A Smart, Flexible Energy System: a call for evidence

Response on behalf of the Solar Trade Association

About us

Since 1978, the Solar Trade Association (STA) has worked to promote the benefits of solar energy and to make its adoption easy and profitable for domestic and commercial users. A not-for-profit association, we are funded entirely by our membership, which includes installers, manufacturers, distributors, large scale developers, investors and law firms. Our mission is to empower the UK solar transformation. We are paving the way for solar to deliver the maximum possible share of UK energy by 2030 by enabling a bigger and better solar industry. We represent both solar heat and power, and have a proven track record of winning breakthroughs for solar PV and solar thermal.

Following a recent survey of STA members, 70% of our members are now considering or are actively involved in energy storage, from domestic through to large scale, and our investor members are seeking opportunities in this space. We are due to launch two energy storage working groups, one at residential scale in tandem with our PV Rooftop working group and one at large-scale in tandem with our Large Scale Solar Asset Management working group. We look forward to working with government and the regulator on delivery of the smart, flexible energy system.

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Would you like this response to remain confidential?	No

Executive Summary

The solar industry has provided the major challenge to date to business as usual in the power sector. Solar has 'turned the grid on its head' and provided unprecedented opportunities for diverse new entrants to invest in and innovate with clean power. Indeed, solar has been the catalyst for major

technological development globally, particularly in storage and network operations. Solar therefore sits naturally at the heart of a smart system and it is uniquely placed to form the bedrock of a clean energy future. The unparalleled cost reduction potential of solar, acknowledge by BEIS, combined with the tremendous benefits of a smart, flexible system outlined by the NIC mean that a smart energy system can also be the cheapest.

To achieve carbon targets and better value for consumers more variable renewables are required. Analysis by Aurora for the STA[1] (submitted as evidence) shows that the variability of solar imposes negligible costs on the system today and tripling deployment will incur modest integration costs. Importantly, the analysis shows that solar combined with battery storage delivers net economic benefits for the system, illustrating the value of flexibility on the system. The Call for Evidence presents a strong analysis of the barriers to storage that concurs with our own and these barriers should be removed immediately. However, we identify further barriers herein; a lack of consumer standards at the domestic scale; and to storage co-location with renewables – an important flexibility opportunity that needs better recognition & prompt barrier removal.

We recognise that the unexpected speed of growth solar has presented a genuine challenge to the DNOs, NG and the TSO and that solar growth has exceeded the capacity to respond in some areas within existing arrangements. A lack of strategic direction in the power system to resolve these challenges has been felt by the solar industry for several years. This call for evidence is therefore needed and strongly welcome. We hope that the BEIS/Ofgem leadership now offered under the smart energy agenda will strengthen to deliver the bold and far-reaching change to the system our members feel is necessary. The industry is ready to deliver innovative, smart solutions *now* and we urge BEIS/Ofgem to open up system-wide markets as soon as possible. **The RIIO-ED1 reopener provides an opportunity to expedite action.**

We strongly welcome the recognition in the consultation that network charging 'may' require broader consideration and note the consultation understates the importance of this. We urge fundamental rather than incremental change. **An independent, whole-system review of network charging is needed urgently** instead of the current piecemeal approach, which too often results in decisions that run counter to the smart power agenda. Processes under way now, such as Ofgem's embedded benefits review and other changes such as DCP228, fly directly in the face of the intended outcomes of this consultation. There is concern about the current process of industry self-governance of the Codes.

More broadly, **too much of Government's renewable energy policy is now running counter to the delivery of smart power**. Withdrawal of nearly all support prematurely for solar has had a severe impact on the industry, with the loss of valuable skills and investment capabilities. Unhelpfully for the wider system and consumers, strong competitive pressure and the sheer innovative dynamism of our industry is being lost. Sharp business rate rises on commercial rooftop solar intended for self-consumption will give precisely the opposite incentives needed to a key stakeholder in smart power.

[1] Aurora Energy Research and STA (2016) Intermittency and the cost of integrating solar in the GB power market: http://www.solar-trade.org.uk/intermittency-cost-integrating-solar-gb-power-market/

We are delighted by the Government's vision of more empowered consumers/prosumers. With 850,000 solar PV roofs in the UK, solar is a technology proven to attract unique public engagement and it provides a valuable entry point for deeper engagement with the tremendous smart opportunities for consumers described by BEIS. However, the implications for smart metering (which we welcome) for existing domestic solar owners receiving deemed export needs dedicated attention and clarity.

The day to day **experience of our members on the networks can be frustrating & remains a long way from a DSO model**, as our case studies illustrate. It is difficult to assess whether DNOs really are sufficiently empowered to transition to DSOs as Ofgem and BEIS assert. We do not believe that to be the case and suggest responsibility lies with BEIS/Ofgem to more clearly define the target DSO model and to better align the incentives on DNOs to achieve the desirable outcomes outlined in the Call for Evidence. The current approach of rewarding DNO trials and pilots, while still valuable for genuinely new innovation, is too limited and piecemeal. BEIS/Ofgem need to move faster to systematically open up key smart markets to the wider industry. In particular, we would like to see the market for network deferral properly (which has been assessed) rolled out. The ancillary services markets also require greater transparency and better market access for solar, which can provide a range of system services.

Ofgem and BEIS need to project manage this paradigm shift robustly. It is essential to set out a timetabled action plan to enable the industry and investors to understand when key decisions with implications for project economics will be made. The undertakings that emerge as a result of this call for evidence also need to be properly resourced, given the cost of inaction.

Finally we would like to see recognition of the tremendous industrial opportunity smart power presents for the UK and the additional value of early action.

Summary of key priorities

1. The Spring Plan should identify **early actions that will accelerate market access for flexibility services on the distribution networks and services in ancillary markets**. Every opportunity should be taken to expedite appropriate incentives on DNOs (including through the RIIO-ED1 reopener) and the TSO to open up competitive markets in smart services.

2. A **clear definition of storage should be implemented as a priority and other barriers should be removed immediately**, as identified in the call for evidence.

3. BEIS/Ofgem need to **define proposals on the target DSO model and TO/SO interface** and **put in place proper incentives to deliver these now** to enable local markets for smart power.

4. BEIS/Ofgem need to commission an **independent holistic review of network charging** within the context of the policy intent of a smart, flexible energy system.

5. Given BEIS/Ofgem's commitment to smart power there must be **greater joined-up thinking and alignment across all aspects of energy policy** instead of the current silo approach. This includes level playing fields and market access for renewables & fair treatment in the tax framework.

6. Crucially, a **timetabled action plan needs to be published alongside the Spring Plan.**

Evidence contributed by the STA

- Aurora Energy Research and STA (2016) *Intermittency and the cost of integrating solar in the GB power market*[2]
- STA (2016) *Solar + Storage = Opportunities*[3]
- Member case studies (in response to question 44)

Answers to Consultation questions

In our response to the call for evidence we respond to each question in turn. On some topics we perceive that they are best answered by experts more actively working in those sectors, and have not responded. These questions are omitted.

Chapter 2: Removing policy and regulatory barriers

Enabling storage

Q.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.

Yes, the barriers highlighted are largely in line with those we identify as our policy asks within our position paper *Solar + Storage = Opportunities*[4]. These are drawn out in further detail in the questions below, though we also add the following:

Lack of standards to support consumer confidence and healthy market growth. There is currently a lack of standards in place for residential and commercial storage to enable a high-quality storage industry to run safely. The importance of minimum standards for consumer confidence cannot be overstated. It is crucial that the storage systems that are installed in the coming years are sold fairly and installed well, from good components, and in a way that is safe and effective. Poor consumer experiences and bad reputations can damage markets before they can take off. Many standards and guidelines were developed in Germany as part of their storage grant programme which could be easily replicated, including legal frameworks for storage recycling, a fire fighting guidebook, safety guidelines and technical standards. The IET has recently released a draft Code of Practice for Electrical Energy Storage Systems[5], which the industry should be encouraged to adopt as a positive first step. The development of comprehensive consumer standards and guidelines should be strongly supported and

[2] Aurora Energy Research and STA (2016) Intermittency and the cost of integrating solar in the GB power market: http://www.solar-trade.org.uk/intermittency-cost-integrating-solar-gb-power-market/
[3] STA (2016) Solar + Storage = Opportunities: http://www.solar-trade.org.uk/solar-storage-opportunities/
[4] STA (2016) Solar + Storage = Opportunities: http://www.solar-trade.org.uk/solar-storage-opportunities/
[5] IET (2017) Code of Practice for Electrical Energy Storage Systems: http://www.theiet.org/resources/standards/eess-cop.cfm

driven by the government as part of their storage strategy. This should include smart communication standards for permitting distributed storage owned by homeowners to support grid services.

Barriers to entry to different markets and poor visibility over services required. There is also a need to alter regulations to enable storage to access the market and participate on an equal footing to generation. For example the rules of the capacity mechanism put the balance in favour of existing generation plant rather than storage, in particular given the shortness of contract lengths. This reduces the time horizon in which funders can expect to return their investments in storage, and pushes up cost relative to other technologies. As another example, there are currently c.26 services required by the National Grid for balancing and ancillary services. The technical specifications for delivery among many of these services are similar, however it is difficult to navigate the full range of services, and there is little forward visibility on which will be required and when. There is also a lack of clarity around which can be 'stacked' when bidding into tenders and whether services can be delivered at the same time (possible with effective metering). The ancillary services market should be reformed, condensed and simplified to enable newer market entrants (such as storage developers) to compete with existing generation assets.

Much more should be done to incentivise DNOs to develop flexibility markets, including storage (see below).

Q.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.

Yes, though we add the following:

Prioritise flexible solutions where this relieves network constraints. Connection applications for storage (and other flexibility solutions) should be prioritised where they reduce stress on the network, defer costly network upgrades and enable more customers to connect. There is a vast amount of academic and practical evidence that energy storage (stationary and EVs) can benefit both consumers and the costs of electricity distribution, yet DNOs are presently discouraged by restrictive regulation to leverage the benefits of storage in their networks. As BEIS notes, storage may add or reduce load on the system, however network operators must assume a 'worst case' scenario without a realistic understanding of how storage is controlled. For example, a DNO might consider that storage and PV will export at the same time, which is implausible in a self-consumption scenario where the system is configured to reduce customer electricity bills. Furthermore, at grid scale it is highly unlikely (and can be prevented) that storage discharges onto the network at times of peak generation and low demand.

Storage can be used to relieve network constraints, and it can reduce distribution costs where deployed with generation close to demand. This needs to be recognised in how connection agreements are negotiated with the DNO. Ofgem should consider how queue jumping, flexible connections within agreed parameters, and other commercial arrangements can be used to make better use of storage in managing the networks. DNOs should publish maps where storage can assist the network to encourage connections in certain (stressed) parts of the electricity distribution system.

Co-location of storage with renewables. Ofgem has recently approved the first application to re-accredit a solar PV array under the RO following the installation of storage on-site. Following high interest from industry and engagement by the STA and other trade bodies, Ofgem now intends to publish guidelines on how this can be achieved. We look forward to disseminating the results to the industry. Ofgem must primarily address the key perceived risks for financers: firstly the duration for which ROC payments will be suspended during re-accreditation needs clarity; secondly there is a perception that if a re-accreditation is unsuccessful a project cannot then revert to its previous state in which it was successfully accredited and may lose ROC payment altogether. Addressing these investor barriers will enable significant additional storage connecting to existing sites, which is a win for the industry (new market opportunities), a win for network operators (added flexibility), and a win for consumers (downward pressure on electricity price through arbitrage). Ofgem should take this opportunity to ensure the same guidance is issued for FiT schemes, and the Low Carbon Contracts Company should ensure a similar process is enacted for CfD schemes.

Consider favourably material changes to grid connections that provide greater flexibility. The problem with material changes to grid connection goes beyond the RO, CfD and FiT, and applies to grid connections in general. Connecting storage to existing sites can add flexibility, time shift generation at times of high supply, make better use of underutilised grid capacity, and increase efficiency in cases of over-planting at connection points. These all have efficient outcomes. However in many cases DNOs consider the addition of storage as a material change and there are fears that the site may lose its existing connection and go to the back of the grid queue. National Grid has a more collaborative and enabling connections process, which is clear that connectees can revert to the previous agreed arrangement if necessary, whereas DNOs do not. The result is a missed opportunity on the distribution networks.

These barriers must be addressed in the ENA's consultation on material change, which we understand is due to be re-issued. In order to extract maximum value from the system, efficiently manage the network and allow for innovation, it is important that a clear distinction is made between material changes to *existing* connected customers and projects in the pre-connection phase. Furthermore, the terms should not be overly prescriptive on what existing connected customers can and cannot do with their connection so long as certain parameters are adhered to. Changes that provide greater flexibility shouldn't be classed as material where the agreed export capacity is never exceeded or the asset behaves according to agreed parameters. As such, where changes will relieve constraints and enable more efficient management of the network DNOs should be incentivised to encourage schemes. Facilitating co-location will require new commercial arrangements and greater metering and export limiting capabilities.

Statements of Works. While DNOs have a 60 business day statutory timescale for providing grid connection assessments, National Grid does not have a similar timescale for Statements of Works. National Grid may insist on agreeing SOW subsequent to a connection offer being accepted, which can change the timescales and cost of the connection dramatically after development has already begun and significant investment committed. This is delaying the roll-out of several storage sites on the distribution network, and must be addressed. We provide evidence of this in response to question 44.

Q.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.***

In terms of the immediate actions identified in the consultation, we agree. Storage should be treated as non-intermittent and this needs to be clarified. Flexible connections should be made available, enabling the DNO to manage storage assets at times of high network stress, which has already been achieved for solar PV. Innovation could support projects whereby energy storage alongside renewable generation is actively controlled by a DNO in the event of high network stress.

Double-charging of final consumption levies can be solved on a quicker timescale than regulatory clarity around storage as an asset class. Levying charges on final consumption, and not all consumption/import, would solve the problem. This can be achieved by modifying how existing generation license regulations apply to storage via secondary legislation. As a short-term priority BEIS/Ofgem should implement this and issue a statement. However, while this is a good short term fix it should not be seen as a long-term solution. We support the resolution of this issue as soon as possible in advance of the definition of storage as a separate asset class, as identified above, and BEIS should indicate their timescales for achieving these to provide greater investor confidence.

Network charging. Careful consideration needs to be given to how DUoS and TNUoS charges apply to storage, given that the reason for installing storage will often be to operate at peak times. Given the system benefits from storage (i.e. the business case rests on system optimisation rather than consuming or generating power) it should not be charged excessively and disproportionately, which may be the case if it is treated as a generation asset. Regulatory clarity will help resolve this, as discussed below.

The primary concern with network charging (which is unfortunately only discussed fleetingly in this consultation) relates to **current changes to distribution network charging**. Ofgem and the industry code panels are seeking to remove perceived market distortions deriving from network charging via the ongoing review of embedded benefits and other modifications such as DCP228. We agree that the current charging arrangements need updating, however the modifications Ofgem is minded to support are not fit for purpose, and are in fact directly counter to the intent of this consultation. The current proposals will reduce the economic viability of flexibility on the system by flattening and removing price signals that incentivise demand reduction or generation turn-up during peak times. Many storage business models depend on price differentials in network charging. As a result the economic benefits from flexibility will be diminished. The proposals have been put forward by industry code panel representatives with commercial interests in which distributed generation and providers of flexibility are underrepresented. Industry modifications are being rushed through without proper consideration of whole system implications, and with a lack of objectivity, due diligence or appropriate consultation. Furthermore, the modifications will not actually remove distortions in the market as they only apply to future connections, therefore falling short on their own terms. See recommendations below for independent whole system review of charging Q 14.

BEIS's smart power work cannot be isolated from Ofgem's current actions in the embedded benefits review, or they will become, to a certain extent, meaningless. Given that network charging is a highly complex and interrelated area, isolated interventions without an holistic consideration of the knock-on effects risks a series of unintended negative consequences across the system. Indeed Ofgem itself highlights the risk of "unintended consequences" in their open letter signalling the modifications. For example, the Association for Decentralised Energy commissioned Cornwall Energy to conduct an analysis quantifying the economic risks of removing the embedded benefit to generators and industrial energy bills, which were found to be substantial[6]. On that basis **we support a freeze of embedded benefits while an independent, holistic review of network charging undertaken as a matter of urgency**. Network charging should be aligned with the smart power agenda: i.e. decarbonisation, low energy bills, security of supply and flexibility.

Finally, careful consideration should be given to how network charging, and potential double charging, applies to EV charging where these are enabled to provide residential storage and grid services.

Q.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.

Network companies can already own storage where it is not licensed for other services, and they have a 2.5% return on capital employed limit. According to EU Directives they cannot operate storage while it is interpreted as generation. The Winter Package indicates the EU is minded to define storage as a separate asset class, as well as to apply certain restrictions on the ability of network companies to own and operate storage assets.

Members are concerned about DNO investments in storage and are instead keen to see open markets for flexibility services. DNOs would have a competitive advantage over private companies when investing in storage. They have an information advantage on the network and can secure cheaper access to capital as they are perceived as long-term, trusted investments.

However, we recognise DNOs should be able to operate storage as a last resort if the market doesn't bring forwards a solution to a particular network problem. There are a number of tests a DNO must run on the market before assessing if installing their own storage is necessary. Where a DNO views it necessary to install their own storage this is likely to reflect the currently poor market access and poor visibility of network constraints rather than any lack of market solutions. There are an estimated 22GW of storage applications in the pipeline looking for connections, which demonstrates no shortage of companies offering solutions.

The priority should always be on procurement of flexibility services rather than ownership. There is a potentially huge market opportunity for network deferral, but in practice there is no functioning

[6] Cornwall Energy and ADE (2016) A Review of the Embedded Benefits accruing to Distribution Connected Generation in GB: http://www.theade.co.uk/embedded-benefits-review--manufacturing-energy-cost-concerns_4069.html

market to deliver it. **There needs to be a fair and open market for network deferral solutions** accessible for all parties as soon as possible and we urge BEIS/Ofgem to ensure this happens.

Developers need visibility of stressed points in electricity networks and indications alongside that of what is causing network stress and the types of energy storage which can assist the DNO. Applications for distributed generation in stressed areas could therefore look at storage to permit better connection agreements which support a transition to the smart power system.

Q.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.

There are two elements to regulatory clarity: how problems for storage relating to a lack of clarity in existing relations can be resolved in the short term, and how to create a comprehensive regulatory structure for storage that enables the smooth future growth of storage in the mid to long term.

In terms of immediate actions required there are a number of existing regulations and policies which currently are unclear for the interaction of solar and energy storage. These include the position of energy storage within existing RO-accredited solar arrays, as identified above, and a number of others, for example at the domestic scale:

- The level of VAT for solar + storage: HMRC have not provided a note identifying their position on how reduced rated VAT applies to domestic battery storage, which creates a commercial risk and an unlevel playing field for the sector.
- Grid connection processes for domestic solar + storage (G83/G59/G100). There is confusion in the industry about the correct process for installing storage, which will delay deployment and increase costs.

We call on the government to work with industry to urgently clarify the existing status of these regulatory issues and how they can incentivise the use of energy storage alongside solar.

In the mid to long term, two processes are possible in tandem: firstly measures can be implemented as a 'quick-fix' to enable more storage quickly. For example, treating storage as a subset of generation within existing licensing regulations could resolve the problem with final consumption levies, therefore removing some barriers. We understand BEIS is currently mapping out what is possible under different routes and the legal implications of each. While we support quick resolutions to immediate issues, we take the view that there will always be shortcomings to this approach. Only a bespoke legal definition and its classification under a separate asset class will be sufficient for application to current legislation and adaptable to allow for continued technological and sectoral development in future.

On that basis we believe government should define storage in primary legislation as a new asset class and activity. The starting point for this definition should be assessing all services the system requires of storage, which markets it should access, and establishing the principles of how connections, codes and levies should apply. A framework should then be designed that builds on that assessment, rather than adapting pre-existing legislation for other assets that tries to fit storage as best as possible in response

to current issues. Given that this is a problem across Europe, we are working with SolarPower Europe to define storage at a European level[7], and we hope this can be implemented as quickly as possible. The alignment of this in UK regulations is an important long-term goal. However, given the timescales involved, it is important that work is also undertaken at UK level.

As the consultation rightly identifies, the classification of storage as a new activity may only be achievable over a longer timescale, and the prospect of further change in future could bring uncertainty in the short term. Therefore as a first step government, in the Spring Plan BEIS should signal their long term intention early to instil confidence in the sector (e.g. what are the timescales for a definition, a license, etc). Government should also confirm that the intention of introducing a license would be to enable rather than hinder the deployment of storage, and so the future changes will not negatively affect existing assets retrospectively.

With regard to planning, treatment under current rules is compounding the difficulty of adding battery storage to solar arrays. Storage added to sites near the 50MW threshold may be automatically rejected by planning officials where they exceed the threshold. The question of how the addition of storage to an existing site that takes the peak capacity of the site above the threshold should be considered. Breeching the 50MW ceiling requires going through national planning, which is a cumbersome process designed for large infrastructure investments and may take years.

One STA member company has a 60MW solar project but cannot get planning permission to add battery storage and the network operator and regulator will not make a decision, even though the addition of storage this will not affect the export limits and performance constraints imposed under the connection offer. Storage assets, for example containerised battery storage units, are often smaller than generation assets of equivalent peak power capacity, and will have different spatial, and environmental impacts. In our view it would be inappropriate for storage developments to have to go through national planning rather than through the Town and Country Planning Act. Local planning has adequate checks and balances in place for assessing the environmental and other impacts of energy generation developments <50MW, and we perceive this would be the same for storage units.

It is important to note that the physical size (and other environmental and amenity impacts) of a storage asset is not only determined by the peak power capacity (MW) but also the energy capacity and output duration (MWh). A 20MW array of batteries that can discharge at maximum capacity for 1 hour will be smaller than a 20MW array that discharges over 5 hours. This should be taken into consideration when defining the planning process for storage.

Q.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.

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[7] SolarPower Europe (2016) 10 Policy Priorities for Solar & Storage: http://www.solarpowereurope.org/fileadmin/user_upload/documents/Media/281116_SolarPower_Europe_Outlines_10_Policy_Priorities_for_Solar___Storage.pdf

We support the ESN's definition, as developed by industry, which is at a higher level and therefore more widely applicable to technologies, markets and service requirements. We urge BEIS/Ofgem to issue an open letter stating the definition that will be used from now on for all modifications, market design, applications in existing legislation, etc.

Chapter 3: Providing price signals for flexibility

System Value Pricing

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

In the first instance, the fundamental enablers that create a benefit from offering flexibility are **drivers from price signals**, for example load-shifting at peak times in response to network charging or to provide arbitrage in the wholesale market. Price signals can be locational or temporal, and should aim to reflect both costs and the needs of the system. The stronger these price signals the greater the incentive to access flexibility, and where they are flattened the lesser the potential benefit for providers regardless of the needs of the system operator. Therefore greater visibility of and exposure to these price signals would help ensure the true system-value of flexibility can be captured and responded to by the market.

In terms of **time-based price signals**, many business models providing flexible solutions (e.g. storage, DSR providers) rely on these signals and could be unviable without them. In a smart, flexible energy system it is important that industry is given sufficient exposure to these to enable efficient operation of the network. This is discussed further in response to question 14.

In terms of **locational price signals**, there is already a strong locational element for connections: DNO offers to connect are determined by the works required in the local network to accommodate additional generation capacity. Any new connection is expected to pay the full cost of these works which could range from £10,000 to £10m+. For locational pricing for network charging (e.g. to give a clearer short-term signals as to the system's requirements for additional generation, flexibility, grid services) the entirety of networking charging would need to be made much more transparent, as currently it is challenging to estimate site-specific embedded benefits and other network charges. Further, there could be significant costs or benefits for different connection customers on the system, and this would need to be considered very carefully.

One locational element that should be introduced is that **curtailment and constraint on distribution networks should be valued properly and communicated to the market**. This would incentivise DNOs and other parties to alleviate these. Currently constraints are compensated on the transmission network, but DNOs have little to no incentive to reduce constraints, which weighs against efficient local management of networks and inhibits a level playing field for distributed solar generators.

In terms of other enablers, there could be structural reform to the balancing services market:

- **Greater transparency and consolidation of balancing and ancillary services**. There are currently c.32 ancillary and balancing services procured by National Grid. These can be similar in terms of technical specification and capabilities required, but there is complexity and a lack of transparency of the various tender processes. Frequently similar services attract very different prices, owing to opacity and a lack of competition across services where they have not been procured on truly open and transparent tenders. Services should be consolidated and steps should be taken to enable greater competition for these to bring down costs and enable more efficient allocation.
- **Open markets for balancing services.** Currently National Grid is the main purchaser of flexibility. DNOs and suppliers are not investing to a great extent. In Europe balancing services have been opened up to the market, rather than being centrally procured by the system operator. This has created a market of aggregators and private balancing services which has significantly reduced balancing costs in Germany: balancing costs have fallen by 50% in Germany since 2008. Denmark also operates a similar system.
- **Tradeable standardised flexibility products**. Open markets where products are standardised will enable more liquidity and competition, as flexibility products (for example, set durations of demand turn down/up) tend towards a competitively-determined and transparent price. This uniformity will attract more buyers and sellers to the market. In future these products should be tradeable peer-to-peer via open platforms to put further downward pressure on price.
- **Procurement of services could be closer to real-time**, to increase efficiency in the allocation of resources and creating a more accessible, competitive market. For example, frequency response is bought one month in advance, at which point it is difficult to assess how much might be needed. Closer to real-time procurement could enable allocation of a more optimal volume. Germany and Austria now have quarter-hourly trading products and gate closure for trading is 30 minutes ahead of real time. This means intra-day forecasting is very accurate

Other enablers include:

- There should be **more distribution level procurement of grid support services** and foresight on when and how much of this is likely to be procured. DNO-level services and network investments should be coordinated with whole system-level operations, as identified in chapter 5. This should include an open market for network deferral solutions, as discussed in response to question 44.
- **Longer contracts for services**. The recent EFR tender attracted prices of roughly half that for similar bids in the FFR tender. A significant contributing factor for this is likely to be contract lengths (4 years in EFR vs 1 year in FFR), which make projects more investible.
- Our members are also concerned at the **lack of clarity over which revenue streams providers are allowed to stack in bidding for services**, for example EFR. National Grid's Power Responsive programme is looking at multi-revenue contracts, enabling service stacking, which should be supported. In the meantime, there should be greater coordination and communication from National Grid and DNOs around which services are currently stackable and which are not.

Technology is a key enabler:

- **Smart *billing* metres** will create the capabilities for accessing the value of flexibility at the domestic level, enabling automated responses to time-of-use tariffs. There needs to be clear national technical specification of these to support smart system architecture, as without this the planned roll-out of smart metres will fall short of the policy intent. This includes enabling time-of-use tariffs for consumers with energy storage and PV. This is discussed further below.
- **Sufficient metering** for generators and flexibility providers down to low capacity thresholds, able to communicate in real-time with sufficiently granular data, will also be required. National Grid is currently consulting on this in their Requirements for Generators work stream. Steps should be taken to future-proof the industry for flexibility needs in the long-term to avoid the need for expensive and contractually complex retrofitting where metering or equipment needs to be replaced.
- **More investment in IT:** The industry has delivered substantial innovation in IT to enable smart business models, such as peer-to-peer trading and closer to real time responses to price signals. There is a risk that the whole system of generation and demand assets and other appliances are not equipped to integrate with and respond to these systems. Standards incentivising greater data exchange and more granular communication capabilities would speed the rate at which the system sees a benefit from this innovation.

Finally, the box below highlights some key grid flexibility services that solar provides to the grid that are often overlooked:

BOX: Grid Services that Solar PV can provide:

The latent capabilities of solar PV are underrated in the UK, and could easily become part of the solution given market access. PV plant operation can be modified to provide additional services to the grid. Presently, it is unclear what requirements PV generators should meet; enhanced co-operation between the PV industry, National Grid and DNOs is therefore needed. The need to harmonise requirements is important to avoid product variance and ensure cost-effective solutions.

Voltage control: Solar PV plants are already helping with steady state voltage control at the request of DNOs (and NG), but they are capable of much more. Solar PV plants are able to respond to remote signals and events that occur on the grid to help stabilise voltage, often within a matter of seconds.

Controlling how power comes online is also important for voltage control. Inverters, which are integral to solar installations, allow ramping up and down of generation capacity. Solar power is exceptionally well placed to offer voltage control services; it already has the necessary equipment in place. It is now mandatory to provide these services in Germany. STA member Belectric has sensors in the German network so that their solar PV farms can dynamically react in real time to the grid's needs for voltage control.

System inertia: There always needs to be sufficient inertia in the system to secure against the consequences of a supply/demand mismatch. Variable renewables can deliver 'synthetic inertia'- rapidly altering power output in a response to a change in frequency. This capability is not yet included in the Grid Code, but experience from Germany shows that this is well suited to supporting the grid's inertia needs. Belectric is currently providing a test case for doing this in the UK.

Frequency control: Sufficient levels of system response have to be scheduled by NG to maintain frequency. Solar PV plants can provide control services to the grid as they are able to switch on or off within a few seconds. National grid currently pays £200m for frequency controls from big centralised plant and they anticipate procuring more of these services in the future. Belectric is providing a much cheaper way of doing this using an 'Energy Buffer Unit', which comprises a solar farm and battery system and which can react extremely quickly to correct frequency disturbances.

Fast reactive power: As solar PV inverters allow millisecond responsiveness, canny traders in Germany are managing systems below maximum output so that output can also be increased upwards rapidly if needed. This is a question of the market valuing flexibility more than the opportunity cost, and it makes for a very efficient market.

Q.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?

Answers to this question are given in response question 12 - in addition:

As a first step **BEIS must intervene in Ofgem's current review of embedded benefits and other changes to network charges**. The removal of Triad benefits and implementation of DCP228 flatten time of use price signals and reduce the economics of providing flexibility, against the needs of the network operators. This is directly counter to the aim of this consultation, and is a step away from true system value pricing. The proposals have been designed by incumbents in industry through the CUSC and DCUSA panels where distributed generation and providers of flexibility are underrepresented. The system of self-governance enables expert assessment of a highly complex area, but fails where system change is needed and these parties have a commercial interest against the changes required to enable this transition. As an anecdote, we are informed there is little discussion in technical grid forums of a smart, flexible energy system, and issues are largely constrained to immediate problem-solving. Furthermore, as previously discussed, the current proposals fall short of removing all distortions from network charging and could lead to significant negative unintended consequences. Given the complexity and inter-related nature of network charging, there needs to be an independent holistic review of network charging that is fit for the future envisaged in this call for evidence.

Our perception is that Ofgem is too willing to accept industry code modifications without objective scrutiny and alignment to strategic objectives. We are concerned about resourcing of comprehensive and holistic network charging review, yet this is necessary. We urge Ofgem and BEIS to commission/fund this.

Stronger incentives on DNOs to incorporate procurement of flexibility (and other smart services) into business as usual. For example the RIIO framework has intended to incentivise DNOs to use more flexibility products vs traditional capital-intensive upgrades. Much of the actions resulting from this process have been through innovation trials, but there is little evidence to date that DNOs are subsequently implementing this in their core business. These incentives could be strengthened and the economic and policy incentives shaping DNO activity could be re-assessed to regulate towards a system where local balancing and procurement of flexibility becomes business as usual. This is discussed in chapter 5.

Smart Tariffs

Q.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.

We have responded to questions 15-18 together

The STA agrees with the proposed benefits of smart tariffs for both the domestic and commercial consumer. We also agree with the premise that building blocks need to be in place before smart tariffs are likely to be adopted by customers. However some observations are discussed below:

Greater clarity is needed on the impact of smart meters on deemed export for domestic solar. To potentially avoid damaging retrospective change, existing solar generators will want assurance that the introduction of a smart meter will not impact their ability to have a deemed 50% export without

their approval. We appreciate that the deemed export was introduced initially as a temporary measure where 'it is not possible or practical to measure export by way of export meter readings', with a long term intent to remove it once sufficient metering is in place. The Secretary of State reviews the deemed export provision each year and within the last FiT review there was insufficient evidence available to justify a change. Following discussions with Ofgem members are concerned that policy decisions may be made on the treatment of existing FIT customers without full consultation or notification. It is vital that Government engages with industry long before any changes to this policy are considered, and they must signal their intention early.

In relation to smart tariffs, implementing a 'smart' system for domestic consumers is not as simple as introducing half-hourly settlement and smart tariffs. Whilst this is a significant improvement on the current 'fixed' consumer price it is insufficient on its own. 'Smart and flexible' is the goal, which implies the need for technologies that enable load-shifting and interaction with the network, solar with storage and smart appliances.

The main role of Government in the smart meter roll-out should be in setting clear national technical specifications of minimum capability required, which are currently lacking. Without this the planned roll-out of smart meters will fall short of the policy intent. It is vital that meters are capable of smart *billing* in the true sense, and not simply more granular, automated metering of consumption. Another step government could take is ensuring product manufacturers are offering smart appliances in order to improve the viability of responding to market signals.

Once the technological enablers and incentives are in place, the growing competitive nature of the energy supplier market coupled with the growing 'prosumer' approach to onsite generation should ensure a healthy market in smart tariffs. However, there are further hurdles to achieving this;

There is a mismatch between the whole-system benefits of residential-level exposure to time-of-use price signals (for which aggregators are best placed to take advantage) and the current incentives for consumers to adopt the technology. It took four years to deliver 875,000 solar homes with a good tariff-based incentive. Consumers understood that a payback/return on investment was a worthwhile investment as well being good for the environment. The Government is planning on installing ~53m smart meters over the next four years without significant perceivable benefits. That is a very big ask. Whilst consumers may be interested, their goal will be to save money but with minimal effort.

Without greater incentives and a more rapid deployment of residential-scale storage we are concerned that individual homeowners may not be sufficiently informed or incentivised to take advantage of half-hourly signals. The likely result will be a relatively limited market of early adopters. However, aggregators and supply companies are well-placed to accelerate uptake given their own interests in residential-scale flexibility. It is important that appropriate incentives are in place for them, and that supply companies are able to properly communicate the benefits of smart meters, and that these are made immediately available to consumers.

Smart Distribution Tariffs - incremental change

Q.19 Are distribution charges currently acting as a barrier to the development of a more flexible system? Please provide details, including experiences/case studies where relevant.

We have responded to questions 19-21 together.

Yes, distribution charges are acting as a barrier. The current regime was designed for a highly centralised system and recovered costs accordingly – although current charges are widely acknowledged not to be cost reflective. The electricity system is now becoming more distributed, so distortions are increasing as the regime of charges no longer fits the design (and intended future design) of the electricity system. Naturally there can be a tendency in the traditional industry to resist adjusting cost recovery.

As above, moves to flatten time-of-use signals on the demand side reduce the competitiveness of distributed flexibility providers to the benefit of incumbents. Another barrier is the lack of a forward view of DUoS charges, which would have been less important in the past in a more 'one-way' system, but with the increasing importance of DSR in managing our networks is now limiting the ability of demand customers to respond. More forward visibility would enable greater consumer engagement.

Who pays for the grid is a key question that needs addressing if we are to transition to a more flexible, distributed energy system, and distribution charges will need to be both cost-reflective while also fit for purpose in facilitating this strategic change. Incremental adjustments will enable a certain amount of progress but are inadequate, particularly given the interrelated nature of network charges and their knock-on effects. Furthermore, incremental changes are often likely to be counter to the policy intent, given industry self-governance of the codes.

Therefore the urgency must be on implementing an holistic review early, given the timescales involved, to design a regime of network charges fit for the future. This requires fundamental change, and should recognise the inherent benefit of locating generation close to demand, as well as providing price signals that enable the market to respond according to network needs in providing efficient solutions.

Smart Distribution Tariffs - fundamental change

Q.22 Do you anticipate that underlying network cost drivers are likely to substantively change as the use of the distribution network changes? If so, in what way and how should DUoS charges change as a result?

Yes. Network investment is primarily driven by the requirement to meet peaks in supply and demand, which in the past have been accepted as a given and relatively predictable. With greater electrification and more variable and distributed supply in future peaks are likely to increase and put stress on expensive network assets. Much of our distribution system is more than 50 years old and designed to supply homes and business of a different era. Challenges to distribution infrastructure will become more acute in the future with more embedded generation and increased demand from electrification of heat and transport. Concurrently opportunities to shave peaks are becoming clear.

This will engender both new stresses and opportunities on local networks and DNOs must have inadequate capacity and incentive to respond. Traditional means of managing, such as capital-intensive grid upgrades, are often not the optimal solution and may result in significant sunk costs in underused networks that must be borne by the end consumer. Business models for investment and cost recovery will therefore also have to change, as DNOs need the option to use technologies other than cables and transformers in network design – the potential for demand reduction also exists. Therefore it is important that generators and flexibility providers have adequate exposure to network cost drivers to enable DNOs and providers of flexibility to manage the network through efficient allocation of resources.

DUoS charges should reflect the inherent value of locating generation close to demand, particularly in locations where there is a shortage of supply. For example, as identified by the ECC Committee, the UK has higher than average network losses at roughly 8%[8]. Solar provides a benefit for the consumer in reducing these losses. Charges should also enable industry to access to the value of responding at times when the system would benefit from an increase or reduction in load. Charges should also be published over longer time horizons to allow greater forward visibility.

National Grid is currently undergoing a charging review in response to equivalent issues at transmission level[9]. The aim is to identify both short- and long-term issues and solutions that could be implemented in order to re-design network charging that facilitates efficient allocation of resources in future. We support this initiative, though it should not be carried out without proper consideration of network charging at distribution level, or there may be unintended consequences. An independent, holistic review of charging across the whole network should be undertaken that takes into account the needs of the whole system in view of a smart, flexible energy future.

Q.23 Network charges can send both short term signals to support efficient operation and flexibility needs in close to real time as well as longer term signals relating to new investments, and connections to, the distribution network. Can DUoS charges send both short term and long term signals at the same time effectively? Should they do so? And if so, how?

DUoS charges do send both short- and (to a lesser extent) long-term signals effectively at commercial and industrial scale. Short-term signals for efficient operation are provided in time-of-use price differentials, enabling providers of flexibility to respond to network stresses in real-time as appropriate (though this would be enhanced with greater forward-visibility of DUoS as noted above), while long-term signals for new investment and resource allocation are provided in the anticipation of the economic benefit of meeting these short-term signals.

In order for distribution charges to provide greater long-term signals for efficient investment in resources, DUoS charges should not be considered in isolation from distribution connection charges. There is currently an 'all or nothing' approach to connection charging, in which customers are

[8] ECC Committee (2015) Energy network costs: transparent and fair? http://www.publications.parliament.uk/pa/cm201415/cmselect/cmenergy/386/386.pdf

[9] National Grid (2016) National Grid Charging Review: http://www2.nationalgrid.com/UK/Industry-information/System-charges/Electricity-transmission/charging_review/

expected to take on disproportionate cost burdens should their connection precipitate network upgrades. This raises a significant barrier to entry for smaller, embedded customers, which will include providers of flexibility and distributed generation, therefore dampening the ability of industry to respond to long-term price signals. There needs to a more 'mid-way' charging framework, and a package of network charging that recognises and facilitates the benefit of local generation and balancing.

At the domestic scale distribution charges are not providing sufficient price signals, as there is not yet half-hourly settlement and most customers are billed on a fixed-price contract with suppliers. Even when half-hourly settlement is implemented the price signals are unlikely to influence investment decisions (other factors are much more significant in determining this). However, despite the very small price differentials, smart billing metres would enable exposure to these and aggregators will be well-placed to take advantage of this.

Q.24 In the context of the DSO transition and the models set out in Chapter 5 we would be interested to understand your views of the interaction between potential distribution charges and this thinking.

Answered in response to chapter 5. In addition, we note the ECC Committee took evidence that charging generators at all for the use of the system is unusual in the EU and this could lead to competitive disadvantage as the UK integrates[10]. It has long been appreciated that current network charges are largely fudged and work is needed to identify truly cost reflective charging, taking account the broader economic benefits of providing intelligent price signals. To conclude, an independent holistic review of network charging is needed that takes into account the cost *and benefit* of different technologies on the system.

Other Government Policies

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

In order to meet the requirements set out in the Carbon Budgets at least cost we will need more renewable energy on the system. This will lead to greater variability of supply and embedded generation across the network. The NIC identified flexibility as a 'low-regret' option that can deliver considerable savings regardless. However, a smart, flexible energy system eases the integration of variable renewables into the system so that the renewables pathway is clearly the cheapest pathway. Distributed renewables and flexibility are also essential for the electrification and decarbonisation of transport – flexibility greatly reduces the carbon footprint of EVs. A smart energy future is one in which consumers are empowered. The physical and financial scalability and load profile of solar leave it well placed to open up the power sector, shifting power - in both senses of the word - towards the

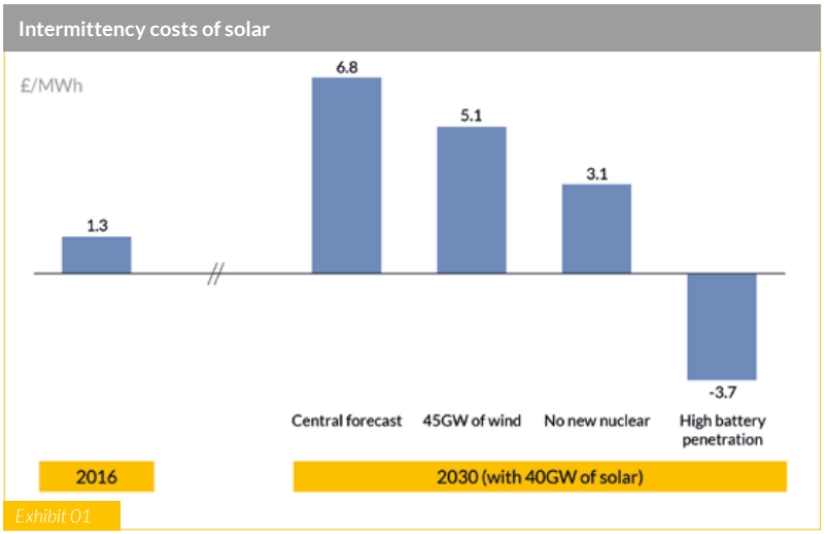
[10] ECC Committee (2016) Low carbon network infrastructure inquiry: https://www.parliament.uk/business/committees/committees-a-z/commons-select/energy-and-climate-change-committee/inquiries/parliament-2015/low-carbon-network/

consumer. Realising the full benefits of a smart, flexible energy system therefore will only be possible with embedded generation, particularly solar.

The economic benefit for the consumer of the transition to a smart, flexible energy system has been quantified by the National Infrastructure Commission at c.£8bn per year by 2030, repeated in this call for evidence. It is important to note that this will only be enabled if renewables continue to be deployed on the system and in the efficient fashion smart approaches enable. Part of this benefit can be seen as a 'payback' for historic renewables support mechanisms for funded with consumer levies.

Aurora Energy Research analysis illustrates the imperative for deploying solar[11]. Assuming 40GW of solar in 2030, in line with the Committee on Climate Change's 50gCO_2/kWh scenario in the 5th Carbon Budget[12], the system integration costs of solar increase from negligible costs today to more significant levels (Aurora's modelling indicates an increase from £1.3/MWh to £6.8/MWh). Part of this cost is driven by output variability (power generated not necessarily when it would be most valuable) and part through the need for backup generation to provide security of supply when solar irradiance is low.

However, when coupled with a high deployment of battery storage (8GW), the system integration costs become negative: i.e. there is a net economic benefit in system integration costs from a high deployment of solar coupled with a high deployment of batteries. The benefit comes primarily from two factors: from the unique synergy of solar with battery storage which works exceptionally well to meet peaks. This puts downwards pressure on prices in the energy and balancing markets through load shifting and arbitrage; and from battery output displacing the need for more expensive peaking plant, for example reducing prices in the capacity market, and therefore bringing overall system costs down. This is shown in the graph below;



[11] Aurora Energy Research and STA (2016) Intermittency and the cost of integrating solar in the GB power market: http://www.solar-trade.org.uk/intermittency-cost-integrating-solar-gb-power-market/

[12] CCC (2016) The fifth carbon budget – The next step towards a low-carbon economy: https://www.theccc.org.uk/publication/the-fifth-carbon-budget-the-next-step-towards-a-low-carbon-economy/

A conclusion of this analysis is that **flexibility will be cheaper to deploy on the system with a high deployment of renewable electricity generation to complement it**. Batteries move power from when it is generated to when it is most needed, thereby improving the capture price of renewables and better matching supply to demand, which is also variable. This is done more economically using solar than would be the case from equivalent generation assets with a continuous (i.e. "baseload") power output profile. Indeed, the graph above also highlights the system cost of the lack of flexibility new nuclear will impose. It is often forgotten that large, centralised units of inflexible supply also impose their own system costs, including the implications of unplanned failure or maintenance.

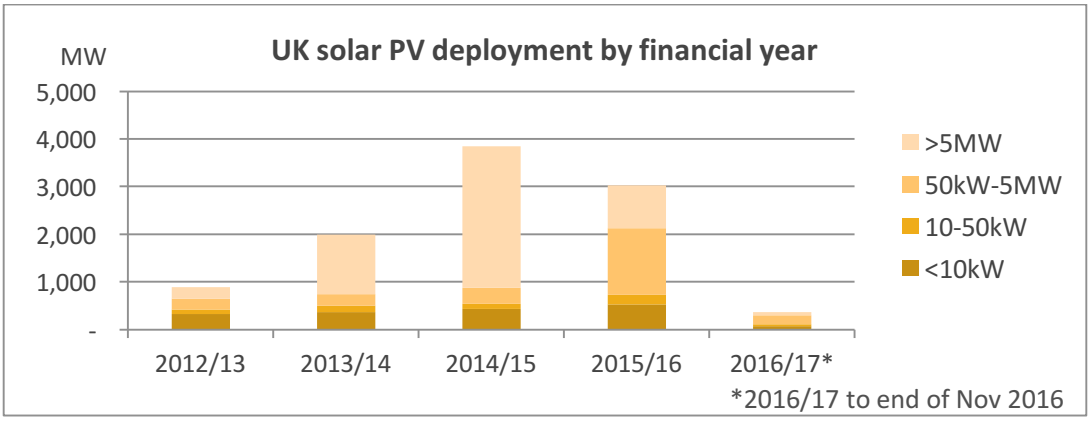
Given the interdependence and synergies between storage and variable technologies it is inefficient to deploy one without the other, and vital that Government continues to support both. Unfortunately, the speed and scale of recent changes to Government policy have put cheap and innovative solar deployment at risk.

Large-scale solar: In BEIS's LCOE projections[13], although an imperfect measure for representing the true price of electricity, large-scale solar will be one of the cheapest ways of generating clean power by 2020, and the cheapest way of generating power outright by 2030 alongside onshore wind. This must be taken into account given the government's commitment to affordable energy for the consumer. For solar 70% of these cost reductions need to come from balance of system costs (as opposed to module prices), which depend on an efficient route to market and economies of scale, and are therefore highly policy- and country-specific[14]. In other words, this is a sector that needs volume growth & an efficient operating environment in order to drive down costs. There is therefore a major role for the UK government to facilitate solar cost reduction to deliver the cheap and clean power needed for a decarbonised, smart, flexible energy system. The removal of a route to market for large-scale solar over the past 18 months has led to a dramatic reduction in deployment, as shown in the following graph[15].

[13] BEIS (2016) Electricity Generation Costs: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/566567/BEIS_Electricity_Generation_Cost_Report.pdf

[14] IRENA (2016) The power to change: solar and wind cost reduction potential to 2025: http://www.irena.org/DocumentDownloads/Publications/IRENA_Power_to_Change_2016.pdf

[15] Data source: BEIS (2016) Solar photovoltaics deployment https://www.gov.uk/government/statistics/solar-photovoltaics-deployment



Market access is further inhibited by the cannibalisation effect of variable renewables, the increasing subsidy of fossil generators through the CM and the freezing of the CFP. Wholesale prices alone are no longer an adequate investment signal for new generation. Without appropriate market frameworks more utility scale solar will not be built. The government has taken steps to address security of supply risks through the capacity mechanism, supporting thermal generation through consumer-funded levies. Government now needs to address carbon and affordability risk.

The cheapest clean technologies including utility solar have been shut out of the market following the closure of the RO and the ongoing absence of 'Pot 1' CfD auctions. This is an own goal that will increase the cost of decarbonising our energy supply, reduce competitive pressures and slow the transition to a smart energy future.

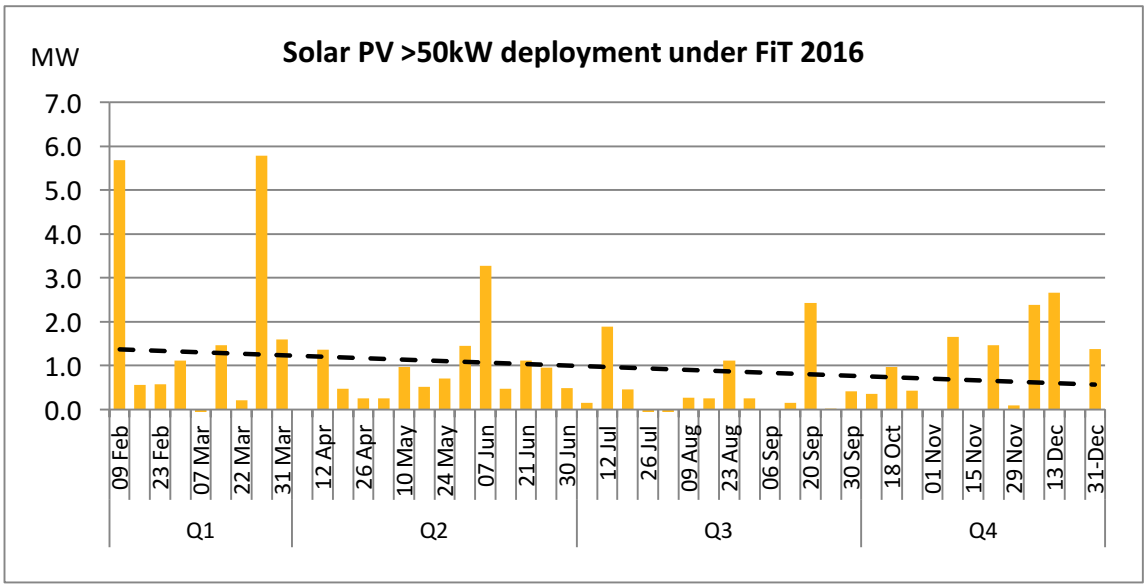
Shutting competitive technologies out of the market also threatens the diversity of generation on the system. The economic importance of diversity is highlighted in the Aurora graph on system integration costs of solar above. The portfolio effect from the generation profiles of wind and solar reduces the need for backup and overall system costs. Therefore it is essential that all technologies are allowed to compete and deploy together.

Commercial rooftop solar: Commercial rooftop solar is particularly important to the smart energy agenda. The greatest system efficiency savings can be achieved through the commercial sector according to NG. Commercial companies are increasingly interested in investing in solar, storage, EV fleets and in taking DSR contracts. Solar is particularly cost-effective and efficient at this scale, where it provides necessary day time power at the point of use and competes with retail prices.

Regrettably the commercial solar rooftop market has been historically under-supported in the UK. The 2014 DECC Solar Strategy promised to put 'rocket boosters' under the commercial rooftop sector. Instead the FIT was cut dramatically and commercial rooftop deployment constrained to an extreme extent through capacity triggers. Not surprisingly the already modest commercial rooftop market has declined further as shown in the graph below[16]. Incredibly Government policy has threatened the

[16] Data source: Ofgem (2017) Feed-in Tariffs deployment caps reports https://www.ofgem.gov.uk/environmental-programmes/fit/contacts-guidance-and-resources/public-reports-and-data-fit/feed-tariffs-deployment-caps-reports

commercial rooftop sector even further through the sharp planned business rate rises for onsite self-supply with solar from April. This is particularly perverse from a smart energy perspective because the new business rates will reward exporting solar power onto the grid and strongly penalise self-consumption. We urge the BEIS smart power team to speak to HMT colleagues as soon as possible to explain why this would be nonsensical.



We have been working with the VOA, BEIS, HMT and DCLG to ensure that business rates on rooftop solar are proportionate. Of further concern is that battery storage is also included alongside solar cells and panels in Table 1 of Statutory Instrument (2000/540) outlining the valuation of plant and machinery[17]. The simple threat of these tax increases has already put the sector at risk and at a competitive disadvantage (CHP is exempt from business rates) both at home and internationally.

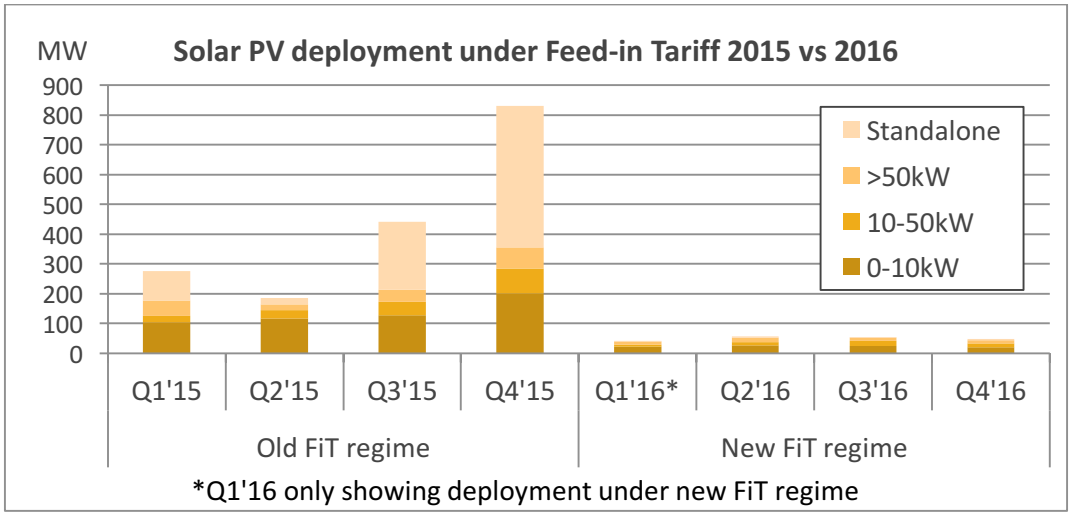
It is vital that government actively supports the deployment of commercial rooftop solar.

Residential solar: The domestic solar market has shown continual underperformance since the FiT review. The majority of the more than 12,500 job losses[18] over the past year in solar have been concentrated in the domestic installer industry segment. Unless the market recovers, the potential to use solar to help drive smart, flexible capabilities at residential scale will be inhibited. The STA recognises the industry's responsibilities to help improve this market but is keen to work with Government to achieve this (see below).

[17] Her Majesty's Government (2000) The Valuation for Rating (Plant and Machinery) (England) Regulations 2000 No. 540 http://www.legislation.gov.uk/uksi/2000/540/pdfs/uksi_20000540_en.pdf

[18] STA and PwC (2016) Seeing through the gloom: UK solar seeks stability after subsidy cuts: http://www.solar-trade.org.uk/pwc-and-sta-survey/

Following a c.67% reduction in the tariffs and the imposition of barriers such as deployment caps, the residential and commercial rooftop solar markets are failing. STA analysis[19] shows there has been a c.83% year-on-year reduction in deployment under the FiT since the changes came into force early last year, as shown in the graph below[20].



The domestic tariffs have been reduced to a rate too low to sustain a healthy market, with c.40% of the entire solar budget under FiTs going unspent last year as take-up has declined.

Q.26 What changes to 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?

The latest CM auction results show progress in bringing more flexibility online, and enabling new entrants to compete with existing generation, but more progress on this is needed to level the playing field for flexibility providers. We suggest the following as examples of measures that could be taken to achieve this:

Longer contracts for DSR and storage. This issue is well-known and frequently voiced by industry, but the impact cannot be understated. Short contract lengths (1 year for DSR and storage vs 15 years for thermal generation) reduce the window in which assets must provide a return for investors, increasing both the cost per MW and the cost of capital. The disparity in contract lengths arises in part due to the wish to incentivise large-scale new build plant, with capital expenditure thresholds in place to facilitate

[19] STA (2016) Solar deployment under Feed-in Tariff Q1-Q3 2016 http://www.solar-trade.org.uk/wp-content/uploads/2016/11/Solar-PV-FiT-deployment-Q1-Q3-2016_STA-briefing-1.pdf

[20] Data sources: DECC (2016) Monthly MCS and ROOFIT degression statistics https://www.gov.uk/government/statistical-data-sets/monthly-mcs-and-roofit-statistics ; Ofgem (2017) Feed-in Tariffs deployment caps reports https://www.ofgem.gov.uk/environmental-programmes/fit/contacts-guidance-and-resources/public-reports-and-data-fit/feed-tariffs-deployment-caps-reports

this. However, it reduces the ability for cheaper and more efficient options to provide the same service. DSR and storage are unlikely to require 15 year contracts, but small increases in contract lengths would provide substantial cost benefits.

Secondary market for obligation trading. This is similar to the concept of tradeable standardised flexibility products outlines in response to question 11. The more industry is enabled to find the cheapest solution the more efficient the outcome, and the cheaper the final cost to consumer. Were industry able to sell (elements of) their CM obligations on a secondary market it would draw more providers of flexibility into the CM.

Allow EFR as a relevant ancillary service for CM contract delivery deviation. EFR delivery is currently not seen as a permissible reason for deviating from capacity market contracts, whereas FFR are is. This is illogical and should be resolved.

Q.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?

In response to this question we first highlight the need for more fundamental market design reform, before highlighting areas of current policy that need adjusting to level the playing field for solar power.

Consecutive interventions in the energy market have removed competitive pressures. Capacity market payments and the low marginal cost of renewables have reduced the wholesale price to the extent that sufficient generation, renewable or otherwise, will not be built in the current framework without a support-mechanism, ultimately paid for by the consumer. There is currently no route to market for large scale solar and no signalled resolution of this in future. Government's cherry-picking of (usually more expensive) technologies for support is reducing competitive pressures and shutting out some of the cheapest ways of generating clean power.

The question asks for interventions in which technologies fully account for the costs and benefits they place on the system. The market stabilisation CfD proposal (see below) seeks to approximate this by incorporating carbon and wider system within the strike price. However, costs and benefits are likely to remain contested and they start from the legacy of a once publicly funded centralised system.

There must be realism on whether on can ever 'fully account for the costs and benefits' of generation. These will shift depending on how the system works. For example, if DNOs are sufficiently empowered to transition to DSOs, the DNO and TO interface can be much better managed to avoid costs & difficulties for NG, thus reducing the costs of distributed power. The reality of technology change is that, regardless of analyses, business and consumers increasingly want to invest in EVs, solar, storage and other onsite technologies. This is a trend that any modern economy must recognise and enable. The challenge is to enable that to happen as cost effectively as possible. The opportunity is to act early.

The CfD has short-comings as it insulates against market signals to some extent. The same can be said for the capacity market, which some argue is an inefficient and relatively expensive means of guaranteeing security of supply. By comparison Germany intends to rely on competition in power

markets to provide security of supply at least cost relying only on a modest security reserve (5% of peak demand capacity)[21]. DECC's own impact assessment for the capacity market initially estimated that a standing reserve would have been considerably cheaper [22].

As far as possible market design should maximise competition (open tendering on performance, not technology) to achieve strategic objectives. Government's role must be in setting a framework based on the principle of leaving outcomes to the market as far as possible within clearly defined regulatory parameters. This includes carbon performance which we believe needs stronger emphasis in the power industry to steer investment. Alongside other trade bodies we look forward to working with government on pursing these principles more effectively in future.

In the near term, we identify modifications to current policy that can level the playing field for solar, better incentivising the deployment of renewables while accounting for the costs and benefits to the system.

Reform the LCF in line with a smart, flexible energy system. Solar has extremely low support needs today to be viable – the STA is looking for only £30 million in a new Pot1 round open to all mature technologies. Government intervention to remove barriers and enable routes to market is as important as appropriate subsidy. The STA is concerned by the Government's approach of cherry picking particularly large-scale technologies – mostly more expensive than solar – for public subsidy. Going forwards there needs to be competitive access to markets and a more level playing field for distributed power. The LCF and other policies outlined in this section should support this if the Government wants to deliver a smart, competitive and cost-effective system.

Large-scale solar: The CfD provided a mechanism for overcoming the lack of route to market for cheap, utility solar and this should be reinstated. The mechanism gives the Government clear volume control and supports intra- and inter-technology competition. Additional, regular auctions for solar should be reintroduced.

- One solution currently being discussed with BEIS is a **technology neutral 'market-stabilising' or 'subsidy-free' CfD**. It is possible to set an administrative price cap that approximates an appropriate cost of generation as well as wider costs (e.g. the carbon price and the system integration costs of intermittency). This would mean all technologies, including gas, could compete for CfDs so that the cheapest energy is procured. The CfD framework has the potential to evolve into a payment method for providing the low-carbon generation that the UK needs in the 2020s without any net subsidy – it provides a route to market that ultimately

[21] Clean Energy Wire (2016) Germany's new power market design: https://www.cleanenergywire.org/factsheets/germanys-new-power-market-design
[22] DECC (2011) Impact Assessment: Capacity mechanism - intervention and options: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/42797/3883-capacity-mechanism-consultation-impact-assessment.pdf

saves consumers money[23]. We welcome the chance to work with government on this concept further.

- Failing this, given the lack of a route to market or competitive opportunities for large-scale solar, we envisage that solar plus storage could compete for pot 2 CfDs, therefore procuring both renewable capacity and flexibility at the same time. These sites are more responsive to market price signals, and would therefore be more responsive to the needs of the system.

Commercial- scale solar: Commercial actors are able to unlock huge potential investment in distributed generation and technologies that provide flexibility. The sector can be highly engaged, offers scale and a learning space where business energy models of the future can be trialled.

- **BEIS must implement biannual FiT budget reconciliation and address barriers to commercial rooftops.** In the government's response to the FiT review consultation in December 2015 It was established that BEIS would monitor the FiT budget and tariff bands, making adjustments with underspend where appropriate. An increase in the current low quarterly cap volume in the >50kW band under the FiT would allow meaningful growth in this market. We calculate an additional 70MW could be delivered at no additional cost to the budget already committed by recycling unspent funds. This equates to a potential additional investment in solar of £70m (c.60% of which on UK content), and would engage more businesses in the energy system. Please see further proposals in our position paper *Making Feed-in Tariffs Work*[24].

- **Solar should be incentivised through the tax framework.** Currently solar is penalised in the tax framework with fossil fuels receiving more favourable treatment (ECAs, business rates). This is totally unacceptable - as a bare minimum solar must operate on a level playing field. The upcoming six to eightfold increase in business rates on solar installations intended primarily for self-consumption is directly at odds with transitioning to a distributed, flexible energy system. The STA has worked with the VOA to successfully agree appropriate rateable values on solar intended for export, however due to legislation introduced in 2000 (well before the mainstreaming of solar PV and the very concept of a smart energy future) the VOA is unable to set these rates appropriately for installations intended for self-consumption. We propose that **all solar, whether for export of self-consumption, should be valued equally according to the rates already agreed with the VOA**. In addition, the expiry of the micro-generation exemption from ratings for sites <50kW will inhibit future deployment. BEIS must make this case to Treasury and urge intervention on this issue. A resolution is possible in secondary legislation without further need for consultation. A legal precedent exists for onsite Combined Heat and Power, which is already classed as excepted plant and machinery.

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[23] CCC (2016) The fifth carbon budget – The next step towards a low-carbon economy: https://www.theccc.org.uk/publication/the-fifth-carbon-budget-the-next-step-towards-a-low-carbon-economy/ ; Policy Exchange (2015) Powering Up: the future of onshore wind: https://policyexchange.org.uk/wp-content/uploads/2016/09/powering-up-2.pdf

[24] STA (2016) Making Feed-in Tariffs Work: http://www.solar-trade.org.uk/making-feed-in-tariffs-work/

- **Enhanced Capital Allowances** should extend to solar and storage. Currently solar has the lowest capital allowance at 8% - compared to 20% for general plant and machinery. We have opened discussions with the Carbon Trust and a number of tax experts to determine the impact of introducing ECAs for solar. STA modelling on a 250kW system shows that an ECA increases the IRR of solar by potentially 2.5%, reducing the payback time by three years. The significance of this is that **the value of an ECA may be more significant than the value of a generation tariff for large companies.** Government should work with the Carbon Trust to include solar PV in the Energy Technology List, making PV eligible for enhanced capital allowances (ECAs). This could be done on a self-consumption rather than a product differentiation basis. We would welcome the opportunity to discuss our work on this in more detail.

Residential-scale solar: Residential solar will provide the foundation of an engaged consumer model, and the solar sector is well-placed to effectively promote its rollout. The experienced sales and technical workforce can promote residential solar in combination with battery storage, the roll out of smart billing meters, EV charging points and smart appliances. We welcome the aims of the Bonfield Review and look forward to engaging with that process, though we stress that more concrete action and detail is needed to boost the home retrofit market. There is a number of barriers that the STA has asked BEIS to consult on in 2017 to help stimulate the market. These are set out below:

- **Implement biannual FiT budget reconciliation & remove red tape.** As above, we are now nearly one year into the new FiT scheme and no biannual budget reconciliation process has been forthcoming. Half of the budget for solar FiTs <10kW was unspent last year. BEIS must please address this. We submitted evidence on this in our position paper *Making Feed-in Tariffs Work*[25], where we also established a number of barriers that could be removed at no extra cost beyond that already committed. For example, the requirement for an EPC rated D or above to be issued before the commissioning date on an MCS certificate to be eligible for higher rate FiTs is not workable for new build properties, as an EPC cannot be carried out on an incomplete home. Given that all new builds are built to an EPC of D or above regardless, and that there is a FiT budget cap, this is an unnecessary requirement that is inhibiting the most cost effective means for increasing deployment of residential solar - installation during construction.

- **Safeguard the export tariff:** we have started early discussions with BEIS around the future of the domestic solar market post Q1'2019 when the FiT scheme is due to close. We propose that there needs to be a fair export price providing a floor that accurately reflects the market value of generation spilled onto the system.

- **Explore smart solar:** BEIS is interested in how a package of technologies (solar, storage, smart meter and time of use tariffs) might be incentivised. We agree an integrated approach could be a good opportunity to accelerate smart homes. We are open to discussion of this policy, though we must point out some members are resistant to further Government support

[25] STA (2016) Making Feed-in Tariffs Work: http://www.solar-trade.org.uk/making-feed-in-tariffs-work/

schemes having experienced severe damage from shock policy changes. The STA remains keen to work with BEIS on this concept.

- **Higher building standards to future-proof our housing stock for a smart, flexible energy system.** Following the removal of the Zero Carbon Homes commitment, government needs to re-commit promptly to regulations that will future proof our housing stock for a smart, flexible energy system. Higher building standards will boost the deployment of solar, as well as smart-enabled homes suitable for storage, smart meters, smart appliances and electric vehicle charging points.

Chapter 4: A system for the consumer

We perceive that the questions on smart appliances, ultra-low emission vehicles, cyber security and DSR are more expertly answered by those working in the sector, and as such have not responded in detail. However we highlight some key points for consideration.

Smart Appliances

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

Consumer representatives are advising a strong emphasis on automation to ensure the benefits of smart metering can be more equitably shared and a gap does not develop between savvy and more vulnerable households – this again supports the need for higher specification smart meter functionality, as highlighted in response to question 15.

Ultra-Low Emission Vehicles

Q.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?

Sale of EVs is set to increase dramatically in the years ahead. Owing to consumer behaviour, vehicle performance and the introduction of low emission vehicle zones, electric vehicles are most likely to be deployed in cities. In addition to electrification of heat this will lead to sharp and spatially concentrated spikes in load. This will place increased stress on both the national and local electricity distribution networks across the country. Distribution costs presently make up 25% of a domestic electricity bill at present (according to Ofgem Data[26]) and costs are increasing.

[26] Ofgem (2017) Breakdown of an electricity bill: https://www.ofgem.gov.uk/chart/breakdown-electricity-bill

The growth of EVs, not only solar, is therefore necessitating a smart approach on local networks. Without a smart system Imperial's analysis shows the carbon footprint of EVs will remain high and demand spikes will result in huge asset and network inefficiencies. The benefits of EVs over fossil fuels cars are immense – everything from air pollution, public health, to carbon and noise pollution – illustrating how hard it is to fully account for the costs and benefits of providing distributed infrastructure.

A shift to electric vehicles offers the opportunity to intelligently deploy distributed solar PV to charge EVs and reduce local network pressures. A report by the RAC estimated that cars are parked for more than 95% of the time.[27]

Chapter 5: The roles of different parties in the system and network operation

It is very difficult for us to objectively assess if, as the Government and Ofgem state, RIIO already provides sufficient tools for DNOs to transition effectively to DSOs, yet this is a fundamental question. The solar industry's experience of RIIO was that solar deployment was woefully under-forecast, relying on data that was clearly out of date. RIIO does not provide enough incentives on DNOs to open up flexibility markets. The timescales identified in RIIO-ED2 seem a very long way off to the solar & storage industries - realising the vision of smart power requires bolder action today to keep pace. We welcome DNO innovation, but there is frustration at the culture of ad hoc DNO pilots when the industry is clearly ready and keen to deliver innovative solutions now - as the sheer scale of the response to the EFR process demonstrated. Opportunities for doing so need to be opened up as quickly as possible through open and transparent markets to provide solutions, particularly in network deferral and ancillary markets. In contrast, current experience on the networks is too often inconsistent, unfair and frustrating (see case studies below) suggesting current incentives are inadequate/misaligned. There needs to be far greater national harmonisation of approaches.

We are confident the market is ready to deliver much of the massive technological innovative smart systems require. Responsibility lies with BEIS and Ofgem to expedite deeper system-wide changes that enable the market to innovate and deliver key smart power capabilities on a large scale.

We recognise that change takes time, but Government rightly recognises today's tremendous technological momentum and the economic opportunity. In our view Ofgem and BEIS need to better define the desired DSO model and correctly align commercial incentives to achieve widely desired outcomes. This is also true for the SO which appears to be carrying out a lot of 'good will' work despite uncertainty on its future role – this isn't sustainable. We recognise this will take some time. However, we believe that there are early actions that could be taken under the Spring Plan with the opportunity for the RIIO-ED1 reopener to provide earlier and desirable system-wide changes. We note the ECC Committee Inquiry into DNOs recommended an interim review of RIIO and believed the settlement was too generous and targets too easy to meet.

We would particularly welcome:

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[27] RAC (2012) Spaced out: perspectives on parking policy: http://www.racfoundation.org/research/mobility/spaced-out-perspectives-on-parking

- Prompt action to unlock distribution network reinforcement deferral markets which DECC/Ofgem estimate can save £2.5 - £12 billion to 2050[28]
- Consolidation of balancing and ancillary services, more open markets for these (as identified in response to question 11) and harmonisation and coordination of these between the distribution and transmission level
- Clearer definition and recognition of the grid services distributed generation can provide
- A holistic significant review of network charging within the strategic context of enabled DSOs
- Reformed membership and processes on the network Code Panels to reflect smart energy needs and stakeholders

Resolving network difficulties to date has relied on discussion at technical fora at which the renewables industry is now barely represented (please note the Associations are currently working to correct this) – this underrepresentation is a direct result of the scale and pace of support removal for renewables. When the industry benefitted from significant representation the consistent feedback was the lack of strategic direction from Government and Ofgem inhibiting effective progress. There is also concern at the make-up of the Codes Panels, which no longer reflect the stakeholders in clean, smart energy. As above, we are disappointed by current damaging regulatory changes which are counter to the smart power agenda, namely the Embedded Benefits Review and DCP228.

Q.43 Do you agree with the emerging system requirements we have identified (set out in Figure 1)? Are any missing?

We agree with the emerging system requirements identified, albeit we emphasise the opening up of markets for 'non-build' solutions and ancillary services to the industry as a means to encourage greater competition. We would also add de minimis security-of-supply factors as these have a significant impact on network charging. We are surprised not to see carbon performance as a system requirement, which is surely the key driver for change. We understand German networks are required to meet carbon targets. It is these kinds of performance targets that must drive investment in future.

We agree that immediate action is urgent and necessary and we stress that priority areas/barriers should be acted on swiftly, but we also believe further analysis is needed to correctly identify the fundamental reforms needed to the DSO business model. What is missing is *how* the DNO/DSO business model will change comprehensively to align shareholder value with system requirements and with a much better experience for distributed customers on the network. Ultimately DSOs must be incentivised economically to deliver on this agenda.

Q.44 Do you have any data which illustrates: a) the current scale and cost of the system impacts described in table 7, and how these might change in the future? b) the potential efficiency savings which could be achieved, now and in the future, through a more co-ordinated approach to managing these impacts?

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28 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/394509/DECC_Energy_Investment_Report_WEB.pdf

We recognise the challenging impacts set out in Table 7, however there are also tremendously positive system impacts that also need to be recognised. These include; much wider ownership of clean power generation; new entrants & sources of investment; new competitive pressure from low carbon generators; empowered consumers & consumer choice; innovation impetus; avoided imports and increased energy security; carbon savings; broader industrial opportunities for UK plc; and potentially avoided transmission costs. Broad system analysis by e.g. the IEA and the World Alliance for Decentralised Energy suggests the scale of avoided network costs is considerable (14% vs the reference scenario, equivalent to $2.9 trillion globally)[29]. The successful storage pilot by UKPN to avoid reinforcement costs clearly illustrates the savings to be made in practice. As above, we note Ofgem/DECC's assessment of the value of distribution network deferral and we urge Government to act now to unlock this.

Our members are naturally at the forefront of experiencing the current challenges of network operations in practice. The day-to-day experience for many of our members and their clients remains a long way from a fair, efficient and coherent, let alone smart, system. The following case studies represent some of the key issues members are facing due to inefficient distribution network operation.

Constraints inhibiting even domestic solar and small commercial rooftop schemes: One member in the UKPN area (UKPN is widely recognised as a progressive DNO) recently sought to install a 40kW solar rooftop for a recognised charity. The G59 application was refused by the DNO stating that an application for Statement of Works to NG would be required and in any event fault limits had been reached. A G83 connection at 11kW may be offered instead. The client complained and within 48 hours a different offer was made putting an export limit on the scheme. This illustrates the inconsistency in treatment.

In this instance the client benefited from exceptionally high self-consumption. However, for other users export restrictions are becoming common place, inhibiting the prosumer model, damaging the investment case, project performance and reducing the amount of clean power available to the system. The company reports that in 50% of cases where domestic installations are seeking to go beyond the 3.68kW limit and require a G59 they are refused. In one example a domestic scheme was referred to necessary reinforcements requiring £millions of investment.

Fair treatment under Statements of Works continues to be a problem. Improvements to the process where the developer applies to the DNO for a grid connection are noted. However, the process becomes highly problematic when NGET is involved in a Statement of Works subsequent to the connection offer being made. Unlike connection applications there is no statutory time scale for carrying these out and costs can be extreme. One member in the WPD area waited two years for a Statement of Works. In this instance NGET also tried to introduce a cancellation fee of £1693.34/MW – around £82K per project with 45% to be lodged with them prior to planning permission. This was subsequently rescinded but NGET also required £26K to review any variation to the scheme. We are not aware that either of these costs are allowed under the DNO license. The NGET SoW process should

[29] IEA (2006) World Energy Outlook: http://www.worldenergyoutlook.org/media/weowebsite/2008-1994/weo2006.pdf ; WADE (2006) The WADE economic model: http://www.localpower.org/documents/report_model_past.pdf

be included in the DNO Connection Offer & subject to the same statutory timescale and terms.

Curtailment and constraints: members are experiencing extremely high levels of curtailment and constraints, in some cases these are unsupportable. For example, one member experienced lost revenues of over £700k from just two sites last year due to constraints on a low voltage line. Despite having solutions available they have struggled to engage the DNO in question. Data from another member's experience is shown in the following charts showing the curtailment they would be exposed to under an Active Network Management connection on a 1MW array. This shows almost no generation would be permitted from March to November. Without incentives on DNOs to address either curtailment or constraints the industry will continue to be exposed to substantial lost revenue.

4. Contour plot of curtailed energy over an average 12-month period:

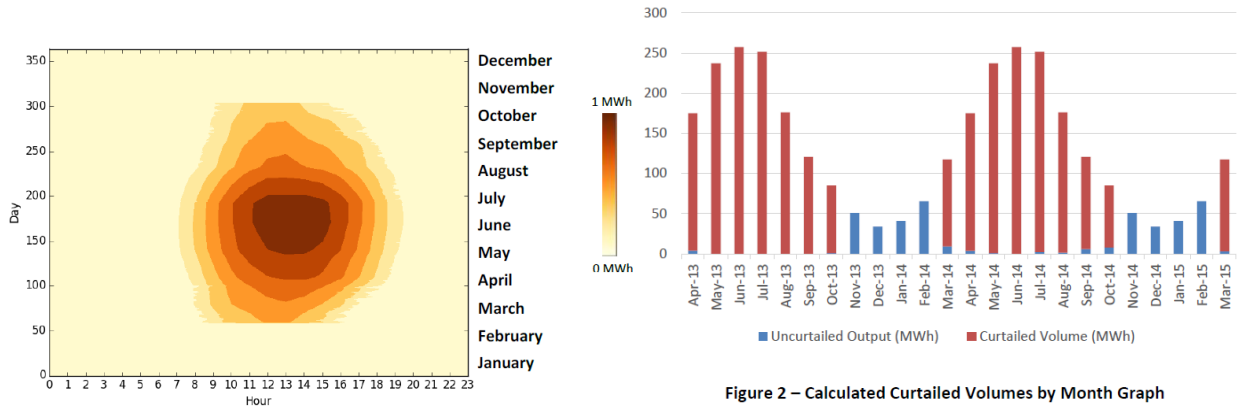


Figure 2 – Calculated Curtailed Volumes by Month Graph

As another illustration of the frustration caused by the lack of incentive to resolve these issues, another member was delighted by a WPD press release in March 2016[30] stating that the F-route constraints issue had been resolved satisfactorily with NGET, and therefore that 'new offers we issue will no longer include this restriction.' In practice this constraint is still being included in connection offers, the most recent one received in December.

Lack of ability to connect storage solutions: We very much welcome the identification of key barriers to storage and we urge their removal asap. However, regulatory barriers remain to unlocking the meaningful markets that the industry is ready to deliver. The potential for co-location of storage with renewables to provide flexibility and ancillary services is not emphasised enough in the call for evidence and the experience of our members already seeking to do this is frustrating. There needs to be greater clarity on the connection and metering process for storage, and DNOs and local planners should be incentivised to engage with storage customers on recognition of the potential benefits they can provide for smarter network management.

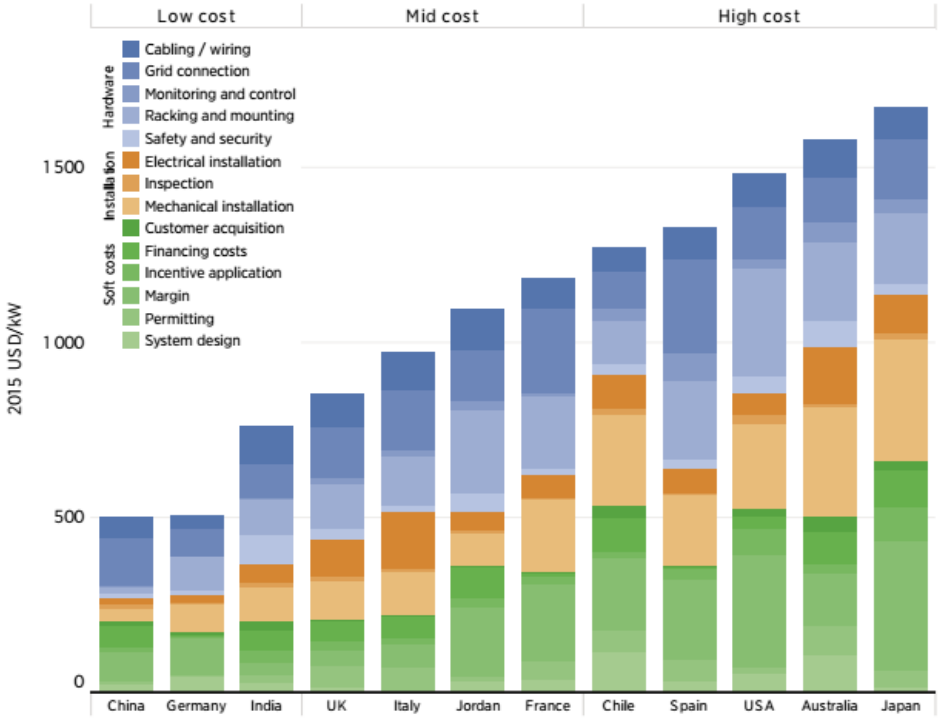
Lack of information and markets for flexibility providers: inherent in the above is that members seeking to offer smarter solutions to network constraints are reporting a lack of basic information and market opportunities provided by DNOs. This is inhibiting innovation, engagement from industry, and

[30] WPD (2016) South West 132kV network capacity restriction UPDATE March 2016: https://www.westernpower.co.uk/docs/connections/Generation/Generation-capacity-map/Distributed-Generation-EHV-Constraint-Maps/WPD-South-West-F-Route-Constraint-Information-Marc.aspx

disappointing pioneering 'smart' consumers who want to invest in clean power generation. One member seeking to provide solutions has experienced huge connection fees, no guarantee of grid availability and full DNO rights for curtailment making flexibility projects unviable.

The graph below[31] compares the Balance of System costs of solar internationally. It is worth noting that network-related costs are significantly higher in the UK than in Germany despite Germany having considerably greater solar capacity.

FIGURE 2: DETAILED BREAKDOWN OF SOLAR PV BOS COSTS BY COUNTRY, 2015



Source: IRENA Renewable Cost Database.

Q.45 With regard to the need for immediate action: a) Do you agree with the proposed roles of DSOs and the need for increased coordination between DSOs, the SO and TOs in delivering efficient network planning and local/system-wide use of resources? b) How could industry best carry these activities forward? Do you agree the further progress we describe is both necessary and possible over the coming year? c) Are there any legal or regulatory barriers (e.g. including appropriate incentives), to the immediate actions we identify as necessary? If so, please state and prioritise them.

This is an area defined by highly complex inter-relationships and effective management is crucial to the successful delivery of a smart, flexible energy system. Given our members' daily experience on

[31] IRENA (2015) The power to change: solar and wind cost reduction potential to 2025:: http://www.irena.org/DocumentDownloads/Publications/IRENA_Power_to_Change_2016.pdf

networks today we are not convinced that DNOs are sufficiently empowered to take on the role of DSOs in practice as identified, and therefore we question the extent to which industry can carry activities forward effectively. We understand far greater IT investment is needed by DNOs for one thing. We fully support the actions that the call for evidence highlights need implementing, but we are not convinced there are appropriate incentives, regulatory provisions or markets/commercial offerings in place.

Stronger incentives for DNOs to reduce constraints and outages. DNOs are currently not sufficiently incentivised to reduce outages, from which the losses in some cases can be insurmountable. Parties to the BMU and those at transmission level are compensated for outages that lead to imbalance. This is not the case for distributed generation, and as such solar in particular is put at a competitive disadvantage. Without compensation for losses incurred from constraints, DNOs are able to turn customers off and have little incentive to procure a quick resolution. In some instances our members have even been prepared to commit resources to helping DNOs to resolve constraint issues but have not been able to engage. Proper valuation of constraints would incite more urgency in connecting smarter solutions. This should be implemented alongside giving DNOs greater freedom to invest ahead of need in designated areas of the network.

Establish markets for network deferral solutions. As highlighted in our response to question 4, there is a potentially huge market opportunity for network deferral, but in practice there is no functioning market to deliver it. DNOs are currently restricted in ability to invest ahead of time, and without an open market for flexible solutions to network deferral the tendency will continue to be towards higher constraints, with few incentives to address these as described above. Again, DECC has already estimated that smart grids can reduce the cost of additional distribution reinforcement by between £2.5bn and £12bn by 2050[32]. There needs to be a fair, open and quantifiable market for network deferral solutions accessible for all parties as soon as possible and we urge BEIS/Ofgem to ensure this happens.

A requirement to provide local markets for balancing services. Linked to our response to question 11, there needs to be greater DNO level procurement of balancing services. There is currently no obligation for DNOs to balance the system locally unless asked by the SO. With increasing distributed generation on the system the responsibilities of the DSOs to manage this locally should be increased. Currently there is limited evidence of DNOs procuring flexibility products.

Obligation to coordinate actions across all levels of the system. Naturally we agree that far better co-ordination is needed between the DSO, the SO and TOs. There needs to be much better data sharing and alignment of incentives between DSO and TSO, and a joined-up approach to the procurement of services to avoid inefficient actions and avoid curtailment as much as possible. DNOs and SOs need visibility on what's happening right across the system, and to be able to anticipate and respond to signals from other parts of the network.

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[32] DECC (2015) Delivering UK Energy Investment: Networks: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/394509/DECC_Energy_Investment_Report_WEB.pdf

Co-ordination with local planners: Members also believe better co-ordination may be needed with local planners given the barriers planning can present, including to co-location with storage (see case studies in question 44). Several members have noted the positive approach now taken in Scotland and Wales where planners with expertise in energy are making decisions for smaller schemes to help deliver regional Government energy priorities.

ANM provides a good example of the need for better regulatory reforms now. In theory ANM should enable solar generators to connect cheaply to the networks, subject to curtailments. It is technically possible and there is no regulatory barrier to DNOs rolling this out. However, in practice ANM leaves developers with massive risk – often too much to make projects investible. The more generators come on line the greater the risk of turn-down. Crucially, ANM should not only been seen as a method of preventing circuit failure - it is a first step towards local balancing and relieving network congestion, which has the potential to deliver considerable broader cost savings. Elexon outlines how the ANM approach could be further developed to provide fairer and commercially viable treatment for distributed generators and more efficient balancing decisions[33].

Q.46 With regard to further future changes to arrangements: a) Do you consider that further changes to roles and arrangements are likely to be necessary? Please provide reasons. If so, when do you consider they would be needed? Why? b) What are your views on the different models, including: i. whether the models presented illustrate the right range of potential arrangements to act as a basis for further thinking and analysis? Are there any other models/trials we should be aware of? ii. which other changes or arrangements might be needed to support the adoption of different models? iii. do you have any initial thoughts on the potential benefits, costs and risks of the models?

As highlighted above we welcome the recognition of the need for immediate action but believe that deeper regulatory and operational reform is needed to achieve the desired DSO model. This is based on the experience of our members which remains very challenging as illustrated above. Current regulation of the networks is based on outdated projections of solar deployment and cost reduction. In reality DSOs and the TSOs have struggled to catch up with deployment. While welcome, the steps taken by Ofgem to date to facilitate DSO transition are modest and have focused on trials rewarded as a 'bonus.' There needs now to be early action to deliver much stronger & more system-wide incentives. As highlighted by the ECC Committee, we propose that the RIIO-ED1 price control failed to deliver concrete incentives for DNOs to transition towards smarter operation of the network as business as usual, and the targets set by Ofgem have been too low[34].

Generally there is large amount of creative thinking in the call for evidence and beyond on how DNOs could transform to DSOs, yet a comprehensive proposal and route map is missing. A clear vision for DSOs has not been set out in this consultation although innovative ideas are mooted. 'The benefits of

[33] Elexon (2015) Active management of distributed generation: https://www.elexon.co.uk/wp-content/uploads/2015/03/Active-Management-of-Distributed-Generation_March2015.pdf
[34] ECC Committee (2015) Energy network costs: transparent and fair?: http://www.publications.parliament.uk/pa/cm201415/cmselect/cmenergy/386/386.pdf

DSOs seem near universally acknowledged' as the ECC Committee inquiry noted. More work is needed to define an effective DSO model, with the potential for early action under the RIIO-ED1 reopener and a road map, with timescales, for full DSO introduction. We suggest this work be carried out as a matter of urgency drawing on best practice internationally. The DSO model needs to identify how the DSO will interact effectively with a very wide variety of stakeholders.

Members are particularly interested in the development of local markets for local power which a DSO model could facilitate. At the moment the system offers an 'all or nothing' approach to charging suppliers of power for licensing and network use. It would be good to see a middle way for charging and licensing to facilitate local supply to local users. If the DSO is empowered to balance demand and supply locally the economic advantages of generating power close to the user, avoiding transmission pressure, become clear and should be reflected in a mid-level licensing and charging regime.

Chapter 6: Innovation

Q.47 Can you give specific examples of types of support that would be most effective in bringing forward innovation in these areas?

We have responded to questions 47 and 48 together. As identified in our response to the questions in chapter 5, we perceive that while innovation funding and trials are welcome, the most effective means to bringing these innovations forward relies on regulatory measures to incentivise DNOs and the SO to incorporate them into business as usual. Innovation funding and trials have delivered promising results and learning, but the incentives are not sticking. There is little evidence to suggest widespread take-up of these activities in business as usual, and as such the current culture of pilots and innovation funding is inadequate.

The industry has already delivered phenomenal technological and business model innovation, and is on the verge of being able to deliver new innovative services to network operators on a large scale. The onus is on government to ensure sufficiently strong incentives on network operators to procure these activities in business as usual alongside viable and open commercial arrangements to enable industry to deliver it.

A good example of this is Active Network Management. This innovation has delivered a new business model enabling further deployment on the network with the acceptance of intermittent curtailment. Some smaller developers are opting for ANM as the contracts often come with lower connection costs due to network deferral. However, the developer has to take on a potentially insurmountable risk given that there is not guarantee of a return on investment, and there is little evidence as yet of these contracts being taken up to any great extent.

It may too early to conclude on the success of ANM, but steps could be taken to improve its viability as a commercial model. For example, if the capability of controlling output from a connection point is already in place through these contracts, it would seem possible to use this 'two ways.' ANM need not only be concerned with curtailing generation to reduce frequency, but also actively increasing generation to address excess load. In this way ANM could provide a more valuable service for DNOs and providers could be remunerated accordingly, increasing the incentive to contract.