Ofgem, 10 South Colonnade, Canary Wharf, London E14 4PU

Thursday, 28 March 2019

Dear Settlement Reform Team,

Call for Evidence: Potential impacts on consumers following market-wide settlement reform

I'm a researcher at UCL Energy Institute[1], whose work in recent years has focused on social issues connected with uptake and experience of demand response products such as time of use pricing. I welcome the opportunity to respond to this important call for evidence.

Before responding to the individual questions, I have a couple of general points to frame my later comments. Firstly, in the context of this specific call for evidence, I'm interpreting 'engagement' as referring only to consumers' ability/willingness to alter (if necessary) patterns of electricity demand, rather than broader forms of energy-related engagement (e.g. around energy saving or tariff switching in general).

Secondly, I think it is important to be clear that there are two key questions with regard to any kind of flexibility-related information/signal. First, is the consumer actually exposed to the signal in the first place (e.g. signed up to a TOU tariff)? Only if the answer to this is yes, then a secondary question comes into play, which it if they are exposed to signals, how much (if at all) do they respond? So the magnitude of response to any particular kind of signal can only really be interpreted in light of knowledge about how many consumers are willing to be exposed to it.

Please note that I have only included, and responded to, questions were I think I can contribute useful evidence my own work (or that of colleagues) or perspective drawing on the work of others.

I hope these responses are useful, and would be happy to discuss any of them further, or provide more details.

Your faithfully,

Michael Fell

michael.fell@ucl.ac.uk

+44 (0)20 3108 5926

[1] Please note that this response is written in a personal capacity and does not claim to represent the views of others at UCL Energy Institute.

Question 2.3: Based on any relevant evidence you have collected,

a) what proportion of consumers would be price responsive?

Much of our work has focused on whether consumers would expose themselves to price signals. This does not tell us about their actual responsiveness to prices, but we can probably make some logical inferences. Work we conducted several years ago showed that 25-30% of representative sample of the British population were at least somewhat in favour of signing up to a static or dynamic TOU tariff, with or without automated response from a smart thermostat controlling a hypothetical electric heating system (Fell et al., 2015b). See figure 1.

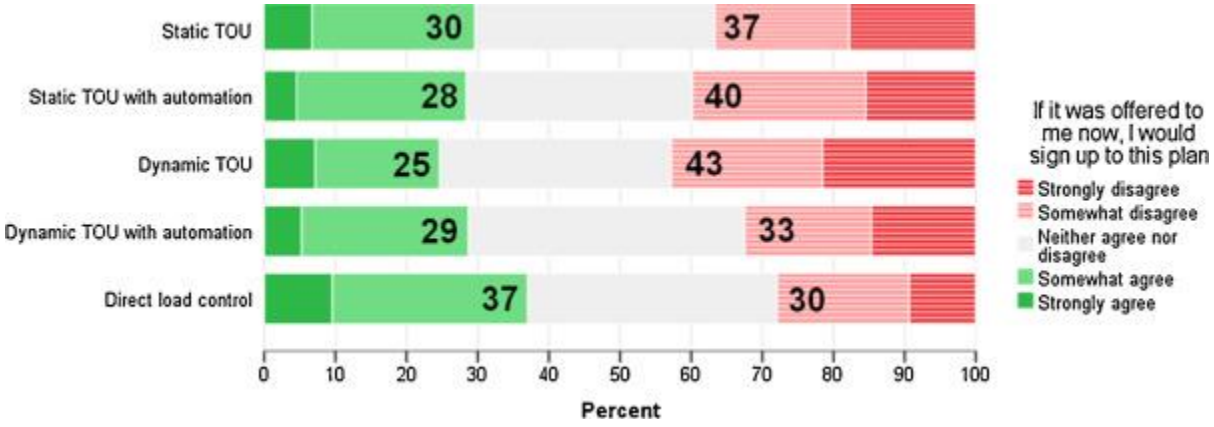

Figure 1: Responses to the item measuring behavioural intention to use each tariff. The numbers of the chart represent the percentage of participants either strongly or somewhat in favor of, or strongly or somewhat against, switching to the tariff in question (Fell et al., 2015b).

There is separate evidence that automation makes response to TOU pricing larger and longer-lasting (Frontier Economics and Sustainability First, 2012). Automation mitigates against factors such as forgetting to respond, or not noticing price changes, while also allowing response to take place at otherwise inconvenient times (e.g. when people are out or sleeping). So we might have some confidence that if 28-29% of people are somewhat willing *in principle* to expose themselves to price signals with automated response of a technology that can be usefully controlled in response to price, this gives us some insight into the proportion of the population that may ultimately be price responsive.

Of course, the actual participation in such a scheme would be limited by people's access to automatable technologies such as electric heating, electric vehicles or other smart appliances – which is currently low but expected to grow. So another approach is to look at the proportion of the population which currently, or may in future, have access to such technologies and assume that some proportion of these will operate them in a way which is responsive to price signals. Work by colleagues has shown that people who currently possess such technologies are more likely to sign up to a TOU tariff (and therefore probably, due to automation, respond) – but it is unclear whether this will extend beyond relatively early adopters (Nicolson et al., 2017). As I'm sure you know, projections on uptake of technologies such as heat pumps are available from organizations such as the Committee on Climate Change (e.g. here).

b) what enablers would be important and what barriers might exist?

The first enabler is that flexibility products are actually offered in the market. While a move to HHS hopes to address this, we do have anecdotal evidence that some suppliers are concerned about the

trust implications of offering such products (the perception being that people will focus on high prices, even if only for short periods). Interestingly, part of the work we did for Citizens Advice suggests this concern may be partly justified. We measured how much people trust their energy suppliers, but experimentally varied some contextual information such as whether TOU tariffs were mentioned directly before this (see the appendix[2], section on "Trust experiment: Aims" onwards). Indeed, just mentioning that TOU tariffs are increasingly being introduced caused people to report lower trust in their supplier. These effect was stronger when we included the information that TOU tariffs are being supported by government, but mitigated when we said they are being supported by consumer groups.

Another important enabler is access to automatable larger electric loads such as heat pumps and EVs, as well as to onsite generation, as mentioned above. There are many and varied financial, social and policy barriers at play here which it is not possible to go into in detail.

c) what volume of load shifting from peak to off-peak periods (%) will a consumer be able to offer?

As part of our report[3] for Citizens Advice with Brattle Group, we conducted a 'review of reviews' of response to time-varying tariffs. We systematically identified as many reviews of response to TOU tariffs as possible, and then synthesised the findings specifically on peak reduction (so only one element of price responsiveness). Many of these studies are based on North American evidence, so we also extracted information from a number of individual UK/Irish trials in order to compare them. More information on how this work was conducted, and the findings, is available in the appendix to the report[4] beginning at slide 63.

The reviews we looked at contained studies with a wide range of price responsiveness, but in summary (slide 68):

- Static TOU tariffs elicited a response of about 10% on average (7-15% range) – this was the most common type of product
- Critical peak pricing had a higher average response, approaching 25% (16-29% range), but of course these reductions only apply from time to time for specific events when high prices are levied
- Critical peak rebates, where consumers are paid to reduce demand on specific events, achieved an average response of around 15% (11-20% range)
- Real-time pricing has relatively few examples, but peak demand reduction was also just under 15% on average.

In the UK/Irish trials reviewed, responses were generally towards the mid to lower end of these ranges (see slide 70). This is likely due to the lower prevalence of larger electrical loads such as air conditioning.

As I set out in my introduction, it is important to note that even while certain types of product may elicit a higher response, this is only useful when combined with knowledge of how many households

[2] https://www.citizensadvice.org.uk/Global/CitizensAdvice/Energy/The%20Value%20of%20TOU%20Tariffs%20in%20GB%20-%20Volume%20II.pdf

[3] https://www.citizensadvice.org.uk/about-us/policy/policy-research-topics/energy-policy-research-and-consultation-responses/energy-policy-research/the-value-of-time-of-use-tariffs-in-great-britain/

[4] https://www.citizensadvice.org.uk/Global/CitizensAdvice/Energy/The%20Value%20of%20TOU%20Tariffs%20in%20GB%20-%20Volume%20II.pdf

(or more properly how much load) might actually participate in such a programme. A programme that achieves a high response in a small overall pool of load is unlikely to be of much use (except perhaps in specific local circumstances).

Question 2.4: A number of different approaches to load shifting exist.

a) Which approaches to load shifting (direct, or indirect, with or without automation) would domestic consumers be more likely to prefer and respond to?

Please see chart in response to Q2.3(a) above. In that research (Fell et al., 2015b), we found that British consumers were most in favour of a slightly discounted flat rate tariff permitting direct load control of heating (37%) compared to 25-30% for TOU tariffs. Because direct load control as a form of automation does not rely as heavily on consumer intervention (although it may be affected by it, e.g. use of overrides) it is likely to increase size and duration of response as discussed above. The type of direct load control we presented was within quite tightly defined bounds and with unlimited override ability – and this override ability has been shown elsewhere to be important for acceptability (e.g. Parkhill et al., 2013).

As part of our work for Citizens Advice we conducted a systematised review of uptake of time-varying tariffs, which is now reported in more detail in an academic paper (Nicolson et al., 2018). Here we found that:

- Dynamic and real-time tariffs tend to be less popular than static ones, likely due to their unpredictability.
- No statistically significant differences were found in stated or actual uptake between static TOU tariffs and critical peak pricing/rebate offerings, although evidence from some individual survey studies suggest static tariffs may also be more popular here.
- Offering automated response alongside a time-varying tariff did not systematically make TOU tariffs more attractive, although this is based on a limited number of studies. However, our own study above which directly compared stated uptake of the same tariff with or without automation finds that automation does increase the popularity of a dynamic TOU tariff.

Relevant to the above (and our own work) is that, as you might expect, levels of actual uptake tend to be lower people's stated intentions as shared in survey-based research. We prefer to view the latter as an indication of interest 'in principle' – recognising that a range of factors may prevent of impede people from participating in practice.

It is also important to note that uptake is likely to depend heavily on how participation in such programmes is framed. For example, our review showed that opt-out programmes achieve substantially higher levels of participation than opt-in. However, opt-out programmes may not always be politically acceptable – so for this reason we suggest that critical peak rebate tariffs (which are generally viewed as non-punitive – resulting only in benefits with no risk of extra costs for consumers) could most safely be introduced on an opt-out basis.

Please also see response to Q2.3(c) above which discusses ow much consumers actually respond to different types of tariff.

b) What are the risks and benefits of these approaches?

The benefit of automated approaches, as discussed above, is that the make response to TOU pricing (or other signals) larger and longer-lasting (Frontier Economics and Sustainability First, 2012). However, it does come with a number of risks. One is related to privacy – depending on how the automation is achieved, it may require substantial amounts of usage data to be shared with third parties. While this is not inherently a problem, it does present security challenges and the risk of parties using data for unexpected and undesired reasons – and concomitant consumer concern.

Another risk associated with automated/direct control approaches is that they could result in dangerously compromised levels of service. For example, in our work for Citizens Advice, we found that 29% of people would offer third parties the ability to turn their thermostat settings up or down by 3 degrees Celsius with no override ability in return for getting a free smart thermostat (see slides on 'thermostat experiment'. There is a risk, especially for people in vulnerable situations, that this could lead to dangerously (or at least uncomfortably) high or low temperatures. While such a situation is unlikely to be acceptable in reality to many consumers, it is a risk we need to remain alert to.

There are further risks connected with bundling smart devices or other services with tariff offerings, such as that consumers are thereafter locked in to compatible tariffs.

c) How could those risks be mitigated?

On privacy, as far as possible principles of data minimization in line with GDPR can help with mitigating any risk. Bidirectional data flow is not necessary to automate demand response (see, for example, storage heaters with timers) so it will be a question of trading off the benefits that additional data collection could support for consumers with the additional privacy/security risks.

On intrusive levels of control, this could be dealt with through principles which ask operators to rule out interventions likely to result in dangerous or uncomfortable conditions for consumers (with reasonable caveats around how consumers ultimately use those technologies) – and provide information on measures they have taken to ensure this. On lock-in, there could be principles requiring interoperability of technologies which are bundled with flexibility-related products/services.

d) Would certain types/groups of consumers favour certain approaches?

Across studies we have conducted we have found no consistent associations between signing up with a flexibility product and age, gender, housing tenure, employment status, education, social grade, being on a pre-payment meter, or income (see (Fell et al., 2015a)). However, we do occasionally see an association between being older and being less likely to participate in offerings such as critical peak rebates and direct load control (see appendix of Citizens Advice study, section on "Results of a survey measuring uptake to time-varying tariffs under a range of design and marketing conditions"[5]). As discussed above, we find greater interest amongst consumers with larger or controllable loads such as EVs and smart appliances and intention to take up flexibility offerings (Nicolson et al., 2017).

[5] https://www.citizensadvice.org.uk/Global/CitizensAdvice/Energy/The%20Value%20of%20TOU%20Tariffs%20in%20GB%20-%20Volume%20II.pdf

e) Would certain types/groups of consumers be at greater risk of detriment from certain approaches? These approaches could include but are not limited to:

• ToU tariffs

• Tariffs reflecting capacity-based charges, which may involve a defined access limit or different types of access option as described in paragraph 2.6 and Appendix 4

There are a wide variety of risk factors which could act alone or in combination, and include:

- Being on a prepayment meter, where exposure to unexpected high costs could rapidly deplete credit
- Being in fuel poverty (low income high cost definition) if unable to avoid higher price periods
- Having large electrical loads such as electric heating could make it hard to avoid capacity charges
- Having disabilities or health conditions which require either specialist equipment or consistent environmental conditions could make it hard to avoid exposure to periods of high costs.
- Tenants who have no choice over which technologies they have access to.
- Households with less flexible schedules, for example those including children.

Please see my response to Q2.6 which discuss some of the implications of this.

Question 2.5: Which parties (eg suppliers, other third parties, network companies, community schemes etc) do you consider could be best placed and/or trusted to facilitate these above approaches?

I think all of the above could be involved, often in combination with each other. I already mentioned above how loss of trust in suppliers connected with TOU tariffs could be mitigated by showing it is supported by consumer organizations. Different actors are likely to be more appropriate for different consumers. For example, some may prefer a well-known, well-established supplier, while others may be more attracted by innovative services offered by an unknown start-up. An open approach should be taken to this, which also facilitates different types of organization working together.

Question 2.6: Certain consumers may face barriers that prevent them from load shifting.

a) What barriers exist that may prevent consumers from load shifting?

b) Which particular groups of domestic consumers may face greater or more significant barriers than others?

c) For particular consumers are there certain types or levels of consumption that there will be less scope to flex (ie are there any forms of consumption that consumers would consider as "essential" and be unable to shift, such that suppliers, network companies or third parties should not be able to offer to reduce consumers' usage below this limit)?

I'm providing a general response to these questions.

There are a whole range of reasons why households may be more or less able to change their patterns of demand. This is not an area I have researched directly so will not provide direct responses to the sub-sections. In our 'review of reviews' of response to TOU pricing for Citizens Advice we did seek evidence on the impact of socio-demographic factors (see appendix[6], slide 80 onwards for the findings of that). In summary, we found no strong evidence that certain groups systematically lose out more than others. However, we add there is good evidence that households with large loads that can be automated can save more (albeit from a starting point of costing more to run), and certain such loads (e.g. EVs) are likely to be taken up preferentially by more affluent consumers, which could result ultimately in distributional impacts.

I would like to introduce here some work that I recently completed with Gareth Powells of Newcastle University introducing some relevant new concepts to this area. Details of this work are contained a paper "Flexibility Capital and Flexibility Justice in Smart Energy Systems", which has been accepted for publication in the journal Energy Research and Social Science and is currently available as a preprint (Powells and Fell, 2019). The work can be summarised as follows.

Flexibility has increasing value across sectors of the economy, including energy. The ability to be flexible (which is what you are interested in here) is affected by a wide variety of sociotechnical factors and determines what we term '*flexibility capital*'. Levels of flexibility capital vary in populations, both absolutely and in the extent to which they are primarily derived from technological (e.g. automated heat pump operation) or social (e.g. avoiding using an electric hob at certain times) means, which has implications for the (dis)comfort and (in)convenience involved in economising flexibility capital. Furthermore, we argue that freedom of choice over whether and how to economise flexibility capital can be limited by factors such as how affluent people are, among others. In constrained systems (such as energy networks), the level of service enjoyed by the more affluent may not simply be higher than those who are less affluent, but may be *directly enabled* by reductions in the latter's comfort and/or convenience which may not feel fully voluntary. There is a real risk that such injustices could be locked into energy infrastructure and market design and governance for the long term as has already happened in labour markets. We introduce the concept of 'flexibility justice' as a frame for these issues of fairness. The following figure summarises these ideas. I hope it might be helpful in thinking through some of the wider fairness implications that transition to a more flexible future might entail.

[6] https://www.citizensadvice.org.uk/Global/CitizensAdvice/Energy/The%20Value%20of%20TOU%20Tariffs%20in%20GB%20-%20Volume%20II.pdf

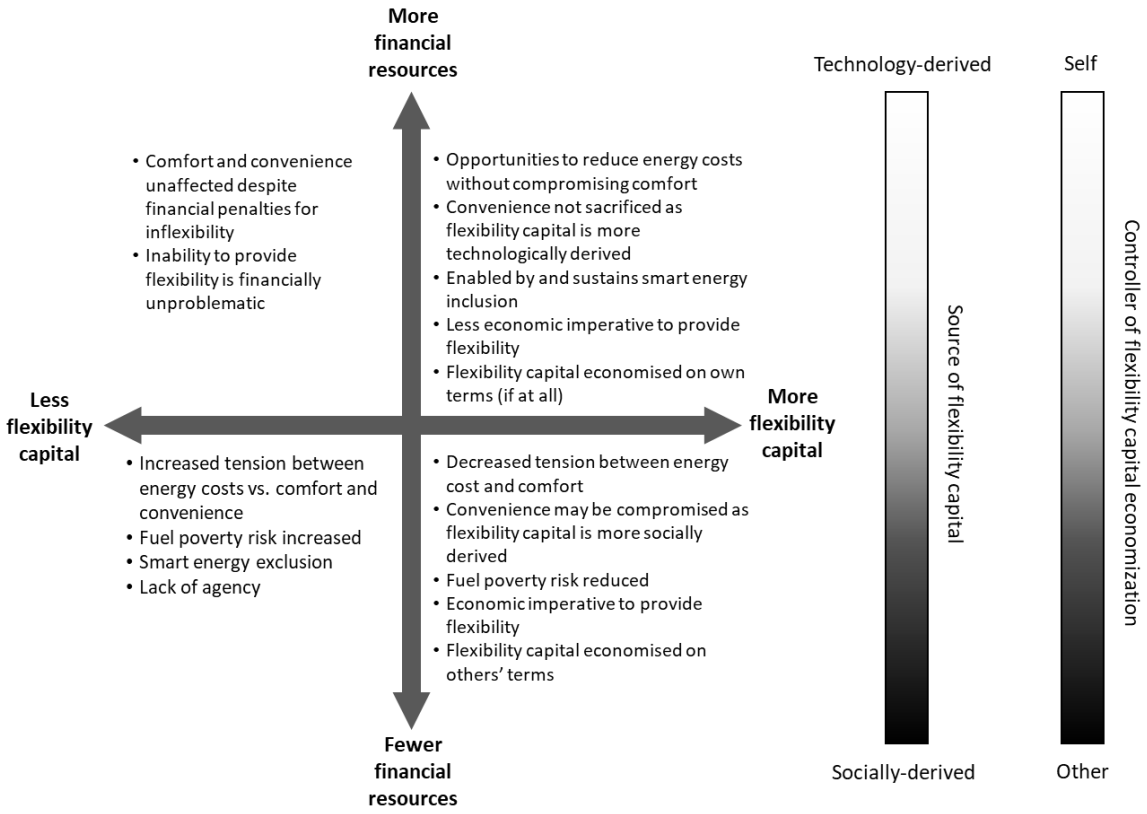

Figure 2: Generalized representation of the interaction between flexibility capital and financial resources (affluence) (Powells and Fell, 2019).

Question 2.7: Do you have any views about the scale of any distributional impacts? How may these be mitigated?

I don't have a particular view on the scale. There is going to be a very real challenge in allowing those who can and want to be flexible to reap the benefits of this, without making those who can't/won't relatively worse off. I think mitigating the worst effects of this is likely to lie in broader policy such as around general energy demand reduction (which should knock on to bill costs) and the way in which some energy-related social policies are funded (i.e. shifting from energy bills to general taxation). This would increase the resilience of those who are not able to vary their consumption patterns to the price penalties associated with this.

Question 2.8: How could innovative technologies or solutions enable more consumers to provide flexibility, either individually or collectively (eg through a community approach)?

I generally support approaches which aim to give people more technologically-derived flexibility capital (see response to Q2.6). Our most relevant work in the area of communal consumption is around peer-to-peer energy trading. I am running an ongoing project looking at what the social impacts might be of such a model. This does not have any findings as yet, but an overview of the research is available as a preprint (Fell, 2019) and a summary of possible impacts is included from p9. One hypothesis we are investigating is that communal assets or trading schemes (if their community benefit motives are clear) could enhance people's ability and readiness to provide flexibility – but we are not yet in a position to say if there is evidence to support this.

Question 2.9: We want to understand what specific concerns or risks of detriment may exist with the use of technology and innovation to enable flexibility.

a) What barriers exist for consumers to access these enabling technologies/innovative products?

The main barriers are likely to be affordability of technology, and freedom of choice to use them. The latter could depend on points such as tenure and access to roof space (for PV installation) or garden/parking space (for heat pumps and EVs). Further space issues apply for smart appliances in general, and storage – in particular hot water storage as many homes no longer have hot water tanks following increase in prevalence of combi-boilers. Work I was involved in showed how automating heat pumps to respond to TOU pricing without heat storage can, under certain circumstances, be unacceptable to householders due to issues around overheating and noise (Sweetnam et al., 2018). This also highlights the importance of considering interactions between technologies (such as heat pumps and heat storage) rather than individual technologies in isolation.

b) How could these barriers be overcome?

The issues I mention above are likely to be most effectively addressed through building and appliance regulation. While I expect this is outside the remit of the set of reforms you are considering, I include it because it again points to the interaction of many different strands of policy and regulation. It is important that regulation related to flexibility should not race ahead too far of related regulation in other areas, but rather a holistic approach should be favoured (see also my response to Q2.7).

c) Are there any particular concerns which may apply for certain consumer groups, eg vulnerable consumers (affordability and practicality)?

I think it is important to be aware of the difference between consumers who chose to have access to relevant technologies (e.g. by buying them) and those who did not (such as tenants who had them installed). As the work on flexibility justice I refer to above discusses, the latter are likely to be more at risk of vulnerability here since technologies are less likely to be operated for either for social benefits or purely as a result of their own free consent.

d) What further protection measures should be considered alongside these technologies?

In the same way that there has been increasing scrutiny of how heat networks might be regulated, the same should be considered where there are service contract arrangements connected with specific technologies. For example, if tenants find themselves in a situation where a condition of their tenancy is that they participate in certain automated flexibility programmes (e.g. through control of a heat pump), then this could be a legitimate area for regulation that would not necessarily be address through existing mechanisms (for example if not offered as part of an energy tariff).

Question 2.10: Do you have any views about whether consumers may prefer particular tariff types over others (for reference, some examples of ToU tariffs are listed in Appendix 2, and potential access options are described in Appendix 4)?

Please see response to Q2.4(a).

Question 2.13: How far could principles-based obligations help ensure tariffs/choices are appropriate, including in relation to potential new access options?

There is no reason why a principles-based approach could not work well here. However, it should require clear statements from suppliers as to how they believe their offerings address the principles, and the indicators on they suggest they should be measured. This should allow best practice approaches to be identified, as well as sub-standard performers.

References

Fell, M.J., 2019. Social impacts of peer-to-peer energy trading: a rapid realist review protocol. https://doi.org/10.31235/osf.io/k2wd5

Fell, M.J., Nicolson, M., Huebner, G.M., Shipworth, D., 2015a. Is it time? Consumers and time of use tariffs (Report to Smart Energy GB). UCL Energy Institute, London, UK.

Fell, M.J., Shipworth, D., Huebner, G.M., Elwell, C.A., 2015b. Public acceptability of domestic demand-side response in Great Britain: The role of automation and direct load control. Energy Research & Social Science, Special Issue on Smart Grids and the Social Sciences 9, 72–84. https://doi.org/10.1016/j.erss.2015.08.023

Frontier Economics, Sustainability First, 2012. Demand Side Response in the domestic sector - a literature review of major trials (Report to DECC). Department of Energy and Climate Change, London, UK.

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

Nicolson, M.L., Fell, M.J., Huebner, G.M., 2018. Consumer demand for time of use electricity tariffs: A systematized review of the empirical evidence. Renewable and Sustainable Energy Reviews 97, 276–289. https://doi.org/10.1016/j.rser.2018.08.040

Parkhill, K., Demski, C., Butler, C., Spence, A., Pidgeon, N., 2013. Transforming the UK Energy System: Public Values, Attitudes and Acceptability – Synthesis Report. UKERC, London.

Powells, G., Fell, M.J., 2019. Flexibility Capital and Flexibility Justice in Smart Energy Systems. https://doi.org/10.31235/osf.io/3nja6

Sweetnam, T., Fell, M., Oikonomou, E., Oreszczyn, T., 2018. Domestic demand-side response with heat pumps: controls and tariffs. Building Research & Information 0, 1–18. https://doi.org/10.1080/09613218.2018.1442775

Contact

This response was written by Michael Fell. It does not claim to represent the views of UCL Energy Institute. Please do not hesitate to get in touch if you would like to discuss any of the points raised:

Michael Fell
michael.fell@ucl.ac.uk
+44 (0)20 3108 5926

UCL Energy Institute, Central House, 14 Upper Woburn Place, London WC1H 0NN

www.ucl.ac.uk/energy