Smarter Network Storage

SNS4.12 - Business Model Consultation Responses

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Product Description

Area	Description
Project Name	Smarter Network Storage (SNS)
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Product Description Author	John Hayling, Smarter Network Storage WS4 Lead (John.hayling@ukpowernetworks.co.uk)
Purpose (why)	The purpose of this document is to present a summary of the responses received following the Business Models Consultation and to record the UK Power Networks reply to these comments.

Contents

1. Introduction

Energy storage is a key source of flexibility that can help address some of the challenges associated with the transition to a low-carbon electricity sector. Storage, as identified by the Smart Grid Forum, is one of the key smart interventions likely to be required in the future smart grid. However, challenges in leveraging the full potential of storage on distribution networks to benefit other industry segments, and a lack of scale demonstrations are currently hampering the efficient and economic uptake of storage by the electricity sector.

The Smarter Network Storage (SNS) project aims to carry out a range of technical and commercial innovation to tackle these challenges and facilitate more efficient and economic adoption of storage. It is differentiated through the demonstration of storage applications across multiple parts of the electricity system, including the distribution network but also outside the boundaries of the distribution network. By demonstrating this multi-purpose application of 6MW/10MWh of energy storage at Leighton Buzzard primary substation, the project will explore the capabilities and value in alternative revenue streams for storage, whilst deferring traditional network reinforcement.

The project aims to provide the industry with a greater understanding and a detailed assessment of the business case with the full economics of energy storage, helping to accommodate increasing levels of intermittent and inflexible low carbon generation. The project was awarded funding of £13.2 million by Ofgem, under the Low Carbon Network Fund (LCNF) scheme in December 2012 and will last four years, from January 2013 to December 2016.

The SNS project published a consultation in July 2013 which identified a number of potential business models for energy storage, from which two lead models were selected. It asked a number of questions relating to the selection process and models templates that were developed for each of the two lead models. This document records the general responses that we received to the consultation and provides a response from UK Power Networks to these responses received. It outlines how the information will be used, where appropriate, later in the project.

2. Background

2.2 Consultation Scope

As part of the SNS project, UK Power Networks launched a consultation on the viable business models for distribution scale Electrical Energy Storage (EES). The principle was to demonstrate and test our thinking on the possible business models for energy storage, including the advantages and disadvantages of the options presented.

The purpose of the consultation was to gather views from all interested parties on the possible business models for distribution connected EES as proposed by UK Power Networks. The consultation also sought assurance from stakeholders and subject matter experts that all significant cost and revenue streams had been accounted for in the business models. We were seeking views on the micro-economic business model: the business model for a particular installation of energy storage, from an investor or 'controlling entity' perspective. We were considering the suitability of the business models for projects of a similar distribution-scale and of similar technology-type to SNS. The intention of the consultation was to complement existing studies on the macro-economic benefit of storage, such as those from Imperial College London[1] and the Energy Research Partnership[2], and inform how these might be achieved in practice. The key features of the technologies that the consultation was applicable to were:

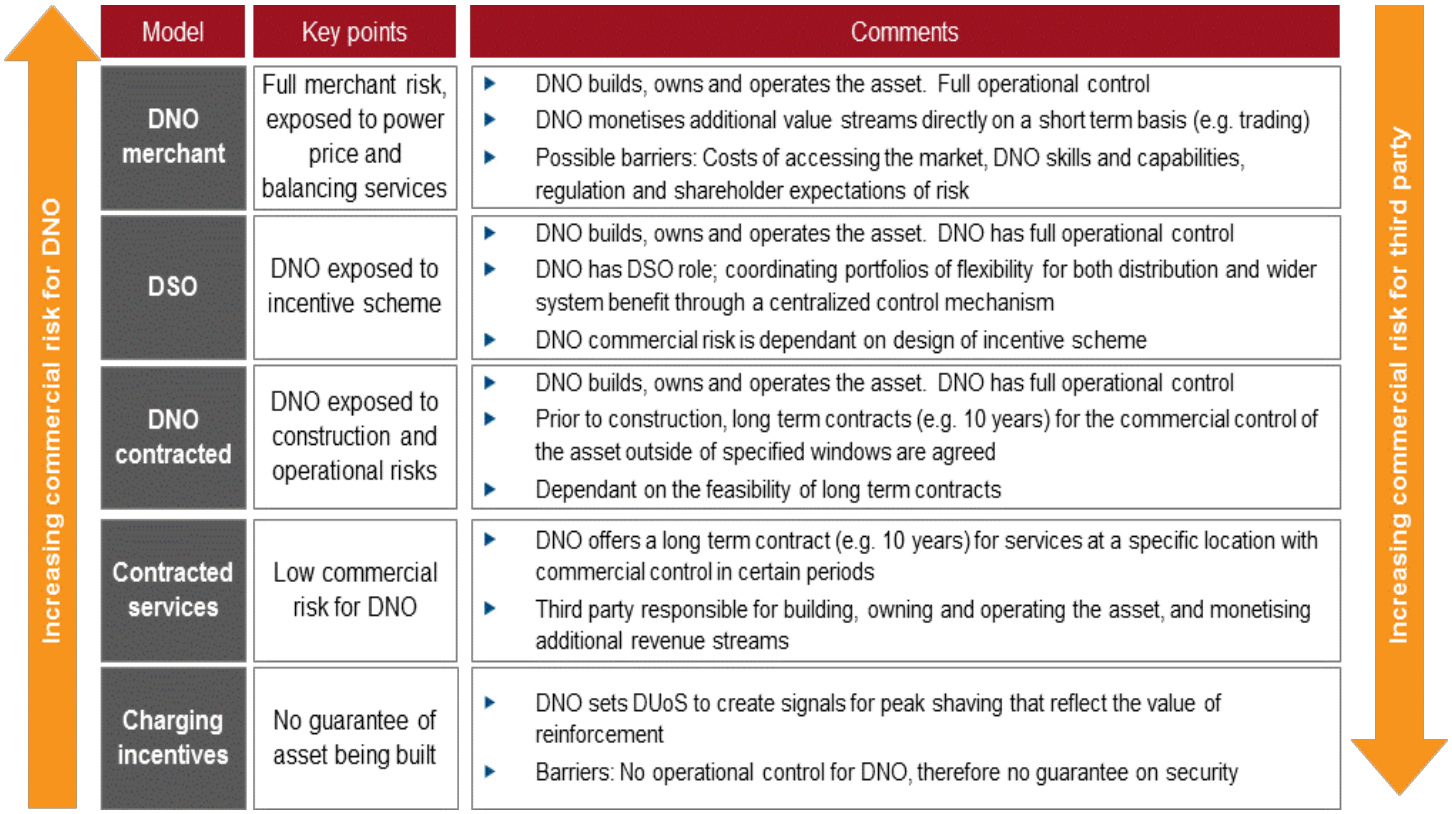
[1] Strategic Assessment of the Role and Value of Energy Storage Systems in the UK Low Carbon Energy Future, Energy Futures Lab, Imperial College, EDF UK R&D, 2012

[2] The future role of energy storage in the UK, Energy Research Partnership 2011

- **Technology**: Electrical energy storage including for example lead-acid, lithium-ion, flow and sodium sulphur batteries. Mechanical storage could also be applicable.
- **Size:** Generation capacity of between 1 MW to 10 MW, with storage capacity equivalent to between one and several hours of generation.
- **Location:** Distribution-network connected at EHV (Extra High Voltage) or HV (High Voltage). We considered business cases for projects located at similar voltages in distribution networks.
- **Primary need:** The primary need is for mitigation of a distribution network constraint that would otherwise require reinforcement. This could be related to network security, statutory voltage limits or fault-levels.
- **Technology and proposition maturity:** Future storage developments, from the first post-LCN Fund projects to a future world in which EES forms part of Business As Usual for DNOs.

2.3 Business models

The consultation identified and considered five broad categories of business model, as shown below in the following diagram.



Model	Key points	Comments
DNO merchant	Full merchant risk, exposed to power price and balancing services	▸ DNO builds, owns and operates the asset. Full operational control ▸ DNO monetises additional value streams directly on a short term basis (e.g. trading) ▸ Possible barriers: Costs of accessing the market, DNO skills and capabilities, regulation and shareholder expectations of risk
DSO	DNO exposed to incentive scheme	▸ DNO builds, owns and operates the asset. DNO has full operational control ▸ DNO has DSO role; coordinating portfolios of flexibility for both distribution and wider system benefit through a centralized control mechanism ▸ DNO commercial risk is dependant on design of incentive scheme
DNO contracted	DNO exposed to construction and operational risks	▸ DNO builds, owns and operates the asset. DNO has full operational control ▸ Prior to construction, long term contracts (e.g. 10 years) for the commercial control of the asset outside of specified windows are agreed ▸ Dependant on the feasibility of long term contracts
Contracted services	Low commercial risk for DNO	▸ DNO offers a long term contract (e.g. 10 years) for services at a specific location with commercial control in certain periods ▸ Third party responsible for building, owning and operating the asset, and monetising additional revenue streams
Charging incentives	No guarantee of asset being built	▸ DNO sets DUoS to create signals for peak shaving that reflect the value of reinforcement ▸ Barriers: No operational control for DNO, therefore no guarantee on security

FIGURE 1: Business Model key features

In the **DNO Merchant** business model, the DNO takes full ownership and operation of the asset and is responsible for monetising the value from the wholesale electricity markets and ancillary services provided to the System Operator. The DNO does this directly in the relevant markets and there is no third party with a direct relationship to the asset.

Under a **DSO** model the DNO would own, operate and maintain the asset as part of a wider role of actively managing its network under a regulatory incentive scheme, akin to the role that National Grid plays at the transmission level. The

DNO would also lead the development and construction of the asset, finance its construction and operation and then hold its full commercial control. The DNO would accrue all the project costs and benefits and there would be no direct third party involvement.

The **DNO Contracted** model differs from the DNO Merchant model due to the involvement of a third party to manage the capacity of the asset when it is not required for security purposes. The DNO would still finance, maintain and operate the asset, but would dispatch for ancillary services at the instruction of a third party.

Under the **Contracted Services** model, the DNO runs a tender for third parties to build and operate storage at a specific site. The DNO makes a fixed annual payment in return for the distribution network services provided by the third party. The third party manages the capacity of the asset when it is not required for security purposes.

The **Charging Incentives** model is one under which the DNO ensures that the DUoS charging creates the right incentives in the location requiring reinforcement. Third parties may or may not respond to the incentives by building storage.

A summary of the potential advantages and disadvantages identified for each model is shown in the following table below.

Business model	Advantages	Disadvantages
DNO Merchant	• DNO has full operational control • May be lower cost of financing if financed as a regulated asset (depending on risk sharing between DNO & Customers)	• DNO requires new skills and capabilities to trade in the wholesale energy market and participate in procurement mechanisms for ancillary services • May not be consistent with DNO shareholder expectations of risk
Distribution System Operator (DSO)	• DNO has full operational control • Specific incentives on DNO to manage costs of balancing the grid • May be lower cost of financing if financed as a regulated asset (depending on risk sharing between DNO & consumers)	• Regulatory regime not yet in place • Commercial risk remains with DNO and Customers
DNO Contracted	• Customers share in additional captured value not previously available, depending on risk/reward sharing • May be lower cost of financing if financed as a regulated asset (depending on risk sharing between DNO & Customers) • Commercial risk for DNO significantly decreased • Third party may be better placed to manage commercial value streams • Third party may be able to aggregate across multiple assets which increases scalability and overall system efficiency	• Complex tolling contract required (i.e. a services contract between the DNO and a third party) • Third party may heavily discount long term value of additional revenues
Contracted Services	• Commercial risk for DNO significantly decreased • Third party may be better placed to manage commercial value streams • Third party may be able to aggregate across multiple assets which increases scalability and overall system efficiency	• DNO does not have direct operational control, reducing confidence for security of supply applications • Complex tolling contract required • Third party may heavily discount long term value of additional revenues • Additional system value and benefits not delivered to customers • More challenging to relocate/redistribute in reaction to changing local network constraints
Charging Incentives	• DNO (and Customers) takes no commercial risk • Incentives based approach may be economically efficient	• No guarantee of storage being built • No DNO control on asset being available for network security when required • Third party exposed to annual changes to incentives

TABLE 1: Business model advantages and disadvantages summary

After reviewing these models, we selected DNO Contracted and Contracted Services as the two lead business models for further consideration. The DNO Merchant model was excluded mainly because of the requirement for the DNO to build a trading capability and take wholesale market risk, which is unlikely to be consistent with future unbundling and regulatory frameworks. The DSO model, while attractive in principle was excluded at this time because the underlying regulation that would define this model has yet to be developed and as such cannot be critically appraised. However,

we recognise that a number of other LCNF projects may benefit from this kind of approach. As such, we do not rule out the possibility that this business model becomes more relevant in the future. The Charging Incentives model was excluded because it provides no guarantee of the storage being built or, once built, being available to provide network security.

2.4 Lead business models

Under the DNO Contracted model, the DNO would own the asset, whereas under Contracted Services it would be owned and operated by a third party (or combination of third parties, such as community groups or local organisations).

The lead business models share a common feature of a long term contract between the DNO and one or more third parties to share the risks and rewards from commercial opportunities that can be captured beyond the asset's network-focussed role of providing network security. The terms for this tolling contract would need to give the third party the greatest freedom possible to optimise the value of additional value streams whilst ensuring that the DNO's security requirement is met.

Impact on network security

The DNO Contracted model gives the DNO direct control over the operation of the storage. The security provided by the Contracted Services model is dependent on the contractual obligations placed on the third party, and how it fulfils these obligations. Whilst not as direct as operational control, this model could provide sufficient security if the terms are well structured. Currently there is limited use of contracted flexibility, however this would be expected to increase and improve the confidence in the use of such assets across the next decade.

Impact on asset value, costs and risks

Both models depend on a well-structured tolling contract that gives as much availability to the third party as possible without compromising security. Both models place the optimisation of the value streams with a third party which is likely to have a more developed set of skills and capabilities to generate value from the storage without imposing high costs of trading, and depend on a third party's willingness to take long term risk on the additional value streams. However, under the DNO Contracted model there is more flexibility for the DNO to share some of this risk, and even carry out some of the optimisation, if the DNO is willing to take some merchant exposure.

A relative advantage of the DNO Contracted model may be a lower cost of capital. However this may not persist as the deployment of storage increases if the risk profile of the utility changes, for example if DSO activities result in less stable revenues. The DNO Contracted option creates the possibility of sharing the risk (and additional benefit) with Customers (if this was considered desirable for Customers), whereas this is not easily possible with the Contracted Services model.

Impact on wider benefits

Under both models, the tolling contract will need to clearly specify the terms on which capacity is made available. There is a risk that the full benefits for the GB system are not captured due to a lack of flexibility in these terms.

The DNO Contracted model allows for competition between third parties in the provision of trading and aggregation. The third party has the ability to transfer their knowledge and expertise to develop projects in other DNO licence areas. Under the Contracted Services model, the third party can also transfer their experience of designing, building and operating other storage assets. Additionally, third parties that have a portfolio of assets in planning, construction or operation may have already established good value arrangements and contracts with the providers of these design, procurement and building services.

Under both models, the DNO may be able to set terms of the technology considered, to ensure that a low carbon solution is procured but is likely to have greater control of the safety and quality assurance in the DNO Contracted model.

Future proofing of business model

Both models allow for aggregation of the dispatch of multiple assets by the third party. The Contracted Services model allows one third party to operate storage across multiple DNO licence areas.

From a regulatory perspective the DNO Contracted model could face barriers as the DNO approaches its present deminimis non-distribution activity limit, which is 2.5 per cent of the sum of the licensee's share capital, its share premium, and its consolidated reserves.

Based on our review of the lead models, both the DNO Contracted and Contracted Services appear to be feasible business models for distribution-connected storage. While the DNO Contracted model generally faces more regulatory barriers in the longer term at scale, it is important for the industry to further assess these and remove where possible to prevent bias to sub-optimal models and restricting the timely adoption of storage. There are some key barriers for these models that are shared: the complexity of the tolling contract and the willingness of a third party to take long term risk on the additional value streams.

3. Overview of Responses

Summary of Responses

We received a total 11 responses to the consultation. Most respondents were in full agreement with the range of business models presented, the choice of assessment criteria used, and the proposed lead models. An additional model was proposed by two respondents, which in essence was to use a storage device to solely satisfy a single location specific application. In this case the battery would not operate commercially and would therefore purely operate as a regulated asset with no additional revenue.

The table below provides a quick summary of the responses that we received to the business models question of the consultation:

Do you agree with the:	1.Electralink	2.REDT	3.Eon	4.Northern Powergrid	5.Good Energy	6.RES	7.Hghview Power Storage	8.AMT SYBEX	9.British Gas	10.National Grid	11.SSE
1. Range of models?	✓	✓	✓	*	✓	✓	✓	✓	✓	✓	✓
2. Choice of Assessment?	-	-	✓	*	✓	✓	✓	✓	✓	✓	-
3. Two lead models?	-	-	✓	*	✓	✓	✓	✓	✓	✓	-
4. Regulatory Treatment?	-	-	-	-	-	✓	✓	✓	✓	✓	-
5. Advantages / disadvantages of the lead models?	-	-	-	-	*	*	✓	✓	✓	✓	-
6. What is your favoured lead model?	-	DC	CS	-	CS	CS	DC	DC	CS	DC	-

TABLE 2: Quick summary of consultation responses

Key to table 2:

✓	Generally agreed (and did not specifically disagree) with the question
*	Did not answer directly or provided an alternative / unrelated comment
-	Did not answer / comment on this question
DC	DNO Contracted Model
CS	Contracted Services Model

4. Detailed responses to consultation questions

4.1 Business Models for Storage

1. ***Do you agree with the range of business models presented in Section2.1?***
    a. *Are these business models and their variants representative of the range of plausible business models?*
    b. *Do you agree with the characterisations of each of these business models in their respective Sections 2.1.1 through to Section2.1.5?*

Most responders agreed with the full range of business models presented. Two responses (Northern Powergrid and SSE) offered a further model which consisted of the installation of a network storage device to meet a single location specific application of a DNO. This model was termed “DNO Capex” by Northern Powergrid. This model essentially treats the storage device as a regulated asset which generates no additional revenue. Good Energy felt that a further model which would allow for multiple parties should have been given. RES highlighted that the lead models focused on the DNO leading or directing development and felt that a solution led by a developer, such is the case with renewables development was missing. British Gas felt there was no essential difference between the DNO Merchant and DSO models and together they should be renamed “DNO Operated”.

With regards to the characterisations of each model, one responder (Northern Powergrid) re-iterated that the DNO Merchant model was not compatible with the current regulatory regime due to the direct trading requirements. RES felt

that it would be very high risk for a DNO; as operating EES in this way would sit entirely outside of a DNOs existing skill set. They were further concerned with the cost of DNOs managing the development themselves and the time that it would take them. There were possibly other technologies [to Li Ion] that may offer better value and dispatch of the device may prevent a third party from accessing the full commercial opportunity with the DNO Contracted model. Eventually what would trigger the need to conventionally reinforce and if too soon it would reduce the commercial benefit.

Another responder felt that the benefits of deferring a network upgrade was not prominent enough in the consultation. E.On felt that under the Contracted Services model too little incentive could exist for the third party to pass on benefits to the customers on the system, while AMT SYBEX felt that both the Charging Incentives and Contracted Services models presented a risk to the DNO in that it would have less control over the device.

UK Power Networks Response

There is clear agreement that all the models presented or their variants were appropriate and represented the full range of plausible business models with the potential exception of the additional model “DNO Capex” which was suggested as a further model to be considered.

While this is a potential business model structure for storage, the instances in which storage is currently economically viable under this model are relatively limited. In addition we believe that operation of storage in this way would tend to lead to an inefficient use of the storage capacity which could otherwise be put to other uses to benefit the wider system under different models. Hence if all storage were to be installed under this model, it is likely a level of capacity would be over-installed as system operators installed storage to meet solely their own needs.

As the main thrust of the SNS project is to demonstrate the economic viability of EES when operated to benefit multiple parts of the system and generating additional revenue streams, this model would be unable to add to the learning and is therefore not to be considered further.

Whilst multi party ownership is an arrangement that is described in the consultation, it has not specifically been identified as a separate business model. Rather it is more likely to be a variant of any model that includes third party involvement, and could take the form of a joint venture or consortium arrangement. Alternatively, aspects of the business model could be split between multiple third parties, as will be the case for the trials within the SNS project itself. Of the two lead models presented, considering multi ownership for the contracted services model might make more sense although in theory could even apply to DNO Contracted. Therefore we will look to include it further in the operating and ownership models work being undertaken in the second half of 2016.

The suggested incompatibility of the DNO Merchant and DSO models with the current regulatory regime is recognised and this, together with the required changes in skill set that a DNO would need to make to operate such storage models, are in part why neither of these were selected as lead models to consider further. In so far as any other model might be incompatible with the current regulatory regime, a Legal and Regulatory study is planned as part of the SNS project and this will further identify any such barriers or incompatibilities to entry. The outcome of this study is due to be published at the end of October 2015.

With regards to the battery technology that was selected, the choice was made on the merits of identified project success and procurement criteria, which included the applicability for the site location. Several technologies were considered within a tender process and the chosen technology best met all criteria, including cost-effectiveness. This is fully documented in the project publication SNS1.2 Design & Planning Considerations[3], where more detail is provided.

[3] Design and Planning considerations for large-scale distribution-connected energy storage (SNS1.2) is published on the project web site: http://innovation.ukpowernetworks.co.uk/innovation/en/Projects/tier-2-projects/Smarter-Network-Storage-(SNS)/

The lead business models selected to take forward are by design compatible with a range of battery and other storage technologies available. The cost of developing each type of technology may vary substantially from one another and is likely to have the greatest impact on the overall cost of the development. If, as has been suggested, a DNO's development costs were more than a third party then; if true, would drive the choice of a Contracted Services model over that of DNO Contracted. This decision area will be explored as part of the follow on work scheduled later in the project once construction costs and contributory revenue data from the trials work is known.

2. ***Do you agree with the choice of assessment criteria as described in Section2.1?***
    a. *Are these the key assessment criteria that the business models should be compared against?*
    b. *Are there any additional advantages, disadvantages or barriers to any of the individual business models that have not been included?*

All the responses generally agreed with the choice of assessment criteria used and considered that it was the correct criteria to use, except one respondent (Northern Powergrid) who thought that the consultation was missing comparisons with other forms of storage used in the energy industry, notably as seen in gas or on the transmission system. It further commented to say that the consultation did not mention ownership of the energy stored. Another respondent (National Grid) felt that the criterion of 'minimising cost to the consumer' was missing and another (AMT SYBEX), the 'ability to respond to innovation' was missing too.

One response (E.on) felt that the ability of the DNO to identify or have an understanding of where there is a need for storage on the network and the problems which it can solve should be stressed more in all business cases. Another response (Good Energy) considered that the complexity of tolling charges and the willingness to pay the DNO may be a barrier. An advantage could be savings made if the work could be combined with other civil work going on at the site. Success may ride on the availability of central funding and policy design for incentives under the Electricity Market Reform. There was concern raised in responses over how energy exchanged would be accounted for and the size of the device may limit access to certain services, for example black start or fast frequency response which it was highlighted required a minimum of 10 MW.

Storage as a way of relieving network constraints for other renewables projects was felt by one responder (RES) to be a further advantage of storage in general. It could be treated as part of the connection asset(s) in which case the cost could be recouped in advance. They further felt that there may be other technologies that could offer better value for dispatch of the storage device. This could prevent a third party from accessing the commercial opportunity with the DNO Contracted model. Under this model another responder (British Gas) felt that it was not clear what happens when a DNO's requirement changes. Some felt that third party planning of commercial benefits could provide conflict to the DNO under the Contracted Services model and one respondent (RES) felt that a further disadvantage was that it would require a connection agreement. The DSO model would be reliant upon not only the need for regulatory changes but it was felt (by National Grid) that the lack of skill base within DNO's would be a huge barrier when needing to actively manage the network. Further, one response (RES) questioned if operating the storage device may trigger a need for reinforcement rather than providing for its avoidance and whether this would reduce the commercial benefit as a result.

UK Power Networks Response

We welcomed the suggestion that identified that other energy storage arrangements, gas for example, was not included within the consultation. For the further legal and regulatory work we will seek to include further comparisons. However, the parallels with gas do diverge compared to the lithium-ion technology that the SNS project is using and it might have been more relevant should flow technology or liquid air for example have been the choice. These technologies typically have a lower marginal cost of energy than lithium-ion – i.e. installing additional energy capacity/duration is not significantly more expensive, as for gas. On review we do not believe that it would have changed the outcome of the two lead models identified.

The principle of gas storage allows a gas shipper to purchase a share of a storage facility and to then deposit gas within the facility, recalling the gas when it is in high demand. Alternatively, gas is also held in the high pressure gas network as a way of managing the bulk transmission system. The principle here is broadly the same as balancing services that the SNS storage device will be providing to the grid operator, however, the fundamental difference with electrical storage is both the relative incremental cost of storage and the method; hence the volume of energy and time duration that energy may be stored and used economically. The concept of energy held in the storage device being multiparty owned given the relative size of the storage device, is one that could prove very complex and costly, however like the question of the ownership of the energy stored in the device, we will look to include it in our later analysis and review of ownership arrangements.

Regarding the suggested missing criteria, minimising cost to the consumer; this was intended to be incorporated within the *optimising system value* criterion, where the rationale for choosing storage over conventional reinforcement is looking at minimising the cost of investment. Equally, we did not score the model selection against the specific criterion of innovation as we considered each of the models to be highly innovative in their own right. If able to differentiate between whether one model was more or less innovative then another, we are not certain that this would have added much significance to the model selection.

We envisage that there will need to be some mechanism which identifies where storage on the system might be required and how this would be communicated. We expect this aspect to be considered as part of the ownership and operating arrangements work being undertaken later in the project. Using storage as a means to provide quicker or faster connections on congested parts of the network is also an area that we will look to consider later in the project, if possible.

3. ***Do you agree with the choice of the two lead models and the reasons for selecting these as described in the Qualitative Assessment Summary, Section2.2?***
    a. *Are these options the most likely to be suitable for distribution-connected storage, or should one or more of the other business models (or variants of these) have been considered over the DNO Contracted and Contracted Services models*?
    b. *If so, which models should have been considered and why?*

The responses generally all agreed, with no dissent, that the two lead models were the correct choice and for the reasons suggested in the consultation. DNO Contracted and/or Contracted Services would be the right options and most suitable for distribution connected storage because their characteristics do not require major organisational or regulatory change, which if the tolling contract arrangements are designed appropriately, would enable both models to allocate risk and benefits adequately. Some felt (Good Energy for example) that there was a strong likelihood that the third party would not be a single entity and that more recognition of this should be made. A shared ownership model like community renewables projects or a multiple party model, where each value stream is tendered separately on a regular (monthly) basis was suggested.

UK Power Networks Response

The project will continue to evaluate the two lead models identified and report on the full cost and benefits under the operating and ownership arrangements work to be completed at the end of the project trials. The potential benefits for shared ownership will also be considered.

4. ***Do you agree with the range of four regulatory treatment scenarios presented in Section2.3?***
    a. *Are there other scenarios that should be included?*
    b. *Are there inherent regulatory created limitations that have not been discussed?*
    c. *Are there additional advantages or disadvantages for each of these scenarios that should be considered?*

Not all responders provided comments on the regulatory treatment put forward in the consultation, some citing that it was outside of their area of expertise. Those who did choose to respond to this question except one, agreed with the range of four regulatory treatments scenarios offered. They felt that these covered the plausible options recognising that the nuances of each model will receive further study as part of this project. British Gas suggested there could be a midway approach between the customer / DNO finance scenarios and/or an incentive placed on the DNO to optimise the revenue of the storage device. Another response (RES) suggested that storage could be offered as part of a connection offer assuming it was an economic alternative to traditional reinforcement.

With regards to any regulatory limitations not identified, one responder (E.On) felt that there might be a conflict with a DNO owning what some might view as generation assets and in particular where a single company were active in both the energy market and with connection and/or use of system as they felt there was a clear conflict between the two.

RES felt that if storage were classed as generation it would increase the connection time. They were also concerned that storage might suffer additional costs (use of system charges) for charging and discharging, whilst having no way of being recognised for the general system benefits storage could bring, which they felt would be unfair. One response (Electralink) suggested that there was a significant risk with the Contracted Services model should the revenue stream assumptions and risks prove to be wrong.

UK Power Networks Response

The regulatory treatments will be considered in the further analysis which is due to be completed later in the project. It is clear that a number of potential uncertainties are barriers to storage adoption exist, such as the definition of generation and how storage is classified. These are recognised and have been identified as part of this project and wider work within Ofgem's Smart Grid Forum work.

Further work to assess the extent of these barriers and impacts on the business model types is already underway and will be reported fully in the legal and regulatory study planned within this work area.

4.2 Lead Business Models

5. ***Do you agree with the respective advantages and disadvantages of the two lead business models as described in the Section3?***
    a. *Are there other limitations, barriers or features of these business models, or EES projects in general that have not been considered?*
    b. *Does either of these lead business models disproportionally favor one party over the other?*

There was general agreement on the respective advantages and disadvantages of the two lead models, and it was felt that they had been well considered and had taken account of a broad range of issues over the life of a potential storage device deployment. No responses felt that either of these lead models disproportionally favoured one party over the other apart from RES. They felt that that the DNO Contracted model would overly favour the DNO as sizing of the device would be driven by offset reinforcement thereby putting a third party [developer] at a disadvantage.

Regarding limitations, one respondent (High-View Power Storage) felt that the capacity market may prove unsuitable for storage, in particular the allocation of penalties. Also, much would depend on the budgetary restraints of the DNO, access to funding and the mitigation of circuit / plant reinforcement. For this reason the models should perhaps also include pre-feasibility considerations where the costing for monitoring and measuring flows and capacity on the network is included and future generation modeled, around where the device is intended to be sited. Another suggestion (by RES) was that under the DNO Contracted model the DNO should consider using an EPC (Engineer, Purchase and Construction or “turnkey”) contract as it would bring third parties in, deliver constraint management more quickly providing better sizing of storage and would deliver a lower capital solution, providing greater revenue over an EES systems life.

UK Power Networks Response

The advantages and disadvantages of the two lead modes will be kept under review and will be considered further in the operating and ownership work being undertaken later in the project. The impact of the Electricity Market Reform work and capacity market will be considered within the legal and regulatory review study being undertaken later, however we are minded to agree that the Capacity Mechanism is unlikely to be a suitable additional benefits stream for storage operators due to the open-ended duration of stress-events that could lead to significant downside.

The consultation did not provide the details of how sites that might be considered for a storage solution would be selected or how the development might be offered out to third parties where relevant, other than through a tender process. Should the SNS project prove successful in demonstrating the economic viability of using storage, then more detail as to how this process might operate, we would expect to provide in the final analysis of business and operating models work. While EPC contracts could offer greater certainty of value in some cases, the level of existing internal engineering, procurement and construction experience within many DNOs can also offer best value for customers in other cases.

6. ***From your perspective, which of the two lead business models is most likely to be favoured?***

Of those that provided a view, there was an equal split between responses as to which of the lead models might be most suitable with 4 respondents choosing each. Energy suppliers all favoured the Contracted Services model, whilst the remaining storage / technology developers and the grid operator favoured the DNO Contracted model on the basis that it would in their view provide greater security of supply. Two respondents did not express a preference and one (Northern Powergrid) favoured their own suggestion; ‘DNO Capex’.

UK Power Networks Response

It is interesting to note the equal split of interest between both of the lead models. It appears those with network responsibilities typically favour the DNO Contracted, perhaps due to the enhanced confidence in meeting security of supply and quality objectives, whereas those without physical network assets operating in the market space favour the Contracted Services approach, perhaps due to the more familiar approach currently employed for conventional generation and higher-carbon sources of flexibility. The SNS project will continue to evaluate the two lead models identified and report on the full cost and benefits under the different operating and ownership arrangements work to be completed at the end of the project trials.

4.3 Investment Model Template

7. ***Are there other technology parameters, costs or revenue streams that should have been considered in the investment model template?***
    a. *If so please give details*

Of those who commented, it was generally felt that there was a robust set of parameters, costs and revenue streams that had been identified in the templates. The only parameter felt to be missing was detailed battery performance data costs which had not explicitly been included in the model. The treatment of depreciation and how this asset affects the regulated asset value of the DNO would it was felt require further investigation.

UK Power Networks Response

This template was primarily created as an aid to understanding how the two lead models would operate. Whilst an assumption of battery degradation has been used in its creation, further detailed information will only be known once the two year project trials phase is complete.

8. ***Do you agree with the interrelations of these ancillary services and their associated revenue streams?***
    a. *Are there additional complexities in the dispatch of the asset to utilise these revenue streams that have not been considered? Are they all mutually exclusive or potentially dispatchable in unison, are there additional complexities in the knock-on effect to battery performance that have not been considered?*

It was noted by High-View Power that some services might need to be dispatched in unison and this would add considerable complexity. Consideration to providing triad avoidance services during the winter peak should be considered. Another suggestion from RES was that the model should consider whether any of the primary services would incur penalties if dispatch was not met. This they thought should be factored into the decision of whether to dispatch ancillary services.

Regarding additional complexities in the dispatch of the asset, Good Energy felt that it was not clear how to physically differentiate between the use-of-system charges for each of the different services. With the new Capacity Market still in its design phase it was unclear what degree of “paralleling” of revenue streams and the process by which it would be audited. It was suggested that the model should consider whether any primary service of energy storage incurs penalties if dispatch is not met and factor this into the decision on whether or not to dispatch ancillary services.

UK Power Networks Response

The project intends to trial both single service provision and multi service provision in a form that could be used to develop new system services. While there are some services that could potentially be provided in parallel, it is not intended within the project to deliberately incur penalties for non-delivery due to ‘paralleling’ of services that conflict if dispatched. Rather, services that deliver synergies and can be fully delivered in parallel are to be explored, whilst

conflicts are avoided. Providing triad avoidance services is also a potential service that is now being considered further with our supplier partner.

9. Do you agree with the stated assumptions and model limitations?

a. Should any of these stated assumptions or limitations have been dealt with differently?

The responses generally agreed with the stated assumptions and model limitations although one response (Electralink) felt that the templates did not capture the full level of risks and uncertainties likely. Other comments (Good Energy & RES) included that: further breakdowns of the averted reinforcement costs would have been helpful; some discount should be shown to the DNO Contracted services model to account for it expecting the market to make use of spare capacity of an asset rather than designing the asset specifically for certain uses. It was also suggested, by RES that the assumption that the DNO's cost of capital is significantly less than that of a third party owner should be tested as some battery manufactures or other potential developers would for example, be at least as large in size as a DNO. British Gas agreed and felt that this cost of equity looked too high.

UK Power Networks Response

The allowances made for risk are based upon our project starting assumptions. These parameters are generally user variable within the templates and can easily be modified by a user who wishes to make different assumptions. The total offset reinforcement cost of the SNS project base case has been included in the template as a benchmark for comparison purposes. In practice, avoided reinforcement work will differ widely in both work content and cost between different schemes at different locations. Therefore providing a further cost break of the base case was not seen as relevant to the use of this model.

As regards the cost of equity that has been used, this has been based on Ofgem published and agreed cost of capital allowances from our previous price control[4] for DNO's. The higher rate used for a third party is an assumption we have made. However, the template allows for this value to be altered by any user who wishes to use a different assumption.

[4] http://www.ofgem.gov.uk/Networks/ElecDist/PriceCntrls/DPCR5/Documents1/FP_5_Financial%20Issues.pdf

5 Consultation Respondents

We would like to give our thanks to those that took the time to review and consider the report and share their views.

ElectraLink

REDT UK Ltd

E.On New Build & Technology Limited

Northern Powergrid

Good Energy

RES UK & Ireland Limited

Highview Power Storage

AMT-SYBEX Ltd

British Gas

National Grid

SSE Plc