ENA Open Networks Project: Flexibility Consultation 2020 – A response

Consultation Documents: https://www.energynetworks.org/electricity/futures/open-networks-project/open-networks-project-stakeholder-engagement/public-consultations.html

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Note on responses

We have only responded to questions where we can offer expertise.

New DSO Services –2020 Product 5

Q6–At what point do you believe it is appropriate to standardise new products? For example, should we initiate standardisation early on limited experience, or allow more than 2-3 DNOs to develop and procure similar products before commencing standardisation?

It would be worth reviewing the Internet Engineering Task Force's approach to developing open standards as it is an excellent case study in how to iteratively develop open standards that have produced demonstrable innovation and value-capture.

See https://ietf.org/standards/process/ which summarises the process as:

> *"In outline, the process of creating an Internet Standard is straightforward: a specification undergoes a period of development and several iterations of review by the Internet community and revision based upon experience, is adopted as a Standard by the appropriate body... and is published."*

However they note practical difficulties:

> *"In practice, the process is more complicated, due to (1) the difficulty of creating specifications of high technical quality; (2) the need to consider the interests of all of the affected parties; (3) the importance of establishing widespread community consensus; and (4) the difficulty of evaluating the utility of a particular specification for the Internet community."*

Deeper reading of their process (see especially an informal description at https://ietf.org/standards/process/informal/) leads to this response to your questions:

1. Standards should be developed as part of product development by as many DSO (or other parties) as are motivated (Birds Of a Feather https://ietf.org/about/participate/tao/#bofs);
2. Open standards should then be iteratively refined based on development and usage experience via open publication, test implementations and pre-market demonstrators (via a self-selecting Working Group - https://ietf.org/about/participate/tao/#wgs);
3. An open innovation process is crucial to ensure early experience, user feedback and practical utility are built in to the emerging standards;
4. Handling IPR issues is key to ensuring standards remain open but commercially exploitable and the IETF has recommendations for this process;
5. Product inter-working testing (e.g. across DSOs) is crucial to ensuring open standards are adhered to and not 'hijacked' by vested interests to the detriment of the wider energy system;

Residential Flexibility

Q17a–Do you have any ideas on how we might better engage and encourage participation of residential flexibility in flexibility service provision?

Current research suggests that the amount of residential demand side flexibility that can be realised depends on the time of day (to some extent) season and the energy using practices of the households. Its value to the system therefore depends on the value of the degree of flexibility available at a given time. Empirical research suggests that we can expect to realise at most 5-15% residential electricity demand flexibility during evening peak periods where behaviour-only interventions are used and that there is substantial variation between households and across studies [1], [2]. Recent reviews have shown that there is also large variation (0% - 30%) between studies aimed at reducing energy demand over time (sustained reduction rather than flexibility) even where similar interventions are tested [3]–[5].

We should expect the lower end of these ranges on a population-wide basis as many of the studies contributing to this evidence base are biased self-selecting samples of consumers who are more likely to respond to incentives [2], [6], [7]. We know that consumers are particularly price insensitive in the evening peak period although there are indications that this varies by social group [8], [9]. As far as we are aware there has not been a systematic review of the evidence for residential demand side flexibility at different times of day and seasons and we recommend that a rapid evidence review on this topic should be commissioned.

Work by the DEMAND Research Centre (http://www.demand.ac.uk/) & CREDS (https://www.creds.ac.uk/) amongst others has demonstrated the temporal 'inertia' of many aspects of everyday life. Sequences of activities (including those that use energy) are locked in sequences constrained by patterns of work, commuting, child-schooling, leisure, domestic tasks (cooking, laundry etc) - see [10], [11][1]. However when 'stuff is done' seems to be strongly embedded and this was made abundantly clear during the UK's COVID-19 lockdown period when the usual commuting/schooling/working time constraints were removed from a substantial proportion of the population, yet temporal patterns of residential energy use appear to have stayed largely constant [12].

That said there is evidence that residential customers can and will respond to specific critical 'peak' events which put network supply at risk [13]–[15], particularly when peak events are short in duration [c.f. the SSEN/UoS/DNVGL Low Carbon Network (LCN) Fund SAVE[2] project]. This form of 'acute' flexibility does not necessarily need to be incentivised by price but can be stimulated by appeals to social and 'common resource' or community values [c.f. SAVE's SDRC 8.8[3]] although there is also evidence that automatic curtailment could be effective if a (cost-inducing?) over-ride function is provided [16]. However, such acute 'emergency' flexibility is often small [SAVE SDRC 8.4[4]] and does not offer reliable flexibility services because residential consumers will wish to return to 'normal' patterns as soon as possible. **The rate and scale of this *decay* effect are currently unknown**. As I discuss below, the sector appears to believe that time-varying pricing will incentivise such changes despite little in the way of *robust* evidence that residential consumers respond to energy prices. A survey of the literature shows that more robust evidence is required using large, representative samples such as the 4,000+ Solent region SAVE sample[5], and particularly further investigation into how flexibility varies according to household capabilities (see below).

As a result, expecting flexibility to emerge from the ability of residential customers to actively shift or adjust their real-time patterns of energy demand appears unrealistic except for those groups who may have 'flexibility capital' [17] which can be deployed as a resource to gather income from flexing. It is currently unclear who these might be [18]. Instead **solutions are much more likely to be found in socio-technical arrangements (products + practices) which provide automated demand response/direct control or de-couple energy use from energy demand.** Excellent examples may include thermal (heat/cool)

[1] And also https://www.creds.ac.uk/online-reading-room-explores-temporal-aspects-of-energy-demand/

[2] See https://save-project.co.uk/

[3] See https://save-project.co.uk/wp-content/uploads/2019/09/SSEN-SAVE-8.8-TM4-Community-Energy-Coaching-Trial-Final-Reporting-v3.pdf

[4] See https://save-project.co.uk/wp-content/uploads/2019/09/SDRC-8.48.7_Data-informed-engagement-and-price-signals-trial-report.pdf

[5] See https://energy.soton.ac.uk/save-data-sources/

storage of various kinds, batteries, V2G and so forth that allow the grid to 'see flexibility' but the consumer to 'experience normality'.

As an example, SolarCity installs PV & battery systems in homes in New Zealand at SolarCity's own cost (long term finance) and uses them to buffer consumer demand[6]. The consumer buys electricity generated by this 'behind the meter' power plant from SolarCity and any 'top up' power required from the grid. SolarCity report considerable success in decoupling grid load from end-user consumption thus shifting load invisibly to the consumer whilst reducing grid peak demand **and** overall power bills. Anecdotally SolarCity have seen substantial uptake by low income households due to zero up-front capital cost and lack of exposure to price 'shocks' of the kind that impacted Flick energy's wholesale ToU price-following tariff[7]. The latter demonstrated that rather than respond to variable price tariff rises by reducing demand, the majority of customers simply switched (back) to a flat tariff supplier causing Flick to lose substantial market share in a very short space of time.

Q17b-Can you identify any barriers that might currently exist, along with potential solutions?

Temporal constraints on flexibility

See notes above.

Lack of capacity to invest:

Recent work has noted that socio-technical arrangements that enable flexibility as a service come at some cost and it is unclear whether those who *could* flex have the capital to invest in the technologies to enable them to do so. This not only has clear implications for energy justice and equality of access to potential income generating opportunities[18] but will also restrict the scale of the residential 'flexibility' market. This implies that long term financing of the kind offered by Solar City (zero cost to consumer) and by PV 'rent a roof' schemes may be a more viable business model for leveraging household socio-technical infrastructures.

The impotency of price:

The sector appears to assume that variable tariff pricing will 'simply' incentivise households to use energy at different times of day (flex) and/or to reduce their use. This assumption is a major barrier to progress and the conceptual foundations of the approach (consumers as rational actors, consumers as price responsive flexers) need to be reconsidered [19], [20], [11], [21].

Recent reviews including [1], [2], [22] demonstrate the lack of responsiveness to price in many energy demand reduction (or shifting) trials and attention should also be paid to [4] which discusses non-price effects. Using price incentives may also lead to undesired effects, for example increasing demand outside of critical peak events, thus increasing peaks at other times [see SAVE SDRC 8.4[8]] As noted above many studies which have found price effects tend to be non-representative samples of customers recruited via self-selection (opt-in) who are therefore likely to be positively biased towards the study's aims. The consequence is that larger responses may be found than would be the case for the wider customer base. This is

[6] https://www.solarcity.co.nz/solarzero

[7] https://www.stuff.co.nz/business/108499388/2500-flick-customers-jump-as-wholesale-power-price-pressure-continues

[8] See https://save-project.co.uk/wp-content/uploads/2019/09/SDRC-8.48.7_Data-informed-engagement-and-price-signals-trial-report.pdf

likely to be the case with Octopus Agile's early adopters who appear to show a reasonably large time-of-use response (28% peak demand reduction & 47% for EV owners – see [23]).

'Non-rational' choices

Even if we assume that residential consumers do respond to price, we are still faced with evidence that many are unable to choose the 'right' variable price tariff to match their patterns of use. For example recent research suggests that even when provided with full information in a task that required no greater then primary school level maths skills, only 44% of a representative sample of GB bill payers selected the 'best' ToU tariff for a presented consumption pattern [24] Table 14. Crucially, 'lower' social grades did even worse (39%). The distributional impact across income and other socio-demographic characteristics must therefore be carefully evaluated and is as yet unknown. To complicate matters, recent work using time-use diary data has shown that simple demographic classifications, including income levels, do not appear to predict time of day energy-using activity profiles[25]. This makes it difficult, in the absence of smart meter data, to evaluate exactly who might be at risk and why.

Systemic barriers and solutions

These issues raise serious questions regarding:

- the default 'energy justice' consequences of relying on 'informed choice' of ToU tariffs and thus price incentives to flex demand. As a result, there is some doubt as to whether **informed choices** are actually made (correctly) even with full information and support. Effective commercial services, policy and regulation cannot end with this assumption – if the assumption is wrong, which appears to be the case, then a different approach is required;
- a lack of substation and feeder level energy flow monitoring by DSO/DNOs which prevents straightforward assessment of the impact of localised flexibility or demand response trials without the need for extremely expensive per-dwelling monitoring (in the absence of smart meters – c.f. SAVE);
- the inability of DNOs/DSOs to access dwelling level smart meter data "*which relates to a period of less than one month*" unless it "*ceases (through aggregation or by means of any other process) to be capable of being associated with a domestic customer at relevant premises*"[9]. This prevents linkage to network nodes to enable dwelling-level and LV network-relevant assessment of the impact of flexibility trials and products. It also prevents linkage to household level attribute data which the SAVE project has demonstrated would provide a crucial tool for understanding and modelling the potential flexible resource available and who may be at risk from variable tariffs.

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