Response to the BEIS call for evidence on 'A Smart Flexible Energy System'

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This submission is made by the DEMAND Centre, and specifically by Mitchell Curtis and Dr Jacopo Torriti from the University of Reading; Professor Gordon Walker and Dr Mette Kragh-Furbo from Lancaster University, and DEMAND visitor Dr Giuseppe Salvia from Politecnico di Milano, Milan.

The DEMAND (Dynamics of Energy, Mobility and Demand) Centre is one of six End Use Energy Demand Research Centres funded primarily by the Research Councils UK Energy Programme. DEMAND, which runs from 2013-2018, is co-directed by Professor Elizabeth Shove and Professor Gordon Walker at Lancaster University and involves collaborating academics and researchers from 9 universities across the UK (see WWW.DEMAND.AC.UK for more details).

This submission draws on research undertaken within and outside of the DEMAND Centre. Please contact Gordon Walker g.p.walker@lancaster.ac.uk or Jacopo Torriti j.torriti@reading.ac.uk for any follow up.

Seven of the specific questions posed in the call for evidence are responded to below.

Question 7 *– Removing policy and regulatory barriers – Aggregators – What are the impacts of the perceived barriers for aggregators and other market participants? Please provide your views on: balancing services; extracting value from the balancing mechanism and wholesale market; other market barriers; and consumer protection.*

Ongoing research by Kragh-Furbo and Walker shows concerns amongst some independent aggregators about the procurement process. A respondent said: "The way balancing services are currently procured very much suits large scale generators, but doesn't really aggregators or small scale providers, so we have to tender effectively monthly to the National Grid. If we get a tender rejected, we just don't get paid for a month, which is a pretty bad metric".

Ongoing research by Kragh-Furbo and Walker has also identified other market barriers:

- Other Market Barrier 1
    - It can be a challenge for aggregators to find new DSR participants without public support from the National Grid.
    - Evidence - Some independent aggregators have expressed concerns about finding new DSR participants without the public support from the National Grid; however the Power Responsive campaign has made a difference to this. This is a quote from a respondent: "It was a big challenge for us to go out and find customers when National Grid wasn't really coming out publically stating that this is a technology that they back […] so lots of people thought that it might be something we would do for a short time until they would build a new power station, for example. So, the Power Responsive campaign has been a big boost". Another respondent said: "The fact that

National Grid is providing their own description means that they [customers] know it's not just us that are saying this. It is really there. It exists".

- Other Market Barrier 2
    - A new, more data-driven energy system will challenge current work practices within the National Grid
    - Evidence – Some independent aggregators have expressed concerns about the National Grid and its lack of readiness for a more, data-driven energy world. A respondent said: "There really is a paradigm shift that needs to happen with National Grid, which they are on their way to do, but there is still a long way to go, and that's from interacting with a world of huge tangible assets, so power stations that they can actually ring up and talk to, to really putting their faith in data. […] Getting them to put that faith in the data is a big step. […] but they are definitely being pushed towards a more, highly data-driven world and that's one example where they perhaps have been caught out by not planning for it".

- Other Market Barrier 3
    - There is no differentiation between the types of assets.
    - Evidence – An independent aggregator has expressed concern about the lack of real differentiation between different types of assets: "There is no real differentiation between the types of response, for example, frequency response. I guess that was fine when you knew everyone was basically a coal generator giving you the same, but now that you got batteries and lots of different assets, all with slightly different characteristics, it would make more sense to move towards what we would call a paid for performance metric, where people with superior characteristics get rewarded. For example, we know our assets respond in 2 seconds, and we can reach that practical response, where most power stations react in 7-8 seconds. This is something which has been implemented in America, where it's really done well, new sources of flexibility".

- Other Market Barrier 4
    - Concerns about how fast aggregators can scale due to customer concerns about aggregators being able to control customers' loads. An independent aggregator said: "If we tell them that we can switch their water pumps down, it's naturally met with a sort of conservation 'no thank you', and you really have to go on a long process of trialling it, proving it, trialling it on less critical infrastructure before you are then allowed to go through. That's one of the biggest constraints because it limits how fast we can scale".

Question 28 - *Do you agree with the 4 principles for smart appliances set out above (interoperability, data privacy, grid security, energy consumption)?*

The four principles focus on the software of smart appliances, neglecting the implications related to the hardware. Reparability is recommended as an additional principle.

The inclusion of smart response will likely increase the technological complexity and with it the chances of malfunctions and technological obsolescence. The use of open standards may facilitate customization and upgrading over time. Knowledge, competences, tools and parts are needed to keep machines updated and in working conditions. However, these may not be sufficiently developed and available yet.

Several studies reported that the repair market and professionals have been in decline for decades in Europe and in US (McCollough 2009; Cooper 2010) for a number of reasons, recently summarized by Cooper and Salvia (forthcoming), including repair cost being perceived too high by consumers, the frustration of long repair journeys, lack of spare parts, hardware design hindering upgradability and reparability.

The wider smart appliance system (both software and hardware) throughout the whole lifecycle of the device has to be taken into account in order to limit the risks for obsolete or malfunctioning machines which consumers are not willing or able to have repaired.

Past and ongoing investigation by Salvia and colleagues envisage the grassroots phenomenon of digital making as one (non-exhaustive) promising enabler of the reparability principle, with benefits for environmental sustainability and circular economy strategies (Salvia and Cooper 2016; Salvia and Prendeville, forthcoming). Local communities for programming and manufacturing coalesced in 'makerspaces', which are laboratories of making globally spread, especially in the UK. These could represent distributed pools of knowledge and tools, which can contribute to keep smart appliances in good working order. Together with them also other grassroots and independent initiatives, such as Repair Cafes and Restart Project, are form of decentralized repair, which overcome the barriers and limits of centralized systems of repair (e.g. spare parts availability through manufacturers and high cost of professional repairers for small fixes).

Question 31 *- Are there any other barriers or risks to the uptake of smart appliances in addition to those already identified?*

The use of the epithet 'smart' and similar ones risks being misleading to the consumer. Previous studies and consultations (van den Hoven 2012) reported that advertising devices as 'smart' tend to raise expectations and people may attribute to them higher levels of automation, efficiency, or intelligence than actually embedded.

The potential consequences are mainly twofold. First, consumers may overestimate the savings that can be gained by subscribing to smart tariffs and buying smart appliances, or even spend them in more energy intense products and practices (as also proved by studies on rebound effects related to energy savings initiatives and polices). For instance, with the introduction of more energy efficient smart tariff and technologies, washing machines could be used more frequently or electric cars are driven for longer. As a consequence more energy is demanded throughout the day.

Second, as soon as consumers realize that their expectations of monetary saving and enhanced performance attached to a so-called 'smart' device and energy provision system are not met, confidence and trust may decrease. As a consequence people may drop out from the smart tariff scheme or attach meanings of unreliability and inefficacy to smart technology.

Therefore, naming and terms associated to flexible energy tariffs and compatible appliances have to

be carefully selected and piloted first with consumers in order to anticipate unexpected interpretations and consequences.

Question 32 *- Are there any other options that we should be considering with regards to mitigating potential risks, in particular with relation to vulnerable consumers?*

Information provision may not be sufficient for engaging people in energy saving routines and optimal use of appliances. Previous studies on repair of common domestic appliances for instance proved that the majority of people do not read instructions coming with products. Therefore they are not fully aware of how machines work, how to maintain them, how to cope with malfunctions (Salvia et al 2015).

Work on effective ways for consumer engagement are advocated, making the interaction with and appropriation of smart appliances meaningful for the consumer, otherwise improper use and maintenance can spread and dissatisfaction may emerge. To this end, design may play a major role. Smart appliances can be designed with for effective interaction and use throughout the lifetime of the machine. Examples include:

- The design of operative interfaces which make the machine working understandable to the user; automated response could be made visible rather than hidden as transparency and clarity could help the acceptance of novel products and systems at home; in fact, as also reported in scientific studies, domestic smart devices have been already criticized for being black-boxed, obscure for the consumer in the way they work.
- The design of product-service systems, which considers both hardware and servicing requirement of the appliance and energy provision system as a whole; hardware can be designed for disassembly, upgradability and reparability, ideally also by final consumers; services scenarios may include engagement of local communities and initiatives for making necessary resources available in a more timely and geographically distributed way.

Question 36 *- A system for the consumer - Consumer Engagement with DSR - Can you provide any evidence demonstrating how large non-domestic consumers currently find out about and provide DSR services?*

Analysis by Grünewald & Torriti (2013) of existing DSR in the UK based on data from a DSR aggregator provides evidence of DSR usage by non-domestic consumers. The analysis suggests that present demand response measures tend to utilise stand-by generation capacity in preference to load shifting based on over 80% of the aggregators of non-domestic customers using stand-by generators for DSR.

Question 37 *- A system for the consumer - Consumer Engagement with DSR - Do you recognise the barriers we have identified to large non-domestic customers providing DSR? Can you provide evidence of additional barriers that we have not identified?*

The barriers described in Table 6 of the report provide a good summary of issues faced by non-domestic DSR customers. The additional barriers that could also be included are:

- Additional Barrier 1:
    - Regulatory / Commercial –The on-going variable pricing of the STOR, FFR, CM(TA) programmes results in uncertainty of future DSR financial returns that discourages customer investment to enable DSR.
    - Evidence – Specific examples of non-domestic customers rejecting DSR due to financial return uncertainty is difficult to obtain due to commercial sensitivity. However, research by Olsthoorn et al. (2015) on end-user industrial DSR participation highlights the high-ranking barriers of 'Future regulations not known', 'Electricity cost savings uncertain' and 'Additional investment costs'. These barriers indicate that uncertainty over financial returns is a key issue that could be preventing customer participation. This is further supported by research undertaken by Warren (2014) into demand-side management policy in the UK that highlights this issue: '*If DSM is to play an important part of future UK energy policy, clarity, transparency and stability are essential determinants of success*.'

- Additional Barrier 2:
    - Commercial – Current DSR programme conditions exclude potential flexible loads that rely on shifting demand to off-peak times (e.g. pre-loading of cooling or heating systems).
    - Evidence – The short response times of current DSR programmes (STOR < 20 minutes, FFR < 30 seconds) favour fast response DSR, like backup generators or turndown of motors and appliances. It however disadvantages DSR that is reliant on pre-loading. As outlined by Grünewald & Torriti (2013), more DSR could be made available if sufficient notification was allowed to enable pre-loading of cooling or heating systems to cover the event period.

Question 37 *- A system for the consumer - Consumer Engagement with DSR - Do you think that existing initiatives are the best way to engage large non-domestic consumers with DSR? If not, what else do you think we should be doing?*

The list of barriers highlights that the current initiatives need improving to engage more non-domestic consumers. The following list provides additional actions that could be undertaken to improve uptake:

1. Create a DSR Specific Market
   DSR should have its own energy policy and market to recognise that it exists on the demand side of the equation and therefore should not be wrapped into the current supply side focused policy/market. Clear differentiation will remove customer confusion and allow for specific market mechanisms to be developed for DSR and provide the necessary support for encouraging greater uptake by businesses (Torriti 2015).

2. Increase DSR Contract Duration
   Current DSR contracts have a typical duration of 1 or 2 years. This may discourage investment and engagement by businesses. If contracts for providing DSR services were extended to 4 or 5 years this may provide the necessary certainty to enable businesses

to justify investment and provide sufficient time for the service to become normalised within standard business operations.

3. Recognise Environmental Benefits
   DSR should be directly recognised for the environmental benefits it can offer through inclusion in current climate change schemes. It would need careful qualification of the benefits. Once established this may provide an additional reason for businesses to participate.

4. Enhance Smart Meter Policy
   The current UK Smart Meter rollout could be enhanced to include the option of minute level usage reading in additional to the current half-hourly readings. This would then remove the current requirement and cost of having to install equipment to provide the necessary minute level readings required by current DSR programmes.

5. Encourage Open Standards
   The OpenADR Standard aims to reduce the technology cost barriers for used DSR by including standardised control methods within electrical appliances (OpenADR, 2016). While it might not be feasible to force usage of OpenADR in all appliances, any policy changes that encourage its usage or a similar open standard will help lower implementation costs. Although, it is important to note that 'open' does not mean 'free'.

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