A SMART, FLEXIBLE ENERGY SYSTEM

A call for evidence

Silver Spring Networks Response

12-January-2017

Silver Spring Networks' Response: A Smart, Flexible Energy System

Silver Spring Networks welcomes the opportunity to respond to this consultation on **A Smart, Flexible Energy System**. Silver Spring Networks is a global provider of communication, data and distributed compute platforms to support smart metering and smart grid programmes around the world, with over 25 million active devices across 5 continents. We have attached evidence to support our answers to specific questions on the proven benefits of many different applications in different geographies and regulatory regimes - details and web links can be found in the appendix at the end of this response. To summarise our response:

- The current GB energy market structure provides many advantages, including greater competition and lower prices for consumers.
- For rolling out smart grid technology and new flexibility services, this structure presents additional complication, often requiring complex commercial solutions in advance of the deployment of technical solutions. This may hinder the speed of deployment of new technology compared with more vertically integrated markets.
- The selected technologies and specification of the data and communications platform (DCC) to support the national rollout of smart metering may mean delivery of the associated smart grid and flexibility benefits are difficult to realise without augmentation of this technical platform. Lack of detailed voltage, outage, current and other data, and the ability to control assets in near real time may hinder DNOs in realising their ambitions in this area, thus requiring additional parallel investment.
- In order to accelerate some of the flexibility ambitions outlined in the document, it would be sensible to procure and deliver a national, fit for purpose smart grid communications platform, possibly via the DCC, which can support all of the use cases envisaged in the future in a secure, reliable way. One way to rollout such a platform whilst delivering benefits to DNO's immediately would be begin with monitors in electricity substations. This platform could then be augmented as required in the future to connect critical assets such as batteries, EV's, renewable generation and many more besides.

We would be happy to introduce Ofgem and BEIS to any of our customers around the world, particularly those who have been running smart meter/grid programmes for many years now and have seen real customer benefits delivered in their territories.

Yours Sincerely,

Steven Burns

Silver Spring Networks UK & Ireland

Removing policy and regulatory barriers: Enabling Storage

1. **Have we identified and correctly assessed the main policy and regulatory barriers to the development of storage? Are there any additional barriers faced by industry? Please provide evidence to support your views.**

   The areas highlighted in the consultation seem comprehensive. One technological barrier which may be faced by industry is the availability of a fit for purpose smart grid communications platform which can enable the industry to respond to the challenges outlined in this document. If the industry is left to deliver communications solutions to support each individual use case in each geographical area and industry segment, there is a risk of substantial costs being incurred to implement and manage multiple communications platforms, as well as any interoperability/standardisation issues that may arise across the industry.

   In nearly all of our customer deployments around the world, that single unified platform is the AMI communications and data platform. For some of the use cases envisaged in this document, the platform delivered by the DCC will be able to support the needs of the industry. However, there are many where the technical requirements associated with the use case will be too great. For example, connection of renewable generation and/or battery storage on a flexible/curtailable basis requires very low latency (Near Real Time) SLA's for the messages delivered across the network, as well as the ability to process many thousands of message per day per device.

   One way to overcome this technical barrier would be to mandate the procurement and rollout of a purpose built smart grid communication, data and distributed compute platform (perhaps still managed by the DCC but using different underlying technology) which can then be available to the entire industry in support of the delivery of all of these use cases. Applying this platform initially to the > 600,000 electricity substations across the country would deliver immediate benefits to DNO's such as real time power quality data, and would also give a broad network coverage across the entire country. This could then be utilised for a wide range of flexibility services, along with supporting smart grid applications.

2. **Have we identified and correctly assessed the issues regarding network connections for storage? Have we identified the correct areas where more progress is required? Please provide evidence to support your views.**

   From a technical perspective there are number of factors that will affect the connection of storage onto the network, not least as storage will require real time active management. To ensure this is possible, a high-speed, low-latency communications system would be required, as with the Flexible Plug and Play (FPP) project Silver Spring Networks supported with UK Power Networks. The main theme of FPP was the connection of generation, but many of the technical learnings from this scheme could be applied to storage. Please see the enclosed use case: ***SilverSpring-CaseStudy-UKPN.pdf***

Whilst the process of connecting storage will be similar to connecting generation, additional factors will need consideration, such as control and management of the storage charging element. For example, the charge / discharge cycle must be considered, as once storage is charged it can no longer act as a sink for generation. Conversely once discharged, a storage facility can no longer act as a generator and continue to support load related network constraints.

It is likely that this will require enhancements to DNO planning tools and technical skills to adequately model the effect on the DNO networks.

From an operational perspective, the deployment of renewable generation was initially slowed through the inability of the DNOs to transition from passive networks to Active Network Management (ANM). For the successful deployment of storage, it will probably require an extension to existing ANM solutions to manage the generation / load elements of the storage.

Another factor that will influence the network connection is how the storage can be utilised to relieve specific network constraints. As a result, DNOs will need to understand which areas of the network will benefit from storage to help manage local network constraints. At this stage it is currently unclear as to how DNOs will identify and track these potential locations. This is most likely a capability that will develop over time. One example may be areas of high PV penetration with low load. This output could be used to charge storage during high PV output and released in low light / high load conditions.

3. **Have we identified and correctly assessed the issues regarding storage and network charging? Do you agree that flexible connection agreements could help to address issues regarding storage and network charging? Please provide evidence to support your views, in particular on the impact of network charging on the competitiveness of storage compared to other providers of flexibility.**

   Given the constraints that have occurred around generation, flexible connection agreements should be considered, especially as the export from storage will incur similar network constraints to pure generation (thermal, fault current and voltage rise). This is particularly true where storage will be utilised to manage seasonal network constraints and flexibility will be key.

4. **Do you agree with our assessment that network operators could use storage to support their networks? Are there sufficient existing safeguards to enable the development of a competitive market for storage? Are there any circumstances in which network companies should own storage? Please provide evidence to support your views.**

   The emergence of smart grids for DNOs has gradually seen the development of a toolbox approach rather than a “one size fits all” approach to deploying technology. With that in mind, storage has the potential to become a specialised DNO tool to manage specific network constraints, both locally and on a system wide basis. In particular, there are applications associated with the

connection of intermittent renewable generation, where storage has the potential to free up network capacity as part of an Active Network Management (ANM) approach.

As the deployment of storage is in its early stages, it may be too early to decide whether DNOs should or should not have the ability to own and operate storage facilities. In some cases, economies of scale may be available with a larger storage plant serving a range of connected customers, rather than each customer relying on their own installation. The DNO would then be able to sell those services as part of an ANM scheme.

A detailed study has been completed on the Economics of Battery Storage by the Rocky Mountain Institute, which is enclosed with this response. Please follow the enclosed link for more details. Economics of Battery Storage,

5. **Do you agree with our assessment of the regulatory approaches available to provide greater clarity for storage? Please provide evidence to support your views, including any alternative regulatory approaches that you believe we should consider, and your views on how the capacity of a storage installation should be assessed for planning purposes.**

   Yes. No further comment.

6. **Do you agree with any of the proposed definitions of storage? If applicable, how would you amend any of these definitions? Please provide evidence to support your views.**

   Yes, we agree with the storage definitions.

Removing policy and regulatory barriers: Aggregators

We have no comments relating to questions 7-10

Providing price signals for flexibility: System Value Pricing

11. **What types of enablers do you think could make accessing flexibility, and seeing a benefit from offering it, easier in future?**

    Any flexible system, especially one with so many actors and stakeholders requiring time-sensitive information, needs a high performance communication, data and distributed compute platform to underpin it. Such high performance platforms need to support millions of connections, be available everywhere and anywhere, be highly reliable (>99.5% SLA), with low latency (near real time) communications. They also need to reliably deliver thousands of messages per device per day, with robust security. Platforms which meet these criteria can then enable both monitoring and command and control for flexible connections, DSR, Storage management, EV's, CVR, Outage management, balancing interventions etc. Peer to peer communications can also support distributed intelligence and the emergence of further Internet of Things (IoT) application for smart grids. No such infrastructure currently exists in the UK energy market.

The enclosed case study summary, ***Proven Benefits 2016.pdf***, outlines just some of the many use cases delivered through over 25 million devices running on just such an infrastructure, the Silver Spring Networks "Starfish" platform. These flexibility and smart grid applications have been layered on top of a Smart Metering / AMI platform with high performance, low latency, robust security, ubiquitous coverage, and reliable communications at its heart.

For some of the use cases envisaged in this document, the platform which is expected to be delivered by the DCC to support AMI will be able to support the needs of the industry, however there are many instances where the technical requirements associated with the use case will be too great. For example, connection of renewable generation and/or battery storage on a flexible/curtailable basis requires near-real time latency SLA's for the messages delivered across the network, as well as the ability to reliably process many thousands of message per day per device from any location.

Our proposal would be to roll out distribution substation monitoring and control at a national level, which would provide a communication, data and distributed compute platform for all of the envisaged services. In recent years there have been huge advances in development of affordable monitoring at the LV feeder level, which would provide a range of immediate DNO benefits. These would include load monitoring which allow for improved planning, along with future benefits associated with EV / domestic storage management. Additional benefits associated with LV fault management would also deliver immediate improvements in network performance (CML / CI). However, the main benefit would be the delivery of a ubiquitous smart grid platform which could be utilised across MV and LV voltage levels and right down to customer premises. This would then enable many of the flexibility services outlined in this consultation, along with advanced smart grid applications such as automation and remote control (including peer to peer / teaming for fault restoration), LV power electronics and Conservation Voltage Reductions (CVR), which will impact on improving losses performance.

12. **If you are a potential or existing provider of flexibility could you provide evidence on the extent to which you are currently able to access and combine different revenue streams? Where do you see the most attractive opportunities for combining revenues and what do you see as the main barriers preventing you from doing so?**

    We have no comments relating to this question

13. **If you are a potential or existing provider of flexibility are there benefits of your technology which are not currently remunerated or are undervalued? What is preventing you from capturing the full value of these benefits?**

    We have no comments relating to this question

14. **Can you provide evidence to support changes to market and regulatory arrangements that would allow the efficient use of flexibility and what might be the Government's, Ofgem's, and System Operator's role in making these changes?**

We have no comments relating to this question

Providing price signals for flexibility: Smart Tariffs

15. To what extent do you believe Government and Ofgem should play a role in promoting smart tariffs or enabling new business models in this area? Please provide a rationale for your answer, and, if you feel Government and Ofgem should play a role, examples of the sort of interventions which might be helpful.

Dynamic pricing and smart tariffs have the potential to play a vital role in the development of Demand Side Response programmes and the creation of new services for customers. It is our view that Government and Ofgem should work with industry to ensure any new tariffs offered are in the interests of customers, while taking into account the implications for all areas of the energy value chain. Work should also be undertaken to protect against customer bill shock and impacting vulnerable customers in a negative manner. Wider industry changes, such as a move to half-hourly settlement will also need to be considered.

Silver Spring Networks has significant global experience in supporting smart tariffs and demand side response programmes. Examples include the case studies included in the Proven Benefits 2016.pdf attachment, along with the more detailed OG&E case study, SilverSpring-CaseStudy-OGE.pdf.

16. If deemed appropriate, when would it be most sensible for Government/Ofgem to take any further action to drive the market (i.e. what are the relevant trigger points for determining whether to take action)? Please provide a rationale for your answer.

We believe that there are a number of key triggers that could justify further action to drive the market to develop Smart Tariffs.

1. Further closure of UK Generation fleet and subsequent reduction of capacity margin.
2. Wide scale rollout of EVs leading to localised network constraints (mainly at LV and 11kV) and requirement for managed charging.
3. Localised network constraints brought about by renewable generation.
4. Wide scale rollout of smart appliances that are capable of responding to price signals and potentially participating in new markets.

A prerequisite to development of new smart tariffs, is a suitable infrastructure on which to base the application. The UK Smart Metering programme is in advanced stages prior to mass deployment and dynamic tariffs have long been part of the envisaged functionality. Without this in place, the benefits associated with variable tariffs will not be deliverable.

17. What relevant evidence is there from other countries that we should take into account when considering how to encourage the development of smart tariffs?

A number of our customers have already begun to roll out such programmes, leveraging the capacity of their smart metering deployments for additional benefits. Oklahoma Gas and Electric (OG&E) have already undertaken a number of DSR and smart tariff based deployments, built on the capability of an advanced smart metering platform. Initial trials demonstrated an average change in energy usage between 11% and 33%, based purely on price signals. The success of the pilot study programme encouraged OG&E to broaden the program and make it accessible to all customers in their service territory – an industry first to make smart grid-based DR available to everyone.

Please see the enclosed case study for further details. ***SilverSpring-CaseStudy-OGE.pdf*** and the case studies included in the Proven Benefits 2016.pdf attachment.

18. Do you recognise the reasons we have identified for why suppliers may not offer or why larger non-domestic consumers may not take up, smart tariffs? If so, please provide details, especially if you have experienced them. Have we missed any?

We have no comments relating to this question

Providing price signals for flexibility: Smart Distribution Tariffs - Incremental Change

We have no comments relating to question 19-21

Providing price signals for flexibility: Smart Distribution Tariffs – Fundamental Change

We have no comments relating to question 22-24

Providing price signals for flexibility: Other Government Policies

25. Can you provide evidence to show how existing Government policies can help or hinder the transition to a smart energy future?

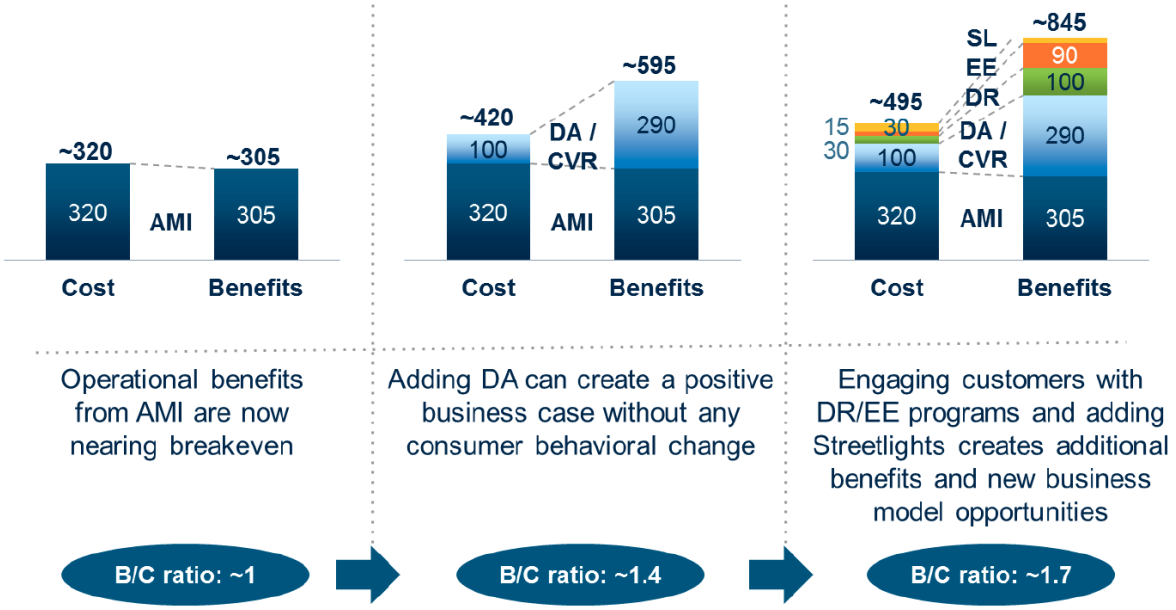
The UK energy market is unique in terms of the level of deregulation and competition that has been applied to the industry. This has led to significant benefits such as cost reduction and increased choice for consumers. Innovations such as the Feed in Tariff and Low Carbon Networks Innovation Fund (NIA / NI) have provided positive stimulus and moved the smart energy future forwards. As a result, the level of technical expertise within the UK energy industry is extremely high.

However, as more players and roles have entered the market, the level of complexity within the system has also increased. Subsequently a wide range of commercial arrangements and services are required to run in parallel with new technological solutions. More regulated / vertically integrated markets can sometimes allow for more innovation and then scale rollout of successful technologies - in the UK these have sometime stalled due to the commercial arrangements required to allow the technology to function within the market and also due to the number of owners of any “problem”.

In many countries, the foundational platform for building a smart grid has been a smart metering / AMI deployment. From this platform, utilities have been able to layer on additional benefits such as network automation, outage management, conservation voltage reduction, DSR and energy efficiency measures. The table below summarises the average benefit to cost ratio of North American utility customer AMI rollouts (North America being the geography with the highest number of smart meters deployed to date and therefore the largest evidence base):

Average NA Smart Grid Business Case*

$/customer, electric only, PV over 20 years



- Based on publicly available U.S. smart grid business/rate cases and includes Silver Spring internal estimates
- AMI – Advanced Metering Infrastructure, DA – Distribution Automation, CVR – Conservation Voltage Reduction, DR – Demand Response, EE – Energy Efficiency, SL – Streetlights

It is unlikely that benefits of this magnitude will be achieved for UK DNOs without some level of parallel investment. In many cases the commercial arrangements to drive these functions will be required to lead the technological advances, rather than the other way around.

In nearly all of our customer deployments around the world, the AMI communications and data platform is used as the base platform from which to deliver all smart grid use cases. For some of the use cases envisaged in this document, the technology platform currently specified by the DCC will be able to support the needs of the industry. However, there are many where the technical requirements associated with the use case will be too great. For example, connection of renewable generation and/or battery storage on a flexible/curtailable basis requires near-real time, low latency SLA's for the messages delivered across the network, as well as the ability to process many thousands of message per day per device.

One way to overcome this technical barrier would be to mandate the procurement and rollout of a purpose built smart grid communication, data and distributed compute platform (perhaps still managed by the DCC but using different underlying technology) which can then be available to the entire industry in support of the delivery of all of these use cases. Applying this platform initially to the > 600,000 electricity substations across the country would deliver immediate benefits to DNO's such as real time power quality data, enabling them to make improvements in CI/CML, and would also give a broad network coverage across the entire country. This platform could then be utilised for a wide range of flexibility services, along with supporting smart grid applications.

In summary, the current set of incentives and polices around the energy market will continue to deliver value for customers and allow some transition to smarter energy future. However, for the full benefits of a smart, flexible system to be realised without market reform, innovative and complicated commercial arrangements will be required which may slow the transition.

26. **What changes to Capacity Market (CM) application/verification processes could reduce barriers to flexibility in the near term, and what longer term evolutions within/alongside the CM might be needed to enable newer forms of flexibility (such as storage and DSR) to contribute in light of future smart system developments?**

    We have no comments relating to this question

27. **Do you have any evidence to support measures that would best incentivise renewable generation, but fully account for the costs and benefits of distributed generation on a smart system?**

    We have no comments relating to this question

A system for the consumer: Smart Appliances

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

- **Yes**
- **No (please explain)**

Yes, we agree with the 4 principles.

29. What evidence do you have in favour of or against any of the options set out to incentivise/ensure that these principles are followed? Please select below which options you would like to submit evidence for, specify if these relate to a particular sector(s), and use the text box/attachments to provide your evidence.

- **Option A: Smart appliance labelling**
- **Option B: Regulate smart appliances**
- **Option C: Require appliances to be smart**
- **Other/none of the above (please explain why)**

We have no comments relating to this question

30. Do you have any evidence to support actions focused on any particular category of appliance? Please select below which category or categories of appliances you would like to submit evidence for, and use the text box/attachments to provide your evidence:

- **Wet appliances (dishwashers, washing machines, washer-dryers, tumble dryers)**
- **Cold appliances (refrigeration units, freezers)**
- **Heating, ventilation and air conditioning**
- **Battery storage systems**
- **Others (please specify)**

Smart Thermostat solutions let consumers and utilities manage energy use and reduce peak demand without sacrificing comfort and convenience. By providing smart thermostat connectivity to a Silver Spring-enabled electric meter, utilities such as OG&E and Hawaiian Electric have enabled devices to respond automatically to time-of-use, critical peak and real-time pricing programs, as well as supporting legacy direct load control programs. Typically, devices connect securely to the meter and are installed by utility contractors or by the customer themselves as part of a bring-your-own thermostat program.

Most demand response (DR) programs in place today use legacy paging solutions that suffer from a number of limitations: Many devices are inoperable, and one-way communications leave no way to remotely detect devices that require service or maintenance. Forecasting and verification of load reductions is also challenging, and, with these legacy technologies approaching end of life, vendor lock-in is a serious risk. Utilising an interoperable, standards-based AMI platform provides an alternative with two-way Direct-to-Grid communications for load control.

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

We have no comments relating to this 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?

We have no comments relating to this question

A system for the consumer: Ultra Low Emission Vehicles

33. How might Government and industry best engage electric vehicle users to promote smart charging for system benefit?

Electric vehicles have the potential to be both an emerging problem and solution for the DNOs. Dense penetration of electric vehicles could well cause localised grid constraints, particularly down to the LV networks. However, long charging cycles also provide an opportunity for demand response services as a large discretionary load, thus aiding in smoothing of demand curves and balancing of peaky renewable generation.

As electric vehicles are causing a gradual cultural shift in transportation, so they could provide a complementary cultural shift in engagement with energy, which should be leveraged. It is at this stage that industry should consider innovative services to leverage the potential role that EVs can play for DSR and V2G applications. For example, just as the mobile phone market has transitioned to selling a service package (included minutes rather than billing per call), industry could begin to offer services to keep the vehicle charged for a rate, rather than a pure on demand / kWh basis. This would then allow aggregators and service providers to manage charging to help support the energy system.

At this stage it would appear there is little engagement with customers regarding energy consideration at the time of purchase of the vehicle. This would provide an ideal opportunity for consumers to be sold specific vehicle related energy services.

In order to underpin any smart charging programme, a fit for purpose communications technology platform will be required. As proposed earlier in this document, this platform should be unified across the energy value chain, and if the current AMI communications platform is not suitable due to technical performance characteristics, a state of the art smart grid platform such as Silver Spring Networks' Starfish could be rolled out nationally to support all of the proposed flexibility use cases.

34. What barriers are there for vehicle and electricity system participants (e.g. vehicle manufacturers, aggregators, energy suppliers, network and system operators) to develop consumer propositions for the:

- **control or shift of electricity consumption during vehicle charging; or**
- **utilisation of an electric vehicle battery for putting electricity back into homes, businesses or the network?**

From a grid perspective, there is currently a lack of network visibility from the 11kV networks down. Therefore, the near real-time feedback loop associated with charging and discharging vehicles is currently not in place. This may have implications both on transformers and circuits down the LV network for both voltage and current constraints. Whilst it was envisaged that the

Smart Metering implementation would provide some of this visibility, it is becoming apparent that alternative methods may require consideration. This could include wide scale distribution substation monitoring to ensure LV circuits and transformers are managed actively rather than the current passive approach in place at present. Without these functions in place, additional risk will be placed on LV networks.

There is still some uncertainty as to how vehicle to grid (V2G) battery usage will be implemented given a range of technical and commercial barriers that currently exist. These include

- Challenges around impact on battery lifespan given additional charge / discharge cycles and impact on vehicle maintenaince costs
- Extra capabilities required on the car and car charger, balanced against manufacturers' desire to reduce the upfront costs. This level of investment is currnetly unclear.
- To date, minimal field trials had led to wider rollout
- Real cost effectiveness of battery discharge compared with DSR still to be ratified. I.e the cost of applying DSR may prove to be a significantly cheaper option than V2G with the required hardware investment and impact on battery life / maintenance.

Before V2G services can be offered, further research needs to be undertaken and outputs disseminated to understand the implications on the vehicle and the network. This will allow a more informed technical and commercial model to be established.

For further details, please see the enclosed EV White Papers or follow the links below

SilverSpring-Whitepaper-EVSmartChargingBiz.pdf and

SilverSpring-Whitepaper-ElectricVehicles.pdf

35. What barriers (regulatory or otherwise) are there to the use of hydrogen water electrolysis as a renewable energy storage medium?

Many of the challenges associated with hydrogen will be the same as for battery storage related technologies. Therefore, hydrogen should be considered in the same discussions on regulatory frameworks as battery storage.

A system for the consumer: Consumer Engagement with DSR

36. Can you provide any evidence demonstrating how large non-domestic consumers currently find out about and provide DSR services?

We have no comments relating to this question

37. 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?

We have no comments relating to this question

38. 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?

We have no comments relating to this question

39. When does engaging/informing domestic and smaller non-domestic consumers about the transition to a smarter energy system become a top priority and why (i.e. in terms of trigger points)?

A number of utilities worldwide have successfully deployed DSR schemes at the domestic scale. In these cases, there have been three pre-requisite factors driving rollout of a programme

1. A clear business case associated with a rollout (e.g. peak load management)
2. A sizeable controllable load at domestic premises (e.g. air conditioning and pool pumps)
3. A smart infrastructure capable of delivering and monitoring the DSR system such as a smart metering platform.
4. Continued penetration of PV and embedded renewables.

At present in the UK, the level of discretionary load is limited. Most large electrical loads such as cooking and white goods are utilised when required, and customers may be reluctant to shift load. Also the UK grid as a whole is scaled adequately to manage current maximum demands, so the current case for domestic DSR has a limited business case.

The primary catalysts for change will be if either there is a significant reduction in generation capacity or an increase in maximum demand through the increased prevalence of Electric Vehicles or electrical space / water heating.

Whist an increase in EV's probably provides the greatest challenge to the network from unconstrained charging, it also provides the greatest opportunity for DSR through managed charging. With enough EVs on the network, this could provide a significant resource for managing both micro and macro network challenges. Charging during high periods of renewable generation, EVs become a load sink to help manage generation related constraints. In times of low level generation, V2G programmes can be used to manage local load constraints.

Deployment of wide scale DSR will also require a suitable smart communications and data platform including both load control and network monitoring. It is recognised that the UK Smart Metering programme was envisaged to deliver both of these elements as part of the scope. As discussed in responses to earlier questions, not all use cases associated with load control will be deliverable through this platform.

In 2013 a study was undertaken to examine the effect of increased penetration of renewables on load profiles by the California Independent System Operator (CAISO). This lead rise to emergence of the "duck curve" chart, a prediction that with increased PV penetration, there will be a corresponding load trough supplied by traditional generation around the middle of the day. The predictions in this report have recently been revisited and have proven to be correct with load profiles altering dramatically in areas of dense connected PV. Further details on this report can be found in the article, Revisiting the Californian Duck Curve. Whilst DSR will play a role in managing peak load, it also has an inverse role to play in the management of midday load troughs, bringing

A system for the consumer: Consumer Protection and Cyber Security

40. Please provide views on what interventions might be necessary to ensure consumer protection in the following areas:

- **Social impacts**
- **Data and privacy**
- **Informed consumers**
- **Preventing abuses**
- **Other**

We have no comments relating to this question

41. Can you provide evidence demonstrating how smart technologies (domestic or industrial/commercial) could compromise the energy system and how likely this is?

There are a wide range of methods that can be utilised to infiltrate energy systems, and without the correct level of security, some of our critical national infrastructure could become open and vulnerable to attack. These methods include intercepting communications, direct attacks to end devices, injection of malicious code into end device firmware, and Distributed Denial of Service attacks.

Smart technologies begin to become a risk to the system when they are operated in a manner which was not intended. This could include attacks such as the mass switching of storage or DSR resources to destabilise an area of the network. Alternatively, the injection of malware into the system could be used to propagate code throughout the system causing wide scale issues.

How likely this is will be dependent on the level and quality of end to end security deployed through the whole solution stack, from the smart device to office head end application. It is our belief that security is not something that can simply be added as an afterthought, but should be created as an integral part of the system design.

Please see enclosed our Whitepaper, ***Smart Grid Security Myths vs. Reality.pdf*** or follow the embedded link.

42. What risks would you highlight in the context of securing the energy system? Please provide evidence on the current likelihood and impact.

As with the answer to Q41, please see enclosed our Whitepaper, ***Smart Grid Security: Myths vs. Reality.pdf.*** This document outlines key security risks to the energy system, including system level threats that attempt to take down the grid; attempts to steal electrical service and attempts to

compromise the confidentiality of data on the system. It also outlines current best practice based on open standard learning from the IT industry, along with attempting to address a range of common myths around the security risks of smart grids.

The roles of different parties in the system and network operation

We have no comments relating to questions 43-46

Innovation

We have no comments relating to questions 47-48

Appendix: Supporting Documents and Online Links

- Case study from UK Power Networks Flexible Plug and Play - SilverSpring-CaseStudy-UKPN.pdf
- Case study from Oklahoma Gas and Electric DSR programme - SilverSpring-CaseStudy-OGE.pdf
- A white paper on Smart Grid Security - Smart Grid Security Myths vs. Reality.pdf
- A summary of benefits from several smart grid projects – Proven Benefits 2016.pdf
- EV Charging - SilverSpring-Whitepaper-EVSmartChargingBiz.pdf
- EV Integration - SilverSpring-Whitepaper-ElectricVehicles.pdf
- The Economics of Battery Energy Storage, Rocky Mountain Institute - The Economics of Battery Energy Storage
- Report into the effects of PV on midday load troughs - Revisiting the California Duck Curve