our online experiment, highlighting the ability to monitor energy use was effective in generating interest in the topic of smart energy.[1]
- **Expedite the roll out of the smart meter data access code so that consumers' smart meter data can be seamlessly integrated into price comparison websites and other tools.**
  The behaviour change roadmaps, based on the literature review, identify a lack of data literacy and complexity aversion as big barriers to overcome for people to engage with smart services.[2] While it is now possible for people to download their smart meter data and upload it to certain tools themselves, the process is far from straightforward and beyond the capability of many energy users.
- **Create targeted resources and advice for households with different combinations of demand flexibility enabling technology (e.g. heat pumps, EVs, solar PV) on how best to optimise their use of these. Use grant application processes as an opportunity to direct households towards these resources.**
  The literature review highlighted that conflicting advice and goals can be a source of confusion and prevent people from operating technology in line with demand flexibility goals.[2] For example, heat pump owners are usually advised to let their systems run continuously for optimal efficiency, which is at odds with instructions to curtail use at peak times. Generalised advice to avoid electricity use at certain times may also not be appropriate for households with generation and storage capacity.
- **Put measures in place to support smart readiness and automation, making the "smart" option the default where relevant (e.g. pre-programming EV chargers to operate outside peak hours).**
  The behavioural taxonomy generated from the literature review highlighted the high cognitive burden associated with maintaining many demand flexibility behaviours and the potential of smart appliances and automation to relieve some of this burden.[2] In our online experiment, time availability was associated with better intentions to reduce peak demand – automation could thus especially be an aid to households that are time poor.[1]

Time-of-use tariffs

- **Prioritise simplicity while people are getting used to time-of-use tariffs: promote consistent naming of products to reduce confusion, provide simple tariff structures to start people off and be very clear about the need to switch tariff to avail of off-peak rates.**
  The literature review identified complexity and information overload as primary barriers both to switching to time-based tariffs and responding to price signals.[2] Previous results from BETT suggest we are still at very early stages of getting people to engage with time-based tariffs in Ireland – most people are not even aware of the need to switch tariff after having a smart meter installed in order to avail of off-peak rates.[7] Our time-of-use analysis showed that the behaviour of households on time-of-use tariffs does not differ much from that of households on flat tariffs, whereas those on simpler day-night tariffs do engage in fewer electricity consuming activities during the evening peak.[3]

[7] SEAI (2024). Behavioural Energy and Travel Tracker: Results report 2 – Summer 2023. https://www.seai.ie/sites/default/files/publications/Behavioural-Energy-and-Travel-Tracker-Report-2.pdf

- **Provide "safety nets" to reduce the risks of switching: e.g. price guarantees for initial contract periods in which customers do not pay more than they would have according to their old rate structure, and/or an option to revert to a flat structure at any time.**
  Through the literature review, loss aversion was identified as one of the main barriers to switching to a time-based tariff – people pay more attention to the risk of their bills going up than the possibility of their bills going down. [2,8] In our online experiment, trust in suppliers was found to be related to likelihood to consider a time-of-use tariff.[1]
- **Provide tariffs with stronger price differentials between peak and off-peak rates.**
  In our online experiment, participants rated saving money on bills as the most important benefit of smart energy and most said they would consider switching to a time-of-use tariff. However, they expected to save only about half the amount that would prompt them to switch on average, and 71% expected to save less than what would make them switch.[1] This scepticism is not unfounded – currently, the largest peak-rate to day-rate ratio on offer in the market is smaller than the smallest ratio tested in the CRU smart metering trial. Previous research suggests that the size of the difference between peak and off-peak rates is what matters in whether time-of-use tariffs are effective in changing behaviour.[9]

Distributional & equity issues

- **Provide increased, targeted supports for the adoption of flexibility-enabling technology among vulnerable households.**
  The behavioural taxonomy created from the literature review highlighted that there are two distinct groups when it comes to flexibility potential – those with flexibility enabling technologies such as EVs and solar PV, and those without.[2] Higher-income homeowners who can afford these technologies stand to gain a lot more from demand flexibility markets than those who cannot afford them or cannot adopt them for other reasons (e.g. renters). It is thus crucial to provide additional support to these vulnerable households, to manage distributional impacts, but also to manage perceptions of fairness, which, as mentioned above, are important for inducing pro-social behaviour.
- **Implement measures to promote the widespread adoption of smart appliances, e.g. training relevant salespeople and providing financial incentives.**
  The literature review highlighted the adoption of smart appliances as a promising avenue for unlocking flexibility while minimising distributional impacts, as these are more affordable than bigger technologies and can be particularly helpful for reducing cognitive burden among the time-poor. [2]

Conclusion

This document highlights some of the main recommendations we see as important for promoting demand flexibility and the uptake of smart energy services, specifically from a behavioural science perspective. It is important to note that this list is not exhaustive, and we direct the reader to the more detailed publications for further insights and recommendations. Further, the research undertaken and recommendations arising from it are reflective of the early stage Ireland is at with regards demand flexibility. As people become more engaged, further research will be needed with regards to how energy users interact with more complex products such as dynamic tariffs and direct load control. The recommendations we make are largely based on evidence from theory and what has previously worked in a variety of different contexts – we always recommend conducting further research to pre-test policies and interventions in their relevant context, and to monitor their effectiveness once deployed.

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[8] Nicolson, M., Huebner, G., & Shipworth, D. (2017). Are consumers willing to switch to smart time of use electricity tariffs? The importance of loss-aversion and electric vehicle ownership. *Energy research & social science, 23*, 82-96. https://doi.org/10.1016/j.erss.2016.12.001

[9] Faruqui, A & Sergici, S (2013). Arcturus: international evidence on dynamic pricing. *The Electricity Journal, 26 (7)*, 55–65. https://doi.org/10.1016/j.tej.2013.07.007