The future for small-scale low-carbon generation

Northern Powergrid's response to the Department for Business, Energy and Industrial Strategy (BEIS) call for evidence

KEY POINTS

- The growth of small-scale low-carbon generation continues to be an important element of the Clean Growth Strategy. It advances the decarbonisation of the electricity system while engaging individuals and communities to be part of this transition. It is important that wherever possible incentives are in place for the generation to be flexible to maximise benefits for all customers. To this end, the introduction of small-scale generation therefore needs to be considered alongside controllable load and storage and with the development of routes to energy and network services markets.
- Our vision for a customer-led distribution system is highly relevant to the development of small-scale generation, storage, and flexible load.
  - Customers value a (local) energy system that maximises utilisation of distributed energy resources (DERs) and access to markets for energy and network services.
  - Distribution System Operators (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.
  - Customers need to either control the generation or co-locate with flexible demand or storage in order to be rewarded for providing flexibility to the system for the benefit of the wider customer base.
- BEIS is right to identify the importance of key national programmes that will assist in delivery of an increasingly smart and flexible system – network charging reform, smart meters, half-hourly settlement, and the subsequent introduction of cost reflective time-of-use (ToU) tariffs.
- There are a few gaps in the thinking laid out in the call for evidence around efficiency and resilience. These benefits need explicit recognition.
  - Small-scale generation is typically located near to a load such that there is a consequential beneficial reduction in electrical (or transportation) losses.
  - Much of our innovation work is now centred on exploring resilience – the use of DERs to 'keep the lights on' when the main electrical infeed is lost (e.g. during extreme weather). This is an important way vulnerable customers can benefit from a smart flexible system.
- Government needs to incentivise the development of commercial and regulatory structures that enable customers to access national and local energy and network services markets. By doing so, the utility of the generation is maximised for all customers – not just those investing.
  - Perverse incentives exist to install larger generators 'behind the meter' – a reduction in network costs and the ability to avoid environmental levies on the electricity bill.
  - This has led to sub optimal development of the system and a burdening of costs onto those who are not part of the projects – typically more likely to be the fuel poor.
- In developing the future framework, Government and Ofgem needs to ensure that the small-scale generation is integrated into a fair, efficient and rewarding system.

August 2018

Detailed responses to BEIS consultation questions

We have answered those questions where as a local network operator we have the most evidence to provide.

Question 1: Have we accurately captured all the opportunities and benefits that small-scale low-carbon generation can provide to the UK energy system over the short, medium and longer-term? Are there any that we have missed? Please provide evidence.

1) The Government has identified a range of opportunities that illustrate the benefits from low-carbon small-scale generation well. However, there are some additional points that need consideration:

   a. We commend Government's targets to increase the energy efficiency in buildings; however the fact that the Energy Performance Certificate (EPC) evaluation is based on cost to run a property means that, in its current version, it is biased towards gas. In line with our responses provided to the *A future framework for heat in buildings*[1] consultation, we believe that:

      i) Although, on average, electricity's emissions' intensity is currently higher that gas (on a gCO_2e/kWh basis)[2], we expect that the emissions' intensity of electricity will continue to fall substantially over the next 10 to 20 years and low-carbon electricity will have a central role to play in the future energy mix, including as a key way of decarbonising both heat and transport.

      ii) One of the main barriers for the uptake of electric heating currently is that electricity is not competitively priced, when compared to other fuels. Electricity to natural gas price (BEIS central estimate[2]) ratio, depending on sector, is 4.1:1 (domestic), 4.6:1 (commercial/public sector) and 4.9:1 (industrial). This is driven, in part, by how electricity and gas are taxed. To efficiently meet decarbonisation targets, it is important that electricity and other sources of energy are taxed on a fair basis, reflecting their carbon intensity and wider environmental effects – this would allow different low-carbon technologies to compete fairly on their relative merits across the energy system.

[1] BEIS, 2018. A future framework for heat in buildings: call for evidence.

[2] BEIS, 2018. Treasury Green Book supplementary appraisal guidance on valuing energy use and greenhouse gas (GHG) emissions. Data tables 1-19 supporting the toolkit and the guidance.

iii) A forecast of increasing summer temperatures indicates that the fuel consumption for cooling is likely to increase in the future[3], thus contributing to an increase in energy costs.

iv) While it will take several decades to phase out gas, oil, and other fossil fuel heating from the existing housing stock (which typically have high peak energy demands), new buildings should be built to high energy efficiency standards such that their heat demand is reduced to a few kW (peak) and easily met through electric heating, be that resistive heating or heat pumps. Building out new gas infrastructure to connect new homes risks stranded assets and unnecessarily pushing up bills for existing gas-connected customers.

v) Tightening the building standards for energy efficiency to meet the standards of zero carbon buildings or above is a vital action for driving the decarbonisation of heat. The UK offers significant potential to increase the building energy efficiency standards for both new build and existing properties.

vi) A combination of approaches is needed to address the carbon emissions produced from heating current building stock, especially, as more than 80% of the current building stock is predicted to still be standing in 2050[4]. These include: increasing energy efficiency, moving to hybrid heating systems, full electrification, where feasible, and potentially hydrogen based systems once low-carbon hydrogen is cost-effective.

b. We agree that energy efficiency and small-scale generation can make a substantial difference in fuel poor and vulnerable households, however, mechanisms will need to be created to make this accessible for households with limited financial flexibility if all potential benefits are to be realised.

c. Although on-site generation has the potential to offset electricity consumption, it does not have an effect on reducing the energy demand of the property in terms of units of energy needed, or increasing the actual energy efficiency of the property.

2) We would like to add that co-location of energy generation and demand not only reduces the infrastructure needed to transport the electricity, but also provides **a reduction in electrical losses** since these are a function of distance travelled.

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[3] National Grid, 2018. Future Energy Scenarios.

[4] Kelly, M.J. 2008. Britain's building stock – a Carbon Challenge. Ministry of Housing, Communities & Local Government.

3) We believe that another key opportunity and benefit that small-scale low-carbon generation can provide to the UK energy system is increasing the energy system **resilience**. Today, standard operational protocols trip off small-scale generation when the power infeed to an area is lost. We are pursuing innovation projects that are evaluating whether this is the optimum operating mode. Ultimately, can we safely keep distributed energy resources online when the grid has been electrically islanded? We say more about our *MicroResilience*[5] project in our response to Question 5 below.

4) Through the Energy Networks Association (ENA) Open Networks project[6], electricity distribution and transmission companies are collaborating to consider the future role of a Distribution System Operator (DSO) and what this would entail. We consider that the DSO will be central to enabling customers' participation in both energy and networks services markets.

5) Network operators can and should modestly 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 and secure platforms for the wider systems and markets to operate on.

6) Our belief is that DSOs should be required to solve network constraints with non-reinforcement solutions (such as energy efficiency or customer flexibility) 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.

7) DSOs could be regulated such that they are only allowed to reinforce the network when they can demonstrate that either other non-network market solutions cannot reliably and securely deliver or that measures being procured have reached the point that their cost exceeds the costs of a network solution paid for over 45 years.

8) We are looking to identify market arrangements that may accommodate large volumes of DERs at the least cost while at the same time delivering value to DERs so that they can thrive in market-

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[5] ENA Smarter Networks Portal, 2017. Microresilience.

[6] Energy Networks Association, 2018. Open Networks Project.

based condition. This is the aim of our *Customer-Led Distribution System*[7] innovation project, being delivered in partnership with the University of Bath and Newcastle University.

9) In such ways, DSOs may not directly deliver energy efficiency improvement measures, but they will help target delivery where it is most useful for the system. We believe that small-scale low-carbon generation has an important role to play in this future system.

Question 2: How can government help consumers benefit from small-scale low-carbon generation such as local communities, local authorities, and those in fuel poverty?

10) As outlined in our response to Question 1, we believe there should be appropriate funding or installation mechanisms in place for these entities to ensure the up-front cost of the technology is not prohibitive and does not exclude these entities or groups from benefitting from lowering their carbon footprint or yielding energy bill savings.

11) The recent State of the Sector Report[8] produced by Community Energy England, with which we have a long-running partnership, provides an up-to-date and evidenced view on this question. It asks Community Energy England members what support they would like to see in the future, and concludes that a "clearer government and local authority strategies - including early stage funding, financing support and subsidy review" are needed.

12) The energy system in Great Britain is changing, and local energy remains a big part of this transformation. Northern Powergrid champions support for community and local energy stakeholders where we continue to see interest and development of projects involving renewable generation and energy efficiency. Our role remains one of using our knowledge to leverage the hard work from communities across our region to provide a helping hand through engagement, education, communication, funding and offering accessible services.

13) Northern Powergrid is in the fourth year of running a fund to allocate support to community energy projects in our Distribution Network Operator (DNO) licence areas. Our *Northern Powergrid Partnering Communities Fund* has a focus on promoting energy efficiency measures and alleviating fuel poverty. In addition, we have also concentrated on supporting those that need it most by promoting the use of the Priority Services Register; enabling additional support for vulnerable energy consumers during a power cut. So far since the beginning of the fund, more than 2,700 people have been reached with efficiency, switching and in-home measures through the community energy projects funded.

[7] ENA Smarter Networks Portal, 2018. Customer-Led Distribution System.

[8] Community Energy England, 2018. State of the Sector Report.

14) Our own research in the topic of local energy[9] highlighted a need for the Government to promote the emergence of collective self-consumption schemes, whereby a group of buildings use the electricity generated locally and the generation owned by the local authority or by the community. This would be done by helping the sector identify scalable business models for collective self-consumption (some trials of this are taking place, but there are still no *off the shelf* solutions that address current needs), and taking measures against the proliferation of private wires, which create issues of cost displacement that affect the fuel poor disproportionally.

15) We therefore believe it is important to enable peer-to-peer trading of energy, using the existing assets. This would allow discontinuing the incentive for people operating behind the meter.

Question 3: The introduction of enabling technology and systems such as the roll out of smart meters, and half-hourly settlement, will provide commercial incentives on energy suppliers to develop and offer tariffs. Will smart tariffs provide a viable route to market for small-scale low-carbon generation? If so over what time frame, and what are the possible barriers to these smart tariffs?

16) The introduction of smart grid technology is expected to provide valuable information to network operators, which will allow operating the network more efficiently and reduce the capital costs. It will also enable a better understanding of capacity available on the network currently - thus we may be able to facilitate more small-scale low-carbon generation on the network.

17) In line with our responses provided to the *Proposals for smart appliances*[10] consultation, 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.

18) 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.

[9] Northern Powergrid, 2017. Local supply of electricity – A Commercial innovation event.

[10] BEIS, 2018. Proposals regarding setting standards for smart appliances.

19) At the moment, peak demand largely follows business or people's preferred patterns of energy consumption. If patterns of energy consumption change, with some demand following lower pricing or higher generation availability, then the timing of peak demand is likely to change in future.

20) Customers can only respond to tariffs that are visible to them (e.g. distribution use of system charges (DUoS) 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 end users see are large enough then they are likely to respond. In terms of tariff elements, it should be unit charges that are used to influence user behaviour via strong price signals as there is an immediate benefit from a change in behaviour.

21) In the short-term, we expect smart tariffs for demand to be relatively simple in structure, perhaps with a static ToU signal across the year with a higher price over the typical weekday evening peak in power prices. Such tariffs may over-value the benefit provided by small-scale low-carbon generation, by providing a cost signal to offset demand in the evening peak period all-year-round, when in fact the benefit is only realised in the winter months. Hence, such tariffs are likely to support the deployment of small-scale low-carbon generation.

22) In the longer-term, we anticipate more complex smart tariffs or flexibility contracts to be introduced, which vary close to real time depending on the total cost of energy at that time, with automated systems (e.g. smart devices) generating customers' responses by reducing demand when the price is high. Such tariffs may in fact reduce the ability of small-scale low-carbon generation to offset costs, as the times when the price is high are likely to coincide with times when renewable generation is typically not active (e.g. shortly after dark on a winter evening) and so the value of small-scale low-carbon generation will be reduced. For the avoidance of doubt, we consider that this reduction would bring the value of small-scale low-carbon generation from a position of being over-valued into being in line with the benefit it provides to the energy system as a whole.

Question 4: Do you agree with the challenges we have identified? Are there any challenges small-scale low-carbon generation presents that you think we have missed? Please provide evidence.

23) There is a number of associated challenges that have not been captured by the consultation document. The most prominent ones we would like to add, are:

   a. **Whole system consideration** – where changing patterns of demand and supply necessitate infrastructure development, all parties with interests in the electricity system should be encouraged to work together for stakeholders to be assured of the best value.

b. The **whole system resilience** should be considered to ensure that all parties are coordinating. Northern Powergrid is involved in the on-going work by Energy Research Partnership which is seeking to understand the nature of resilience of the UK electricity system. This work should continue to better our understanding on interaction with other networks, such as water networks and mobile telephony.

c. Another challenge is posed by an **aggregator operating small scale generation for transmission flexibility services** without knowledge of distribution level constraints. Hence, a number of DSO future worlds are being explored via ENA Open Networks project.

24) With respect to the **system inefficiencies**, we would like to emphasise that generation clusters impact the distribution network, and understanding these helps to mitigate the network costs ultimately borne by customers. Such clustering is a more prominent feature at a distribution level and not at transmission. The associated challenges have been well-evidenced by Ofgem, for example, in its Future Insights Series – *Implications of the transition to Electric Vehicles* report[11].

25) With respect to **system balancing**, it is important to note that a DSO is in a stronger position on visibility of the distribution network, when compared to the System Operator (SO). However, further work is necessary in this area, which is being undertaken by ENA Open Networks project, most notably, the Workstream 3 *Future Worlds* Consultation[12].

26) Please also refer to our response to Question 5.

Question 5: How would you propose the small-scale low-carbon sector, suppliers, off-takers, network/system operators, and/or government can overcome the challenges presented?

27) Northern Powergrid is not only an active participant in the ENA Open Networks project, but also in the ENA Low Carbon Technology working group, where we are working with the industry on the application and notification processes for electric vehicles (EV) and low-carbon generation.

28) To transpose the relevant European legislation[13,14,15] changes into UK legislation, Engineering Recommendations G98 and G99 (published by ENA), will be coming into effect on 27 April 2019 for

[11] Ofgem, 2018. Implications of the transition to Electric Vehicles. Future Insights Series – Paper 5.

[12] ENA, 2018. Future Worlds Consultation.

[13] EC Regulation (EU) 2016/631 of 14 April 2016 establishing a network code on requirements for grid connection of generators (RfG).

[14] EC Regulation (EU) 2016/1388 of 17 August 2016 establishing a Network Code on Demand Connection (DCC).

generators commissioned on or after that date, replacing the current Engineering Recommendations G83 and G59 respectively. These will include the changes in technical operating parameters, as well as new functionality to enable real-time communications.

29) In line with our responses provided to the *Proposals for smart appliances*[10] consultation, we believe that 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.

30) The issue of **inequitable network cost recovery** due to behind the meter generation can be overcome if the on-going Ofgem reforms to residual charging and forward looking charges reach appropriate outcomes:

a. We are supportive of recovering the residual on a fixed or capacity basis, or a hybrid of the two (i.e. using fixed charges as the recovery method but capacity allocating to users based on the capacity required to determine to appropriate level of the residual for each customer group). Fixed charges cannot be avoided, so are the most appropriate cost recovery vehicle, and whilst we can see benefit from recovering the residual via capacity charges there are significant practical challenges to overcome e.g. metering and determining/measuring capacity, and small-scale generators are not currently charged based on capacity. This is one of the potential options being considered as part of Ofgem's *Targeted Charging review*[16] Significant Code Review.

b. If forward looking charges are cost-reflective, behind the meter generation will be appropriately valued, and so there will be no distortion between generation which is metered and generation which is behind the meter. However, cost-reflectivity is not the only objective for network charges, and must be seen in the context of providing charges which are transparent, stable and predictable. This is currently being considered as part of Ofgem's *Reform of Network Access and Forward Looking Charges,* via the *Getting more out of our*

[15] EC Regulation (EU) 2016/1447 of 26 August 2016 establishing a network code on requirements for grid connection of high voltage direct current systems and direct current-connected power park modules (HVDC).

[16] Ofgem, 2018. Targeted Charging Review: Significant Code Review.

electricity networks by reforming access and forward-looking charging arrangements consultation[17].

31) We believe the challenge of **not having a way to track such installations** creates a significant problem for DNOs who would not have a full visibility of installations connected to their networks. However, even in the presence of the existing legal requirement to notify the DNO when new installations are connected to the grid, the DNO is not always notified. For example, we have learned that the commercial incentive of *Feed-in Tariff* (FiT) payment has provided a strong enough incentive for people to submit these notifications and thus has a greater accuracy when compared to the notification data received by Northern Powergrid. Removing this incentive would potentially mean that our awareness of new connections to our network lessens. We are exploring the use of technology to make the notification process easier for installers. One of the opportunities being discussed via ENA is the use of an app to cover G98 notifications, electric vehicles, and heat pumps.

32) It also potentially leads to sub-optimal infrastructure development where decisions could be made to vary system reinforcement were network owners aware of resource availability behind the meter.

33) Facilitating an extensive development of behind the meter installations would mean that those consumers, who cannot afford such developments, are denied this benefit, although they would be subsidising them indirectly through their energy bills.

34) Our *MicroResilience* project[5], running from 2017 to 2020, is exploring smart opportunities to improve resilience. The project will assess the technical viability and comparative economics (including non-financial benefits) of smart technology enabled resilience under the following circumstances:

   a. Critical customers on vulnerable connection

   b. Remote customers on vulnerable connection

   c. Opportune micro-grid application (using already present distributed generation)

   d. Simple storage option.

35) The project intends to provide guidance for the appropriateness of the various solutions tested and their technical benefits and disadvantages. The level of resilience improvement will be assessed alongside the level desired by the customers. Critical customers on a vulnerable connection may have different requirements to a *microgrid* implementation with a significant degree of embedded generation.

[17] Ofgem, 2018. Reform of network access and forward-looking charges.

36) Nested microgrids combined with local balancing within each microgrid, in turn, offer the possibility to vastly reduce the country's dependence on balancing at the transmission grid level. Additionally, the power electronics basis of the *MicroResilience* project[5] insulates the majority of consumers from frequency effects associated with balancing.

37) Finally, inherently promoting local energy projects should also have the potential for keeping energy flows local, reducing balancing costs, and generally promoting system efficiency.

Question 6: What are possible ways to track and monitor behind the meter installations (we would appreciate specific suggestions in relation to how information can be sourced (e.g. direct from businesses and households) and the method for sourcing it (e.g. an annual survey))?

38) We believe that competitive market and innovation can play a part in introducing an incentive for customers to offer the information in return for a benefit.

39) The introduction of a half hourly settlement will mean that a customer's actual use of the network is settled, regardless of presence of behind the meter generation. A problem with behind the meter installations arises when the consumption is not known in the absence of a non-half hourly settlement, and it is assumed that the customer will have a lower usage at all times, which is not the case – for example, the owners of solar photovoltaic (PV) installations will still have a high consumption at winter peak. Nevertheless, information on behind the meter installations clearly has a value for forecasting purposes.

Question 7: What are the special considerations that should be made when attempting to track different kinds of behind the meter activity?

40) Please refer to our response to Questions 6 and 9.

41) Where behind the meter development is required to facilitate societal benefit, this could be considered as requiring special consideration. For example, in the case of public health entities, back-up generation is required.

42) Smart meter consumption data would potentially help to identify what devices are in use behind the meter, e.g. EVs and DER. This would require us to have non-aggregated data and run some automated data analytics. From a DNO perspective, it would be important to understand not only the ownership of behind the meter installations, but also their operating behaviour.

Question 8: How do we develop our tools to model and evaluate the system (including system costs and resilience) as decentralised generation and storage develop, specifically

approaches to system modelling, data capture, forecasting demand and evaluation of value for money?

43) We continue to develop models that allow a greater understanding of the network. Structures that encourage innovation, such as the regulatory innovation allowance, facilitate development of technology and processes that allow the network companies to garner a greater understanding.

44) The settlement of export is a key enabler for accurate forecasting of demand. As the level of FiT installations has increased, so has the level of 'unsettled' export being 'spilt' onto the system. This creates inaccuracy in the data used for forecasting; hence if both import and export are settled on a half-hourly basis, improvements to overall demand forecasting will naturally follow.

45) In addition to the points already raised in our response to Question 7, an understanding of the correct volumes of DER at a postcode level (as a minimum) would be needed to assist in forecasting their future growth more reliably.

46) We are rolling-out low voltage monitoring of the distribution substations, which will provide us with a detailed understanding of the utilisation of the local network. This will supplement the smart metering data.

47) We believe that smart metering data is a key enabler for forecasting. A history of half hourly generation profiles needs to be set against half hourly demand profiles to properly analyse how generation addresses the demand. Such comparison can then enable assessment of the probabilities of coincidences, such as 'generation not being available at time of peak demand'.

48) As such, we use a range of forecasting scenarios that cover a wide range of possible futures to manage the associated uncertainties.

49) We have experienced that small-scale low-carbon technology (LCT) uptake in the Northern Powergrid region, over the RIIO-ED1 2015-23 period is to date much lower than originally forecast:

    a. The rate of LCT uptake is highly sensitive to the Government's stimuli and also depends on the market's ability to find profitable business models.

        i) During the regulatory year 2015-16, a reduction took place on FiT and Renewable Heat Incentive (RHI), and Renewable Obligation (RO) closed for new onshore wind operators. In 2017, the Government announced its plans to ban new petrol and diesel car sales from 2040. As a result, the uptake of LCTs has been slow, although the uptake of electric vehicle (EV) chargers has slightly increased in 2017/18.

ii) Our expectation is that LCT volumes will stabilise at similar volumes in the short term followed by a pick-up, as markets identify new business models; and that the deployment of EV chargers will be relatively stable unless Government transport and energy policy or new commercial models more strongly support the introduction of charging infrastructure.

b. The number of solar PV installations in the first three years of the RIIO-ED1 period (1 April 2015 to 1 April 2018) has been well below forecast level in terms of number of installations, but nearing it in terms of capacity. This confirms the evolution of the market in the last couple of years towards larger sized installations, which is especially acute in Yorkshire. Also, the number of small installations (G83) has dropped significantly year over year, which was unforeseen in the projections. In 2018/19 we expect the Government to determine fiscal support for the FiT regime post-March 2019 which will have an impact on the generation being connected.

Question 9: Are off-takers, suppliers, and aggregators able to lead the deployment of small-scale low-carbon generation currently? If so how will this occur, over what timescales, and what are the implications for deployment levels? How would deployment be supported by the capacity and ancillary services markets as well as the emerging corporate PPA market? Please provide evidence.

50) In line with the Environment & Innovation Regulatory Reporting Pack submitted to Ofgem annually, our observations suggest that the deployment of small-scale low-carbon generation installations on our network is in decline (please refer to Table 1).

51) Customers who install small renewable generation are incentivised to declare it to Ofgem through the FiT scheme. The respective data has been sourced from Ofgem (e-serve) as it has proven to have a higher level of data accuracy in comparison to the notification data received by Northern Powergrid.

Table 1. **Solar PV (G83) deployments in Yorkshire and North East, annual figure**[18]

		2015/16	2016/17	2017/18
Northern Powergrid (Yorkshire) plc	Number of PV installation	13,407	2,323	979
	Estimated size, MW	64.2	8.9	4.0
Northern Powergrid (Northeast) Limited	Number of PV installation	12,172	1,260	751
	Estimated size, MW	54.8	4.8	3.0

[18] Data as of 31 March 2018. Source: Environment & Innovation Regulatory Reporting Pack (2017/18). Table E7-Low Carbon Technologies. *Installed capacity* has been used to filter the G83 from non-G83, as we are assuming that it corresponds to the size of the LCT installed.

Question 10: What would be the impact on jobs, deployment, and the supply chain, if deployment were left to market forces beyond 2019? Please support your answer with clear evidence.

52) This question is best answered by those entities in the generation supply chain.

Question 11: In your view, are small-scale low-carbon generators currently able to deploy independent of subsidy e.g. through the PPA market? Does this vary for differing technologies and capacities of small-scale low-carbon generation e.g. domestic vs. commercial scale? If not, can you explain how long it will take for this market to emerge and if government intervention is required? Please provide evidence.

53) This question is best answered by those entities in the generation supply chain.

Question 12: What factors, including financial, affect your decisions to invest in small-scale lowcarbon generation?

54) This question is best answered by those entities in the generation supply chain.

Question 13: Does government need to take regulatory intervention(s) to enable the development of competitive markets for small-scale low-carbon generation? If so, what and why? If these actions were taken, what benefits would this provide to consumers and the electricity system?

55) If small-scale low-carbon generation faces cost-reflective charges (and benefits) for all aspects of its activity (e.g. its interaction with wholesale markets, its contribution to balancing and its impact on network costs), then any overarching intervention would create a distortion. Therefore, rather than levelling the playing field, it would tip the playing field in favour of small-scale low-carbon generation.

56) Regulatory interventions should only be used if cost-reflective charges are not in place for any given element(s) of the charges faced, or if Government wishes to deliberately create an unlevel playing field to promote certain environmental or social outcomes for example. If Government opts to intervene in this manner then we do not believe DUoS should be the mechanism by which this is achieved.

Question 14: How can we encourage and unlock private sector finance to enable market-led deployment?

57) This question is best answered by those entities in the generation supply chain.

Question 15: How would a guaranteed route to market operating at a discount to the market price impact the transition of small-scale low-carbon generation to competitive markets? Please provide evidence to support your answer.

58) This question is best answered by those entities in the generation supply chain.

Question 16: What innovative solutions would be required in the PPA market to bring forward small-scale low-carbon generation? Please provide evidence to support your answer.

59) This question is best answered by those entities in the generation supply chain.

Question 17: A guaranteed route to market would require costs to be robustly controlled for consumers, as outlined in the Control for Low Carbon Levies. How could this best be achieved, without creating 'boom and bust' cycles for the small-scale low-carbon generation sector?

60) In line with our responses provided to *A future framework for heat in buildings* consultation:

   a. There is a market failure stemming from different, inconsistent taxation of different fuels and fuel prices not being reflective of externalities, such as the abatement cost of greenhouse gas emissions.

   b. A level playing field is needed for all fuels, and fiscal distortions/market failures should be avoided. At present, there is a disproportionate fiscal burden on electricity compared to gas. Furthermore, high carbon content fossil fuels are not subject to Climate Change Levy and are taxed disproportionately to their carbon content. The price of a fuel needs to be reflective of its carbon content.

   c. Policy costs are disproportionally levied on electricity bills; making up 15% of an electricity bill. This has created significant distortions in the market and is leading to inefficiency and perverse outcomes as bill payers are seeking ways to avoid these costs such as generating behind the meter and setting up inefficient private networks.

d. Working with Ofgem, BEIS should evaluate the problems that are being created by the application of environmental levies and taxes to energy bills with the aim of applying taxes in a way that creates fewer perverse incentives. The inefficient development of networks (driven by customers seeking to avoid taxes) is just one such example, and we would encourage policy makers to carefully consider the pros and cons of where they apply environmental social levies/taxes in the context of wider regulatory structures.

Question 18: What would be the general challenges (including technical challenges) of designing a guaranteed route to market that offers a time of export tariff to support the aim of developing a smart and flexible network?

61) In order to be cost-reflective, such a tariff would need to be dynamic in order for the time of export signal to reflect actual system benefits. But this would risk undermining the guaranteed route to market – for example, if the dynamic time of export tariff evolved to be low at times when renewable generation is high and high at other times, small-scale low-carbon generation would only be unable to benefit from the higher prices if able to flexible in its own right or when twinned with some flexible load. In this regard, it could be challenging for an intermittent and uncontrollable generation small-scale generation type, such as solar, to benefit from such an arrangement.

Question 19: How long would a guaranteed route to market need to run for to help the development of competitive markets?

62) This question is best answered by those entities in the generation supply chain.

Question 20: How could future regulations or other interventions be designed in order to capture the benefits of storage combined with small-scale low-carbon generation? If specific technical requirements are needed, please specify those as well.

63) We believe that the current regulation already promotes this where it is an efficient and sensible solution. Following the introduction of half hourly settlement then these incentives will be even sharper. As we transition to the role of DSO, we are exploring the potential value from contracting flexible generation/storage as one source of flexibility that could be used as an alternative to network reinforcement.

64) Our *Distributed Storage & Solar Study* project[19] is testing whether the existence of storage provides the opportunity to amend design policies to allow the connection of more PV than would otherwise be the case before there is a need to trigger reinforcement. It involves the installation of up to 40

[19] ENA Smarter Networks Portal, 2016. Distributed Storage & Solar Study (DS3).

energy storage devices and will also look at the extent to which these can be used to reduce winter peak loading. The study is to conclude in 2019 and is expected to yield data on whether design engineers can, or cannot, take account of the existence of distributed energy storage units to increase the amount of PV that can be connected to a low voltage feeder / substation. This, in turn, would improve planning assumptions and network planning activities.

65) Furthermore, our innovation work includes collaboration with parties such as Nissan[20,21] and other partners developing new low carbon transport options for customers[22,23]. We are only just starting to comprehend the impact that EVs will have on the energy system and how customers will optimise their installed technology and usage patterns. In our work on electric vehicle and Vehicle to Grid technology we are interested in the potential for customers to use the batteries in their vehicles as a means to balance their domestic or commercial load as well earn revenue from export. We note that the charging of EVs may cause customers to opt for larger solar PV domestic installations in order to increase the amount of behind the meter generation available. This makes continued innovation and collaboration between the energy and transport sector important.

Question 21: If implemented what effect would the actions you outline have on the small-scale low-carbon generation sector and the benefits this sector brings to UK consumers?

66) Benefits for three parties need considering – engaged customers offering flexibility, the remainder of (unengaged) electricity customers, and, more generally, the wider population with an interest in the UK's environmental and economic development.

67) For those that want to be engaged, there needs to be a clear benefit for participating – either a personal or community reward. This reflects the benefit to the energy system from the flexibility provided. The generality of customers, engaged and unengaged, benefit from the more economical system.

68) For unengaged customers, the incentives in the standard electricity in the charges need to be cost reflective and incentivise efficient behaviours. However, protection is needed for those unable to engage.

69) There are two key benefits for the UK population as a whole – decarbonisation and the export of goods and services to assist other countries with solutions to their own energy challenges.

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[20] Northern Powergrid, 2017. Northern Powergrid and Nissan sign industry-leading partnership.

[21] Northern Powergrid, 2018. 1,000 Vehicle-to-grid chargers to put UK at forefront of electric vehicle revolution.

[22] ENA Smarter Networks Portal, 2017. Vehicle to Grid (V2G) - the network impact of grid-integrated vehicles.

[23] ENA Smarter Networks Portal, 2017. Silent Night – Hybrid EV Generator.