Proposals regarding Smart Appliances

Northern Powergrid's response to the Department for Business, Energy and Industrial Strategy (BEIS) consultation seeking powers to set standards for smart appliances

KEY POINTS

Northern Powergrid principally supports the introduction of standards for smart appliances that encompass the requirements set out in the European Network Code. In particular, we acknowledge the potential benefits to the energy system from enabling demand-side response (DSR) for consumers through smart appliances.

- We support the introduction of labels for smart appliances to clearly indicate that they comply with the required standards.
- We believe that energy standards for appliances, if they are well designed, can lead to a positive change. We also suggest that the consideration of standardisation is extended to electric vehicle charging to enable best value for customers.
- To ensure consumers are not disadvantaged or limited in their choice, any proposed standards should be set and kept consistent with the European Network Code – Demand Connection Code (DCC) which stipulates technical and compliance requirements for devices providing a DSR service to network operators.
- Enabled by new technology, customers are now beginning to take their place at the hub of the energy system. Any decisions on smart appliance standards need to be taken in an energy system context considering issues like transition to Distribution System Operator (DSO) in parallel. We consider that the DSO will be central to enabling customers' participation in both energy and networks services markets.
- Network operators should expand their roles as simplifying forces in the energy system. DSOs can be the key enablers of the energy system of the future, by providing the smart common infrastructure centred around the customer, upon which a competitive energy services model may operate locally. This can be designed to offer high standards of stability, security, and transparency to all market participants; and to align with the true cost structure of new technologies. In other words, DSOs form stable, safe and secure platforms upon which the wider systems and markets then operate and customers can get the most from their energy assets.
- DSOs will address network constraints with non-reinforcement solutions (such as energy efficiency and load shifting) wherever doing so is the cheapest, reliable and secure solution. This should be technology neutral and we should avoid prescribing specific technologies and approaches and let the options compete on their merits.
- In order to be efficient and effective, the smart appliances policy must be a part of a coherent energy policy framework that looks at optimising the UK energy system as a whole.

Detailed responses to BEIS consultation questions

Question 1: Do you agree that the Government should take powers to allow for regulation on standards for smart appliances?

1. Northern Powergrid is supportive of mandating standards to achieve a uniform compliance and competitive market for 'smart appliances' and their inter-operability, and to facilitate their uptake.
2. We believe that the needs of the customer should come first by allowing them to make the most from their appliances.
3. Standards lead to greater simplicity in terms of inter-operability of energy systems. This simplicity is beneficial to customers as it introduces opportunity to access electricity markets without the difficulty of picking the appliance that provides this functionality.
4. The Government should extend its scope to look at technologies for other customer electricity uses. For example, electric vehicle charging would also benefit of standardisation.
5. *White goods* provide responses that are useful in timescales of seconds and minutes, whereas heat and energy storage DSR can provide flexibility for hours and days. There are several use cases of DSR for consumers, for example:
    a. scheduling the use of an appliance in order to optimise the cost of electricity (as a response to time-of-use tariffs);
    b. using a hot water cylinder or a battery as an energy store for surplus (or cheaper) energy, and discharging it during the energy demand peak; and
    c. providing voltage management.
6. To derive the most benefits and account for the changes in patterns of energy use in the future, a whole-house energy system should be considered. The protocols designed for unlocking the DSR potential of domestic smart appliances should be consistent and compatible with the protocols designed and used for vehicle-to-grid (V2G) charging of electric vehicles and heating to account for concurring energy demand.

Question 2: Do you agree that a label is a good way to engage consumers with smart appliances? Please include your views and experiences with key aspects of labels which are most effective at engaging consumers, including analysis on uptake of the relevant device.

7. We are in support of labelling as a consumer-friendly method of awareness-raising of smart appliances and as a means of clearly indicating compliance with the set standards.

Question 3: The consultation stage Impact Assessment published alongside this consultation document explores the costs and benefits of the options considered for this policy. It indicates that mandating standards for smart appliances provides the greatest net benefits, compared to voluntary standards. Do you agree with our analysis? In particular, please consider the following, and provide analysis to back up your views:

b) Consumer use of the smart function provided by smart appliances in relation to different types of tariffs, including fixed and variable;

c) Potential financial benefits to consumers through smart appliance usage in combination with smart tariffs and offers;

8. We believe that fairness (i.e., the distributional impacts across society) and efficiency are the key issues in designing tariffs that would suit and enable the use of smart appliances.

9. More generally, we believe that tariffs should be designed for the energy system of tomorrow, not of today. Since the evening peak demand follows the peak hours of renewable generation, it is likely that it will become dynamic and might shift in the future. This is a likely result of a combination of an increased renewable generation and deployment of smart appliances (*white goods*, heating, cooling, and the flexibility offered by electric vehicle charging). Thus, it is possible that the future peak demand will occur at times when the current energy demand and current energy tariffs are low, for example, during the night time.

10. In terms of customer response, customers can only respond to tariffs that are visible to them (e.g. distribution use of system charges (UoS) are levied on energy suppliers whose charges to end users are driven by commercial considerations to gain market share and may not reflect any cost signal in the charges they receive). That said, if the cost signals (in potential savings) to end users see are large enough then they likely to respond. In terms of tariff elements it should be unit charges that are used to influence user behaviour as there is an immediate benefit from a change in behaviour. Fixed charges cannot be avoided and are unlikely to influence behaviours.

11. Northern Powergrid's Customer-Led Network Revolution (CLNR)[1] was a major smart grid demonstration project which brought together the key stakeholders in the electricity system (customers, energy suppliers and distributors) developing innovative technologies and commercial arrangements. In addition to the integration of people, processes and technology, this is one of the most significant trials undertaken in GB of customer electricity practices and attitudes (particularly domestic and small and medium enterprises (SME)).

12. In addition to 2,000 SME, industrial & commercial and distributed generation customers, the CLNR customer trials involved ca. 11,000 domestic customers:

    a. We found that time of use tariffs are popular with and easily understood by domestic customers. The majority (60%) saved money on their energy bills (from £30-£350) and the demand in the 4pm to 8pm peak was up to ca. 10% lower than the control group.

    b. Our trial provided a safety net for the 40% that did not save money since they were guaranteed to pay no more than if they had been on a flat tariff.

    c. Compared to the control group, annual electricity consumption was lower amongst our time of use trial participants despite average use increasing in the off-peak period. However this difference in overall consumption was not statistically significant.

    d. Customers reported that it was the household practices of laundry and dishwashing that were most commonly used to flex the times at which electricity was used.

    e. It was also clear from our qualitative learning that the older generation and those with younger children tended to find it most difficult to flex their use of electricity compared to others in the trial.

    f. More development by the industry and policy makers of both tariff design and customer engagement is needed to incentivise better the desired peak load shift at the time it matters most for networks (typically winter peak) while also protecting customers from unavoidable or unaffordable price rises.

    g. The value to DNOs of domestic time of use tariffs will increase with more electric vehicle charging. However, for off-peak charging of electric vehicles to become commonplace we need to resolve an apparent confidence issue observed in today's customers. There is insufficient

[1] Customer-Led Network Revolution, 2015. Project closedown report.

Available from: http://www.networkrevolution.co.uk/wp-content/uploads/2016/09/CLNR-G026-Project-Closedown-Report-FINAL-V2.1-070916.pdf

confidence from some customers that an unmonitored (perhaps automated) overnight charge would be successful and result in a sufficiently charged battery for use the next day.

h. SMEs showed significant reluctance to flex their electricity use and disrupt their business activities. Relative to their size, this reluctance was arguably the most marked and it demonstrated that DNOs will have to develop new, potentially bespoke methods, to engage with this heterogeneous customer group. For those that did participate in the trials, reduced demand was satisfactorily demonstrated during the peak period.

13. The CLNR project involved designing and developing interfaces to connect smart washing machines, heat pumps, and hot water systems to provide value to customers through the provision of flexibility to the energy system. It demonstrated how flexibility could be used to benefit customers. Also, the challenges of integrating the different appliances and technologies for these first-of-a-kind systems were considerable. We therefore believe that standardisation is key to commercialise the technology and provide customers with access to markets.

14. Further, CLNR evaluated the value of different customer low-carbon technologies to distribution (only) flexibility service markets[2]. Using scenarios for markets in 2020, it identified that direct control of different customer technologies provided varying levels of value to distribution markets (2012 prices):

		Annual value of interrupting load at peak
Cold appliances	Fridge	**<£0.20/year**
	Fridge-freezer	
	Freezer	
Wet appliances	Washing machine	**£2/year**
	Dishwasher	**£2/year**
	Dryer	**£4/year**
Hot water heating		**£15/year**
Heat pumps		**£15/year**

15. In essence, this economic evaluation and widespread trialling demonstrated that the value to customers from dry and wet goods smart appliances is not likely to arise from savings in the reinforcement of local distribution networks.

[2] Frontier Economics, 2012. Domestic and SME tariff development for the Customer-Led Network Revolution. A report prepared for Northern Powergrid.

Available from: http://www.networkrevolution.co.uk/project-library/domestic-sme-tariff-development-customer-led-network-revolution/

16. There are key differences between the CLNR analysis and that in the consultation Impact Assessment – namely: the CLNR analysis is the GB distribution market and the Impact Assessment is a European market and includes value from all users of flexibility. However, we note that there is some agreement in the figures. They both identify a similar hierarchy of value according to the size of the resource, as well as the values being of a similar order of magnitude.

17. Looking more broadly, Northern Powergrid is currently undertaking the installation of V2G chargers to explore technical standards and barriers to the adoption of this technology. This has much more potential to offer value to customers due to the scale of the demand side resource.

18. On V2G, we are working in a consortium led by Nissan[3] and with other UK network companies, to deliver a £9.8m project to trial ca. 1,000 vehicle-to-grid chargers. The smart charging infrastructure will enable us to access learning about the consumer use of the smart functions as well as the DSR management opportunities offered by the electric vehicles. We expect this project will provide useful evidence to an increased consideration of standardisation for electric vehicle charging technology in addition to smart appliances that are subject to the current consideration.

d) Monetised and non-monetised costs for industry to comply with standards, including consumer businesses, smart appliance manufacturing businesses, smart appliance service providers, supply chains and the electricity industry (such as Distribution Network Operators);

19. We believe that the costs *to comply* would not affect the Distribution Network Operator (DNO) directly or would already be covered within the scope of its functions.

20. However, there is a reason to believe that the cost *not to comply* (due to e.g. lack of interoperability in smart appliances) would cause significant issues for DNO data systems to manage the non-standard interfaces when sending and receiving data, keeping cyber secure, and optimising the whole system.

21. Additionally, it would have an impact on enabling consumers to exercise the smart functions embedded in their smart appliances.

22. It is for these reasons that we support a wider scope for standardisation – including other customer devices other than simply smart appliances.

[3] Northern Powergrid, 2018. 1000 vehicle-to-grid chargers to put UK at forefront of electric vehicle revolution.

Available from: https://www.northernpowergrid.com/innovation/news/1-000-vehicle-to-grid-chargers-to-put-uk-at-forefront-of-electric-vehicle-revolution

e) Potential impact on the price of smart appliances which comply with standards compared with non-smart appliances.

23. Where the price of a smart appliance has potential to be significantly more than the price of a regular appliance, the Government should ensure social inclusion of all consumers to safeguard an even distribution of consumer and wider system benefits. Where this is the case, the Government should consider the merits for setting up a smart appliance retrofit scheme in the future.

Question 4: In this document, we have proposed minimum functionalities for each principle. Do you agree with these functionalities? What functionalities should be considered in addition to those listed above? Please divide your responses according to:

i. Interoperability;

ii. Grid-stability and cyber-security;

iii. Data Privacy;

iv. Consumer Protection

24. We generally agree with the minimum functionalities listed above.

25. In order for DSO to provide a compelling value propositions for customers and stakeholders, a transition is required to a customer-led, actively managed (and probably semi-autonomous) network where the DSO provide a cost-efficient, non-discriminatory and technology neutral physical trading platform for third parties in our region to participate in the electricity markets.

26. The four criteria are relevant to smart appliances being used to local DSO markets in the same way that they are relevant to participation in national energy markets. Providing customers with 'plug and play' capability through standardisation means that they are ready to connect either to stack value by participating in multiple markets or follow the market that is of most valuable at various stages in the development of continued decarbonisation – recognising that the location of this value will change through time.

27. We would like to emphasise the need for compatibility between the standards set for smart appliances and the procedures set for the electric vehicle charging and the use of more sizeable energy storage (such as home batteries, heat storage).

Question 5: Do you consider that we have correctly outlined above the risks associated with smart appliances? Are there any that are missing and need to be addressed? Please provide evidence.

28. It is important to clarify whether smart appliances might receive signals from network operators and/or energy suppliers. If signals might be received from network operators (either a DNO or the National Grid Electricity System Operator (ESO), Government should take into account the risks associated with ensuring compliance with the Distribution Code and the Grid Code which are in the process of being updated to take account of the relevant changes in European law.

29. Regulation 2016/1388 - Demand Connection Code (DCC) entered into force on 7 September 2016 as European law and is in process of being transposed into the Distribution Code and the Grid Code. The DCC (and hence also the updated Distribution Code and Grid Code) will be taking full effect from 18 August 2019.

30. If a smart appliance is considered a 'Demand Unit' under the DCC and receives a signal from a DNO, it would need to comply with the technical and compliance requirements set out in the DCC.

31. A customer using such a smart appliance to deliver DSR service to a network operator would need to demonstrate compliance with the updated Distribution Code (or the Grid Code, if they provide a service to the ESO).

32. We believe it is essential to avoid the first mover disadvantage and ensure that early adopters of smart appliances will still be able to exercise their function(s) and benefit from their use under various future system scenarios, although these are uncertain at this point in time.

33. We believe that any standards for smart appliances should, first, enable customers to meet the product-related requirements of DCC and, second, warrant that a manufacturer's testing process is in place to ensure the compliance thereof.

34. Additionally, a data sharing process should be in place to enable management and verification of the DSR agreements and the actual usage, e.g. whether the contracted DSR has been deployed or whether the smart appliance has been replaced by a non-smart appliance. An understanding of the consumption that has been deferred or avoided, irrespective of the party initiating the DSR, needs to be available to the DNO so that they can design a network in accordance with Engineering Recommendation P2/6, Security of Supply.

35. There is a variety of benefits stemming from the use of smart appliances. It is important to safeguard that the financial benefits are not double-counted for different smart grid-related initiatives, e.g. the network reinforcement benefits associated with smart appliances and smart meters.

36. In order to manage the risk of network disturbances, we agree with the concept of randomisation/staggered signals. Appropriate recording of randomisation of DSR switching arrangements needs to be in place so that network operators can model and manage the steps in demand, and the associated steps in voltage, that may be experienced and to make sure that such steps don't trigger any unintended frequency responses or other network disturbance.

37. Measures need to be carefully evaluated, especially if a smart appliance is to receive signals from network operators (i.e. ESO and a DNO) and a supplier to avoid potential signalling conflicts and to ensure certainty of the appliance response.

Question 6: Consumer protection is important to the Government, and we will continue to monitor and engage with this to ensure consumers are protected in a smart energy system. This work will include assessment of distributional impacts of smart appliances and consideration of product safety provisions. Do you consider there to be major principles of protection which have not been covered above which will be developed into standards for smart appliances?

38. We believe that interoperability might be a practical way to address several issues pertaining to consumer protection.

39. The volume and types of data from smart meters and other connected devices create both vulnerabilities and opportunities that any revised arrangements will need to manage.

40. The threat to cyber security (often combined with physical building security) is one of the fastest accelerating business risks to all sectors of the economy. The interconnectivity of the future smart energy supply chain introduces a new level of exposure to cyber-attacks. However, the industry is taking the right steps to mitigate these risks through the application of expertise and collaboration (including with the Government). Our approach must be to realise the benefits from interconnectivity while also putting in place 'fire breaks' and other mitigations to compartmentalise the impact of attacks when they occur.

41. Smart thermostats offer a view of the future as they are able to dynamically adjust the settings of the heating system and communicate with other devices. For example, a smart home heating system might have smart radiator control valves, a boiler control, and several room thermostats

communicating through a hub (commonly operated by e.g. Google Home, Alexa, or a set of IFTTT[4] conditional statements).

42. We believe that aggregation at the lowest level, such as smart appliance hub, is potentially a more cyber-secure method than each appliance communicating to the central system individually. This creates fewer data pathways to protect and fewer common causes of failure. In this manner, it would be possible to create an architecture that is capable of fragmenting and surviving, if exposed to a cyber-attack. Consequently, there might be scope for introducing a trusted intermediate system (and standards thereof) to derive cyber-security benefits.

43. We consider there are no other major principles of consumer protection that have not been covered in the consultation document, other than the ones outlined in Question 5.

Question 7: Do you agree that the standards should be applied as uniformly as possible across smart appliances, for example, horizontally, and should be catered to individual appliances only where necessary?

44. Northern Powergrid agrees that the standards should be applied as uniformly as possible across smart appliances.

[4] *If this, then that (IFTTT)* – a web-based service to create chains of simple conditional statements, called applets, to enable communication between devices.