Smart Grid Forum
Work Stream 6

Work Stream 6 Report

August 2012

Identifying potential barriers to smart grid implementation and laying out possible future direction for developing solutions

Context

Background

This is a report from work stream six members[1] to the Smart Grid Forum (SGF) for discussion at the next meeting of the Forum on 23 October. The views expressed are those of the work stream and the conclusions reached are based on members' opinions unless stated otherwise. The purpose of work stream six of the SGF is to:

i) clarify the type of smart grid solutions which may be implemented in RIIO-ED1[2] (as identified by work streams two and three of the SGF);

ii) identify any potential regulatory and commercial barriers to implementing these smart solutions;

iii) propose options for removing these barriers, including:

   a. regulatory options that balance objectives related to cost reflectivity of network charges and equitable treatment of network customers, ensuring a non-discriminatory approach for implementing smart grid solutions and how costs should be recovered by customers;

   b. options for the commercial arrangements (ie the contractual arrangements between customers, DNOs, suppliers and other industry parties) to provide the most efficient outcomes, across the value chain, for the smart grid solutions which may be implemented in RIIO ED1;

   c. options for the customer engagement required to implement smart grid solutions for RIIO ED1 and the potential parties (supplier, Distribution Network Operator (DNO), system operator, aggregator) in the supply chain to undertake this engagement; and

iv) highlight the potential barriers / risks to the most efficient development of the regulatory and commercial arrangements to support smart grid solutions in the longer term.

Pursuant to these terms of reference, the focus of this report is to identify the barriers to the deployment of smart grid solutions for RIIO-ED1. It also provides some high level views on the next steps to resolving these barriers whilst ensuring customers are adequately protected. Some of these next steps will require detailed changes to regulatory or commercial instruments such as licence conditions, charging methodologies, and engineering recommendations. Other next steps will be higher level policy considerations. This report tries to distinguish between the two in order to help identify who might be best placed to take forward this second phase of work. As discussed below, there is a potential

[1] A list of the membership is included in Appendix one to this report.
[2] RIIO-ED1 will be the first electricity distribution price control review under the RIIO principles.

third phase of work, under an extended terms of reference to include wider industry interactions and commercial arrangements.

Ofgem have indicated that they plan to reference the work of this work stream in their September strategy consultation for RIIO-ED1. This should provide DNOs with the confidence that any barriers to the efficient implementation of smart grid solutions they include in their business plans will be successfully removed by April 2015.

When the terms of reference for this work stream were established by the SGF, it was indicated that once they had been progressed through to a conclusion, the SGF may choose to amend them and broaden the scope of the work stream. This will be discussed by the SGF at their next meeting in October. Work stream six will take recommendations to the SGF on the potential scope of work for the new terms of reference. Discussions held to date in the work stream have provided some thoughts on work that can be taken forward by the group in the extended scope. These are captured at the end of the report but are by no means exhaustive.

Structure of the report

Following the terms of reference, the work stream has focussed on the commercial arrangements required to support the development of smart grids in GB and any regulatory impediments to these arrangements taking place. The focus has been on those commercial solutions which have been modelled by work stream three of the SGF as having the potential to play a role in the efficient development of the networks in RIIO-ED1 whilst also taking into account how they may need to develop in RIIO-ED2. This had led to the identification of the following areas as the ones which are most likely to require amendments to the regulatory and commercial framework:

1) Commercial arrangements for demand side response (DSR);

2) Charging issues associated with smart grid solutions;

3) Commercial arrangements for the development of storage;

4) Arrangements for undertaking electricity demand reduction measures;

5) Potential role of a Distribution System Operator (DSO); and

6) Arrangements relevant to integrated energy systems.

The work stream has prioritised each of these areas according to when it is likely DNOs will be able to efficiently implement these solutions. We have identified that some of the solutions are less likely for RIIO-ED1 and may require further trialling and research before it is possible to focus on the barriers and solutions, whilst DNOs may wish to implement others from the start of the next price control. The further into the future the work stream envisages these solutions being implemented the lower the priority which has been allocated to them.

The work stream will continue to review policy developments and monitor their impact on the views expressed in this report and next steps. The work stream has been particularly interested in the development of European Network Codes by the European Network of Transmission System Operators for Electricity[3] (ENTSOE), specifically the Requirements for Generators and the Demand Connection Code[4]. The work stream believe that European network codes may have an impact but the nature of this impact is still unknown.

[3] https://www.entsoe.eu/
[4] ENTSOE's consultation on the Demand Connection Code is available here: https://www.entsoe.eu/consultations/document/docdetails.do?uid=0004-495f-8db5-8fe7-cc6b&

The remainder of this report deals with each of the issues which has been identified above in turn. The identified barriers and issues are explained and next steps to try to resolve them are discussed. Appendix one provides the names of the organisations who have participated to work stream six and a separate Excel file entitled Appendix two provides some detailed DSR case studies for different customer types.

Chapter 1: Demand side response

Background

DSR is a change in demand (or generation) from a customer (commercial or domestic) in response to external stimuli. These stimuli can take a number of forms, from providing real time information on a customers' consumption data, a time of use tariff where the price of electricity increases at certain times, or restricted hours profile whereby a customer must reduce consumption within certain hours. DSR has been identified as a high priority for the work stream as this is a solution which is expected to be economically viable from the start of RIIO-ED1 and can provide real benefits for customers.

Working assumptions

In order to develop a useful methodology for identifying barriers to implementing DSR and proposing solutions, a number of working assumptions have been developed:

i) It is expected that no sophisticated market for DSR will be established by the start of RIIO-ED1;

ii) The scope of work stream six is limited to exploring DSR within a role for DNOs to facilitate timely and efficient delivery of capacity for the connection of either low carbon technologies[5] or conventional appliances and load;

iii) Until full smart meter roll out in 2019, it may be impractical to target upstream reinforcement costs on existing domestic customers who increase demand or generation. Consequently, costs associated with this may have to be socialised. It was noted that if costs are socialised, the incentive for individual customers to enter into DSR arrangements as an alternative means of capacity reinforcement may be reduced;[6]

iv) DNOs should be free to approach all customers (including domestics) to offer DSR contracts on a bilateral basis, subject to adequate measures being in place to protect those customers who are approached;

v) Thought needs to be given to the design of bilateral DSR contracts with commercial customers in order to preserve benefits across the value chain. For instance, contracts may need to contain break clauses to allow customers to sell their DSR into a competitive market if and when a DSR market becomes mature;

vi) It will be essential for DNOs' planning and operation activities to receive notification of where low carbon technologies connect since these may trigger costs on the network and trigger DSR arrangements; and

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The consultation on the Requirements for Generators is available here: https://www.entsoe.eu/consultations/document/docdetails.do?uid=0004-be44-30e2-8240-60ce&

[5] By facilitation role, we mean that DNOs will respond to requests for capacity and ensure that this capacity is provided at efficient cost to enable connection in a timely manner.

[6] This assumption is being revisited in light of the impact that installing equipment with poor power factors can have on the LV network. DNOs may wish to charge domestic customers if they install equipment which is below a certain standard.

vii) There will not be any compromise on the overall security and reliability of the network in RIIO-ED1 despite the challenges posed by the connection of low carbon technologies.

The work stream has made a distinction between the barriers and issues affecting DSR arrangements with commercial and industrial customers and those affecting DSR arrangements with domestic and micro-business customers[7]. This is because it is likely that arrangements with commercial customers will take a different form from those with domestic customers. In addition, the work stream considered that bilateral contracts with domestic customers for DSR are less likely at the start of RIIO-ED1 and therefore should be allocated a lower priority.

Barriers and issues for implementing DSR

Engineering Recommendation P2/6

The work stream has considered the benefits DSR can bring to the network and notes the potential for DSR to play a considerable role in network security of supply. However, there is a potential barrier to DNOs utilising DSR. The security of supply standard, Engineering Recommendation (ER) P2/6 sets out the number of alternative routes of supply which must be available for different sizes of demand groups. The definition of measured demand within ER P2/6 would appear to exclude demand that can be controlled through DSR. Since the group demand is stated to be the sum of Measured Demand and Latent Demand, it can be argued that ER P2/6 excludes controllable demand from the definition of Group Demand[8].

DNOs are required under Standard License Condition (SLC) 24 of the distribution license to conform to ER P2/6. Therefore, DNOs may be required to install assets to meet this standard, whether or not they have DSR arrangements that provide security of supply. DNOs could therefore be dis-incentivised to use DSR as an alternative to reinforcing the network through conventional means. In order to overcome this barrier, ER P2/6 may need revising to recognise the contribution DSR can play in network security. An ENA working group is currently looking at this issue more closely and the work stream will monitor this work.

Trade off between customer's right to withdraw and providing certainty to DNOs

DSR arrangements will need to balance the rights of the DNO and the customer. There is an inherent trade off between customers' and DNOs' interests. In order for the customer to make the most efficient use of their DSR capability, they may need to withdraw from DSR arrangements. This could be because they no longer want to provide it or because they are able to sell their DSR to another party at a higher price. However, this leaves DNOs with the risk of duplicating costs by investing in DSR equipment and DSR payments, and then in reinforcement when the customer withdraws from an arrangement. This may act as a strong disincentive on DNOs to use DSR arrangements in the first instance.

Presence of IDNOs and ICPs may complicate DSR arrangements

The working group has identified that the presence of competition from Independent Distribution Network Operators (IDNOs) and Independent Connection Providers (ICPs) may introduce extra complexity for DSR arrangements. As a minimum, no DSR arrangements should be allowed to restrict competition. The work stream recognises that DNOs, IDNOs

[7] Micro-business customers are classified as profile class 3 or 4 who are a non domestic but have an annual consumption of less than 73,200kWh.

[8] These issues are discussed further at the document below:
http://www.ofgem.gov.uk/Networks/Techn/TechStandds/Documents1/Consultation%20ENW%20LCNF%20ER%20P26%20Derogation.pdf

and ICPs are subject to separate regulatory frameworks and thus the ability of each to offer similar DSR arrangements may be impeded as a result.

Additional barriers and issues specific to DSR for domestic and micro-business customers

Notification of connection of new appliances with high contribution to distribution system peak

The members of the work stream have identified that it would be useful for DNOs to be able to understand the penetration of new appliances such as heat pumps or electric vehicles on their networks. These appliances are likely to make a high contribution to local system peak. Such notification is useful for DNOs as it increases the level of understanding of the risk on different parts of the network and allows for better planning of network investment. This requires the DNO to receive full and prompt notification of the connection of these technologies. However, there is currently no mechanism for such information provision at domestic level except for generation under ER G83/1-1.[9] Such notification may also identify who may have flexible load and thus likely to enter into a DSR arrangement with the DNO or other parties.

Dis-incentive for domestic customers to engage in bilateral DSR arrangements

One of the working assumptions made by the work stream is that the costs of accommodating new low carbon technologies at a domestic level are socialised. If this policy were implemented, it would remove a direct cost incentive on these customers to enter into a bilateral DSR arrangement with the DNO to accommodate a new appliance at the time of its installation. A bilateral arrangement could take the form of a bespoke agreement with an individual domestic customer which would clearly set out how usage could be reduced to ensure that no upstream reinforcement is required. If the costs of accommodating the new appliance are socialised across all customers, the individual customer connecting it will not have to pay upfront reinforcement charges. Therefore, there is no incentive on them to agree to restrict their usage. We recognise that this doesn't remove incentives for domestic customers to agree a DSR arrangement in return for payment more generally.

Visibility of domestic customers' contribution to local network peak

As an alternative to a bilateral DSR arrangement, a signal could be sent through distribution use of system charges to reward a domestic customer for maintaining their load below a certain level at times of local system peak. This would be a universal signal sent to suppliers who would then decide whether to pass it on to domestic customers. In order for DNOs to send this price signal they would need to know the consumption of every domestic customer at the half hour when their system was at peak load. At present it is unclear whether DNOs will have automatic access to the necessary data available to provide this universal signal, via smart meters.

Lack of direct relationship with domestic customers

There is currently no mechanism for DNOs to offer DSR tariffs or arrangements directly to domestic customers as these customers only have a relationship with their supplier. This is in contrast to commercial and industrial customers who will have bespoke connection agreements to which DSR arrangements can be added. However, with the introduction of smart meters and notification processes, the relationship between DNO and customer may change. This change in relationship may be required in order to sufficiently engage customers to manage their energy consumption.

[9] Engineering Recommendation G83/1-1 is the primary industry document governing the connection of small scale embedded generation (SSEG) up to 16Amps per phase to the public electricity distribution networks.

The above issues are more fully described in case studies for different customer types in Appendix two.

Next steps to develop options for arrangements for commercial and industrial customers

In order to put forward options for enablers to tackle the issues raised above there are certain areas of work that should be undertaken. The next steps related to commercial and industrial customers are dealt with below. Many of these relate to the detailed regulatory legal and commercial arrangements.

1) ER P2/6 should be examined and revised if there is any doubt that it does not recognise the contribution of DSR. However, a timeline for this process is still in need of agreement alongside a clear indication of who will take this work forward. If this cannot be revised in time for RIIO-ED1 then Ofgem may need to consider providing specific derogations for DNOs;

2) Given the work stream has identified that DSR arrangements for commercial and domestic customers may need to be different, it may be necessary to draw a distinction between those smaller non domestic customers where direct engagement may not be appropriate and larger industrial users whose energy requirements are a major input to their business and who have significant engagement with the energy industry;

3) It would be helpful to set out high level principles for customers to be able to withdraw from DSR contracts whilst still ensuring that DNOs have the required degree of certainty. These principles may need to include who is liable for reinforcement costs to maintain security of supply when a DSR contract is terminated;

4) In order to ascertain the impact of DSR arrangements on competition for IDNOs and ICPs, it may be necessary to test likely DSR arrangements against the existing competitive markets in place for connections. Through this exercise, it should be possible to determine how competition may be affected and what measures, if any, need to be put in place to protect it; and

5) In order to link the outcomes of work stream six with the development of RIIO-ED1, it will be necessary to test that the emerging outputs and incentives framework for RIIO-ED1 and T1 support the use of DSR where it has net benefits.

Next steps to develop options for DSR arrangements with domestic customers

In order to tackle potential barriers to DSR with domestic customers, it may be worthwhile undertaking the following next steps:

1) In order to overcome the potential barrier that DNOs do not currently have a direct relationship with domestic customers, it may be necessary to set out a consistent set of principles for such engagement, including for engagement via a third party. For example these could cover the high level communication of DSR arrangements and steps to protect customers. These may need to take the form of a code of practice or potentially licence obligations. The working group have proposed that this work is taken on under revised terms of reference;

2) It would be necessary to set out the notification process that customers need to follow to notify the DNO of the connection of new appliances at a domestic level which make a significant contribution to peak demand. This should include the means through which this process will be communicated to customers; and

3) DNOs might be able to send a universal DSR signal (through suppliers) to all customers who exceed a capacity threshold at the half hour of peak network demand through use of system charges. DNOs may need to explore the availability of required consumption data and continue to engage with the Department of Energy and Climate Change (DECC) smart metering programme to consider how they gain access to it whilst complying with appropriate data privacy and security arrangements.

Chapter 2: Charging for low carbon technologies and smart grid solutions

Background

DNOs are required under the terms of their licence to have two separate charging methodologies in place. One must set out how customers will be charged when they connect to the network or request increased capacity. This is known as the common connection charging methodology. These charges are a one-off, usually upfront, payment. The second methodology DNOs are required to have in place sets out the basis for how customers will be charged for transportation of electricity through the distribution system. These are known as use of system charges and are levied by DNOs on suppliers who decide if and how they pass them on to customers. These charges are ongoing and based on the capacity of connection and consumption.

The work stream has identified that the current charging arrangements were not designed with the emergence of smart grid solutions in mind. Equally, they may not be sufficiently robust to provide clarity around the contribution domestic customers should make to upstream reinforcement costs triggered by the connection of low carbon technologies such as heat pumps, electric vehicles and micro-generation. It is expected that there will need to be some updates made to the current arrangements to provide better clarity and consistency of treatment of these costs.

Charging issues and barriers

Consistent charging policy for domestic customers

The work stream has benefitted from discussion of the arrangements which DNOs have in place for allocating costs associated with accommodating new load and generation at the low voltage (LV) network, particularly from existing domestic customers. It has become evident that, in contrast to commercial customers, there is no consistently applied maximum import or export capacity for domestic customers. In addition, even if there were such a threshold, DNOs have no data through which to monitor compliance with this capacity limit. Consequently, it is likely that a DNO might only become aware of excessive loading of an LV circuit when a problem is reported (e.g. voltage issues, equipment failure etc.). Once this occurs, it is very difficult for a DNO to identify which customer(s) were responsible for increasing load. Even if they do identify them, domestic customers are largely unaware that they may be liable for upfront connection charges. If customers are to be targeted with network reinforcement costs, there will need to be far greater communication with these customers to inform them of the impact of their actions on the network.

One of the working assumptions made by the work stream is that the costs of accommodating low carbon technologies, such as heat pumps and micro-generation, at existing premises are socialised. This would mean that the individual customer using the appliance will not pay for any costs associated with upstream reinforcement of the network aside from socialised costs through use of system (DUoS) charges. These costs will be funded by all customers through distribution use of system charges.

Charging for equipment that causes disturbances at a domestic level

The one area where the work stream has challenged this working assumption is where new equipment connected at a domestic premise causes power quality issues. DNOs have expressed a concern that if the costs of connecting all heat pumps are socialised, then there is no incentive on customers to ensure that they purchase equipment with acceptable design standards (in terms of the impact on the power quality on the network). Without this incentive for existing domestic customers, the network costs of accommodating heat pumps could be far higher. If these are socialised, it will mean all customers bear these increased costs. This risk will need to be balanced against the costs which may need to be borne by individual customers and the extent to which they may deter customers from purchasing heat pumps and other equipment.

Charging arrangements for DSR

The work stream considers that the current charging arrangements are based around paying for capacity which has been provided through installing assets. Capacity can also be provided through commercial arrangements for DSR with customers. Consequently, there are a couple of areas where the current charging policy and methodology may need to be updated.

The first is where a new customer who wishes to connect to the distribution network doesn't agree a DSR contract themselves but can be connected to the network without reinforcement because an existing customer agrees a DSR contract with the DNO. In this circumstance the capacity needed to connect the new customer has been provided through DSR arrangements with an existing customer. Yet, the common connection charging methodology only permits DNOs to reflect the 'capital costs' of connection[10]. Consequently, there will need to be some clarity around what the new customer pays in this circumstance. If the new customer pays nothing, then the existing customer may be unable to receive the full benefit for their DSR which might dissuade them from offering it.

Secondly, since current charging arrangements are fixed around charging for capacity created by investment in assets, they tend to be inflexible. The work stream has commented that DSR is likely to be used as a short and medium term as well as longer term solution. Customers may wish to opt out of DSR arrangements if they are proving too intrusive and DNOs may wish to cancel them if they have to undertake reinforcement on the network. Consequently, there needs to be some clarity over the arrangements when DSR contracts are cancelled and what, if any, contribution customers previously connected through DSR need to make to the reinforcement required to provide firm capacity. Without this clarity it may be difficult for customers to weigh up the economic benefits of entering into a DSR arrangement. The same may also be true for arrangements made with Distributed Generation and storage providers to avoid capacity restraints.

Charging arrangements for strategic investment

Another tool which DNOs may choose to use in RIIO-ED1 is making strategic investment decisions. These are investments made in response to demand for network capacity which is anticipated to arrive as opposed to a specific customer request to connect extra demand or generation. Such investment has the potential to avoid significant delays for connection.

The current connection charging arrangements incentivise customers to connect where there is spare capacity. Customers pay a proportion of any upstream reinforcement costs they trigger[11] and where no upstream reinforcement is required they only pay for any sole use assets required to connect them to the network. This is designed to help ensure the network develops most efficiently.

[10] See example here under the definition of minimum cost scheme: http://www.northernpowergrid.com/som_download.cfm?t=media:documentmedia&i=128&p=file All DNOs have identical methodologies in place.

[11] This proportion is calculated under the cost apportionment factor (CAF) which is set out in the common connection charging methodology (CCCM).

There may need to be some further consideration of how the spare capacity created through strategic investment is treated and whether customers who make use of it should fund some of the costs, or if they should be entitled to it for free as per any other spare capacity on the network.

Next steps to develop options for amending charging arrangements

These options for next steps mainly relate to detailed review of legal and regulatory documents, in particular the charging methodologies and associated industry codes:

1) Set out some principles, which could be applied consistently, regarding the circumstances when DNOs can charge for increased load/generation, including for appliances which will cause certain power quality issues, and how and when these charges will be applied. Identify which commercial and regulatory documents will need to change to implement these principles; and

2) Set out a process for making customers and installers aware of the impact of certain types of equipment on power quality on the network and any costs which they might have to bear for remedial actions. In addition, thought will need to be given to a high level strategy for communicating to customers the potential for additional charges; and

3) Set out how existing charging arrangements may need to change to take account of DSR and strategic investment.

Chapter 3: Storage

Background

Storage can take a variety of forms including electrical storage in the form of batteries or conversion of electricity to heat storage. They can help to ensure that excess electricity produced at time of low demand can be converted to a different energy form and stored to allow use of it at times of higher demand. From a DNO perspective this has potential use as it can reduce the volume of electricity which needs to be transported at peak load, potentially reducing the need to reinforce assets.

Investment in storage assets could offer an alternative way for a DNO to avoid or delay the need for traditional investment. However, members of the work stream have commented that the investment in storage can be more efficient if a DNO can use the storage to sell ancillary services into the balancing services markets. The modelling work undertaken by work stream three of the SGF confirms this observation and only selects storage in a small number of cases based on current assumptions that DNOs cannot sell these services. Therefore, the key issues dealt with by work stream six are arrangements for owning and using storage to provide other market services.

Storage is not currently a mature technology for use on the distribution network. DNOs are still in the process of understanding how it can be used to deliver network benefits. As explained below, many of the potential barriers are to increasing the utilisation of storage beyond certain thresholds. These thresholds are only likely to be met once storage use increases substantially from current levels. Therefore, the barriers are not considered a significant issue for the beginning of the RIIO-ED1 price control period. However, they are likely to have a greater impact during the price control and therefore these barriers have been identified as a medium priority.

Potential barriers to implementing storage solutions

By virtue of being a licensed monopoly, a DNO is prohibited from holding generation and supply licences alongside their distribution licence. Discharging storage assets could be

viewed as generation from a regulatory point of view, as it is for pumped hydro storage. There are certain capacity limits on the size of generation which requires a licence[12]. It is noted, however, that the analysis undertaken by work stream three indicates that all storage solutions which could be selected for deployment on the distribution network may be well below this limit.

There are also limits on the amount of revenue DNOs would be allowed to make from ancillary services provided through storage assets. SLC 29 restricts revenue from non-distribution activity to 2.5% of the DNO's share capital. Furthermore, Charge Restriction Condition (CRC) 15 could restrict the revenue DNOs are allowed to earn from extra services, depending on whether ancillary services are designated an excluded service. At present, once an income stream is deemed an excluded service, 85 per cent of the revenue earned through that service is returned to customers. This could act as a disincentive on DNOs to play a role in this area.

If DNOs are not able to operate storage themselves, they will need to explore alternatives. For instance, a third party could own the storage facility with the DNO paying for a specified network support service. The overall costs of this approach could be higher since DNOs may benefit from a lower cost of capital. Alternatively, the DNO could own the storage asset and lease out operation to a third party for management and provision of ancillary services. Different models are being trialled in Low Carbon Network (LCN) Fund projects as at present there is no mature storage market.

As with DSR, the work stream saw ER P2/6 as a potential barrier to implementing storage. Storage can contribute to network security but is currently not recognised by ER P2/6. In order to incentivise the use of storage over less cost efficient conventional investment, it will be necessary to revise ER P2/6.

Next steps for developing options to remove these barriers

It may be worth conducting further analysis in the following areas. Some of these relate to existing regulatory documents and others still require some higher level discussion on the types of commercial arrangements required between different parties.

1) Develop straw man examples of the types of arrangements DNOs or third parties could strike with storage owners or operators (whether DNOs or otherwise) to receive services for constraint or fault management;

2) Assess that the outputs and incentives for RIIO-ED1 do not disincentivise DNOs from using storage where it has net benefits and that there are no new barriers to its efficient deployment;

3) Understand the benefits of DNO ownership of storage compared to renting services from third parties;

If the conclusion of point 3 is that there are significant benefits from DNO ownership of storage compared to third parties then the following may also need to be considered:

4) Understand whether DNOs can enter the ancillary services market. An important consideration will be whether this could distort or enhance the competitive market for these services. The working group have proposed that this work is taken on under revised terms of reference; and

5) Understand how revenue received by DNOs through excluded services is treated and to what extent this may act as a barrier to them selling ancillary services.

[12] These are outlined in the The Electricity (Class Exemptions from the Requirement for a Licence) Order 2001: http://www.legislation.gov.uk/uksi/2001/3270/pdfs/uksi_20013270_en.pdf

Chapter 4: Electricity demand reduction measures

Background

Electricity demand reduction measures are steps which can be taken by commercial and domestic customers alike to reduce their overall energy usage. They can take a number of forms including energy saving light bulbs, insulation in premises or changes to working practices. Electricity demand reduction measures can reduce load, as opposed to simply shifting it (through DSR), and therefore can provide substantial benefits. For instance it could reduce the amount of electricity DNOs need to transport through their network and therefore reduce peak load which triggers reinforcement costs. As this is similar to DSR arrangements, this is also seen as a high priority for RIIO-ED1.

The modelling for work stream 3 of the SGF includes some benefit from electricity reduction measures but it does not specify how the DNO or any other party would ensure that these benefits are realised. There is no mechanism in the model for delivering these benefits so a question remains as to the role of DNOs with respect to demand reduction.

The work stream considered that it needs to assess whether DNOs should be proactively involved in electricity demand reduction. Traditionally suppliers have fulfilled this role via their legal requirements under the Carbon Emissions Reduction Target (CERT)[13] and the Green Deal[14] schemes. The work stream has already identified that under the current price control arrangements, DNOs retain around 50 per cent of any under spend against their allowance. This gives them a strong incentive to find lower cost solutions. Consequently, the work stream has concluded that where electricity demand reduction measures can provide DNOs with such cost savings, they are strongly incentivised to deploy them.

Potential barrier to implementing electricity demand reduction measures

The main barrier for DNOs taking on this more proactive role is the fact that they do not currently have a direct relationship with customers and it is rare for them to enter customers' premises and work beyond the meter. In addition, this activity is viewed as being outside of the core distribution business activities. This raises the prospect of a more active customer relationship which may require careful consideration. In addition, if these services were to be provided through a third party, then consideration needs to be given to the structure of the commercial arrangements between the DNO, third party and the customer.

Further, the work stream has noted that there has been limited trialling of electricity demand reduction measures through the LCN Fund. It is noted that one of the eligibility criteria for the LCN Fund is that the solutions being trialled must have a directly related measurable change in the operation of the distribution system in a controllable way. It was noted that many electricity reduction measures may not meet this criterion. If DNOs are going to take on a more proactive role on electricity demand reduction, then the work stream highlighted that this criterion may need to be amended.

Next steps to develop options to overcome barriers

It may be worthwhile addressing the following next steps:

1) Set out the pros and cons of DNOs taking on a more proactive role in deploying electricity demand reduction measures;

[13] For more information about CERT visit www.decc.gov.uk/en/content/cms/funding/funding_ops/cert/cert.aspx
[14] For more information on the Green Deal visit www.decc.gov.uk/en/content/cms/tackling/green_deal/green_deal.aspx

2) If there are strong merits in DNOs taking on a proactive role, consider how DNOs would engage with customers, including via a third party and the appropriate protection measures which may need to be in place;

3) Understand how the system wide benefits of electricity demand reduction can be captured and reflected to customers;

4) If necessary, consider amending the eligibility criteria for the LCN Fund to ensure that DNOs are free to trial electricity demand reduction measures and gain an understanding of the benefits they can provide;

5) Test that the outputs and incentives for RIIO-ED1 support and encourage DNOs to use electricity demand reduction measures where it has net benefits and that no new barriers have been created; and

6) Amend the Low Carbon Networks Fund eligibility criteria to enable trialling of electricity demand reduction projects.

Chapter 5: Potential distribution system operator role for DNOs

Background

A distribution system operator (DSO) role would involve DNOs taking an active role to balance supply and demand across their network. This could involve sending signals to customers and having arrangements in place to constrain customers' demand or generation. The work stream has flagged that DNOs are already undertaking local system balancing and active network management through LCN Fund trials. These focus on specific sections of the network to alleviate a particular constraint. There are no barriers to DNOs continuing to take these actions, either as innovation projects or business as usual.

The work stream has defined a DSO role as much broader than this, involving co-ordinating numerous real time local balancing schemes through a centralised control mechanism. There are a number of questions around what could trigger a move to such a role:

i) What volume of distributed generation (DG) starts to have an impact on system balancing and will require mechanisms to inform the Transmission System Operator and which party is responsible for monitoring these trigger points?

ii) What impact do grid supply points which export back to the transmission system have on national and/or locational balancing?

iii) At what point does it make economic sense to bring individual active network management schemes together under centralised co-ordination.

It is not clear whether all of these trigger points will be reached within the RIIO-ED1 price control period and therefore barriers to a transition to a DSO role are a lower priority for work stream six. However, it would be useful to understand the trigger points for such a transition and the potential options to notify the Transmission System Operator.

Next steps

The working group have proposed that the following next steps are taken on under revised terms of reference:

1) Set out key trigger points for when a DNO may need to move from undertaking ad hoc balancing actions to an integrated real time approach; and

2) Provide thoughts on which party or group is best placed to undertake an assessment of the time it would take to gear up to a more active role. Specifically, necessary investment, skills development, recruitment and corporate changes would be useful in understanding the lead time for any future transition.

Chapter 6: Integrated energy systems

Background

Integrated energy systems involve joining together separate local energy installations or systems. The objective for doing so may vary, often depending on the needs of the local area but might include maximising overall efficiency or reducing cost for customers. In addition it could also involve managing the imbalance of supply and demand where there is a high penetration of intermittent generation, or making use of energy or other resource that might otherwise be wasted, such as the heat from industrial processes. They can involve converting or storing one form of energy into another, for example connecting a large heat pump or gas-fired combined heat and power (CHP) plant to a district heating system. They can also take far more complex forms, where various energy sources feed interconnected heat and electricity distribution networks and use integrated heat storage.

As such this is a broad topic which could cover a number of different elements and different partner organisations. The work stream is not currently clear how these integrated energy systems will develop and what the DNO costs and benefits will be under the different scenarios. Due to the various approaches to integrated energy systems, it is difficult to define and therefore to assess specific barriers to their implementation. It is likely that different barriers will exist for different systems. It was suggested that an extra complexity is added when attempting to calculate and assess the sharing of costs, benefits and risks across all partners in integrated projects.

This is likely to be an area where further trialling through innovation funding could be beneficial to understand the role of the DNO and understand the barriers present and enablers required.

Next steps

It may be worthwhile undertaking the following next steps:

1) Propose specific areas of integrated energy systems which could benefit from greater and targetted trialling and use of innovation funding; and

2) Monitor current trials on integrated energy solutions which are ongoing and the benefits which emerge.[15]

Potential areas to be taken forward

Whilst discussions have focussed on arrangements required for DNOs to be implemented in RIIO ED1, in trying to examine these, the work stream has made some wider observations for the future development of smart grids.

1) In order to enable a DSR market by 2030, notification of connection of new appliances which make a significant contribution to peak demand may need to be provided not only to the DNO but to suppliers and relevant third parties. There is currently no mechanism for all these parties to be notified simultaneously;

[15] For example the Northern Isles New Energy Solutions project (NINES) http://www.ssepd.co.uk/ProjectUpdates/ and the ECO Island project on the Isle of Wight: http://www.eco-island.org/hub/hydrogen/

2) Transparency of DSR arrangements between DNOs, the transmission system Operator (TSO), and suppliers may be necessary in the future. It is expected to be important for each of these parties to understand which customers are providing DSR, for instance short term operating reserve (STOR) contracts with the TSO. There is currently no mechanism for a DNO to understand which customers on a DNO network have a STOR contract with the system operator (SO). Equally, the SO has no visibility of where a DNO has a DSR contract in place. This visibility would be useful for both parties – for DNOs when considering investment decisions and for the SO when considering system balancing options;

3) If third party ownership of storage is to become established, it may be beneficial for storage providers to sell services to a number of different parties, in separate markets. Therefore, thought will have to given to the design of the agreements to provide a service in a given market so as not to overly restrict the ability to storage providers to offer several different products, while ensuring appropriate coordination between competing contractors. This will obviously need to be balanced against the need for industry parties to have confidence that when they call on a service from a storage provider, that provider is capable of delivering it; and

4) Further, as with DSR, the cost savings from electricity demand reduction are likely to be dispersed across the value chain. If one party, such as a supplier or DNO, drive such measures, it will be unable to capture the whole system benefit. This could mean that the full value of electricity demand reduction is unable to be captured and that schemes which are economical from a whole system perspective are not undertaken because they are not viable from a individual DNO or supplier perspective.

Conclusions

The work stream has established that there are not a huge number of regulatory barriers to DNOs implementing smart grid solutions. The main ones centre on engineering recommendations and charging methodologies, which DNOs have within their power to propose changes too.

What has also become evident is that there may be a lack of commercial enablers to support smart grid solutions. This is particularly the case where DNOs are required to interact with parties outside the usual value chain and use third parties to help provide services such as storage or energy efficiency.

The trialling of such arrangements can provide an invaluable insight into what these enablers need to look like. The work stream has gleaned some important lessons from ongoing LCN Fund trials and considers that there is more to be learnt as these projects mature and run to conclusion.

Future work will need to go beyond looking at the development of smart grid solutions for RIIO-ED1 and assess barriers and enablers for their implementation from a broader perspective. This will need to take into account the interactions between all industry parties and customers to ensure any arrangements are effective and efficient. The work will need to ensure that customers' interests are properly considered and that they accrue appropriate benefits from the use of smart grid solutions.

Appendix 1: Organisation membership of work stream six

Ofgem

Department for Energy and Climate Change

British Gas

Consumer Focus

E.On

EDF Energy

Electralink

Elexon

eMeter

Electricity North West Ltd

Good Energy

KiwiPower

Logica

National Grid Electricity Transmission

Northern Powergrid

PB Power

RenewableUK

Scottish Power Energy Networks

SSE Power Distribution

Sustainability First

UK Power Networks

Western Power Distribution