smarter grid solutions

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Lia Santis
Ofgem
9 Millbank
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Ref. Smart Grids Evaluation Framework – A Smart Grids Forum Consultation Report

Dear Lia,

Smarter Grid Solutions Ltd (SGS) welcomes the opportunity to respond to Ofgem's consultation on the proposed framework for the evaluation of smart grids.

SGS provides a range of hardware platform products, software applications (related to Active Network Management (ANM)) and consultancy services to design and deliver smart grid solutions that help electricity network operators with the challenges associated with grid connections and the changing profiles of demand and generation. These solutions allow grid operators to avoid or defer capital intensive network upgrades while providing more cost effective and faster grid connections for new customers, improving network utilisation, extending network visibility and ultimately reducing customer bills. The ANM applications that we deliver can be used to manage a variety of technical constraints common to distribution networks including thermal, voltage and fault level through the coordinated control of Distributed Energy Resources (e.g. generation, demand, storage or network devices) connected to the network.

SGS has a wealth of practical experience from our work on a number of Smart Grid projects in the UK and Europe which we hope will provide useful input to the consultation process. These include the active management of distributed generation in rural and urban networks, the implementation of trials of domestic demand side management and large scale electrical storage. Examples of SGS projects include the Orkney Registered Power Zone, Northern Isles New Energy Solutions, Low Carbon London and Flexible Plug and Play Low Carbon Networks; all of which have ANM as the key enabler for smart technologies.

This response will provide our views on the specific questions raised within the consultation which aims to address an important but naturally complex challenge. We thought it of value to highlight our main observations separately from the individual question responses:

- The creation of an evaluation framework for smart grids is a complex and ambitious task and as a consequence a number of compromises and simplifications are proposed. We believe that these simplifications severely limit the value and credibility of the proposed framework. We recommend that further progress wait until the output of Workstream 3 is available in order that the proposed framework can better reflect the breadth of smart grid technologies available and, importantly, how combinations of these technologies must interact to deliver solutions to specific network challenges.

- The consultation focuses solely on grid interventions which will create 'headroom' whilst continuing to operate the network in a passive 'fit and forget' manner. This is contrary to the industry-wide belief that more active management of distribution networks will be required to facilitate smart grids.

- The proposed modelling approach fails to recognise the potential use and impact of commercial innovations such as new forms of connection agreements (e.g. as required for demand side response), which are likely to also have a service cost associated with them and are fundamental in many Smart Grid projects;

- The consultation presents a framework for evaluating the cost of smart grids but fails to recognise the potential cost of incentivising Distribution Network Operators to adopt what are perceived, rightly or wrongly, to be higher risk smart grid solutions instead of network reinforcement which provides longer term and steady future revenues;

- The consultation identifies a range of smart solutions which are from a yet to be issued technology list being developed in Workstream 3 of the Smart Grid Working Group. As a consequence, the model fails to recognise the importance of various key technologies. One such technology is ANM. ANM is being widely deployed across a number of existing Smart Grid projects as the central coordinating technology for the management of network constraints. In these projects, it is the combination of ANM, commercial innovation and smart controllable devices that allow latent grid capacity and headroom to be released from the network. The omission of ANM and interaction with commercial innovation as smart solutions appears to be a significant oversight; and

- In Section 4 and in Annex C of the consultation a process has been used to identify four indicative smart solutions broadly chosen to cover the spectrum of key functionalities. Whilst we recognise that Workstream 3 remains formative, and Section 4 will require to be updated in the future to reflect the output of that workstream, SGS do not agree that the selection of indicative technologies in this way is the correct approach. This proposed approach creates a potentially misleading impression, within the industry and wider stakeholder group, that these technologies represent the most important or relevant smart solutions. Notably:

    - the identification at this stage of indicative technologies is likely to create an implicit assumption that these are the most important or effective technologies to deliver the smart grid functions identified. This is not necessarily the case. For example, while Dynamic Line Ratings can be used to provide information on the real time current carrying capacity of a specific component this technology in itself does not manage thermal constraints; instead a technology such as ANM must be deployed with Dynamic Line Ratings to make use of the constantly varying current carrying capacity and hence manage the constraint. The same is true of DNO-led DSM, automatic voltage control and the use of energy storage, all which require to be controlled and coordinated to deliver in a safe and reliable way the management of the technical constraint being faced in any specific network area; and

- the smart grid functionalities / value drivers described (first highlighted in Figure 12 and then used again in Table 7) are also a mix of network constraints to be managed (the function) and a limited subset of Distributed Energy Resources that can be controlled or used to manage those constraints. We would recommend that this section be reconsidered to focus more on the smart grid functionality desired (what technical constraints require to be managed). For example, the management of the technical constraints which allow network reinforcement to be deferred or avoided is in practise achieved by managing thermal, voltage, fault level, and potentially, stability constraints. There are various ways to achieve each of these and some of them are highlighted in the consultation as potential smart solutions. Furthermore, multiple smart solutions are likely to be required to work together, based on the specifics of the network area and nature of the constraint, in order to remove the constraint. A good example, of this is DNO-led DSR which could be combined with a Dynamic Line Rating solution and would require co-ordination by an ANM scheme. Only by focussing on the constraint that requires to be managed can these combinations of smart solutions be properly considered in any meaningful cost benefit analysis against representative network scenarios.

Please find below our specific comments on the questions raised within the consultation:

Section 2

Do you agree with the definition of smart grids?

Yes.

We note that the consultation does not provide a new definition of smart grids but references a number of prior definitions which do collectively represent a view of smart grids that we agree with. We welcome the clear distinction made between smart grids and smart meters.

Have we captured the main complexities associated with assessing the costs and benefits of smart grids?

Partly.

We believe that the proposed evaluation framework is oversimplified and will not present a meaningful or credible assessment of the costs and benefits of smart grids.

Various factors, such as incentives for Distribution Network Operators to implement Smart Grids as opposed to conventional network reinforcement solutions which they are currently skilled, resourced and equipped for, should also be considered.

Quite rightly the consultation focuses the cost benefit analysis on the difference in cost between traditional and smart; however this does not consider the wider societal benefits of smart grids such as reduced wirescape, cheaper connections for generation or demand customers (who generate economic value) and reduced carbon impact as a result of decreased levels of construction.

Do you agree with our approach to dealing with these complexities in the overall evaluation framework?

No.

A simple and transparent decision tree process would appear to be appropriate only for a very high level evaluation. We believe that the limitations of the proposed approach are such that the output is likely to be too far from reality to be meaningful.

We also note that the inclusion of a decision point in 2023 within the model may result in an implicit assumption by Distribution Network Operators that more widespread use of smart solutions (outside of trials such as those funded by the Low Carbon Network Fund) may not be required until after that date. We do not believe that this is the intention but this should be clearly stated.

Section 3

Do the technologies set out in Table 2 constitute a sensible list of value drivers?

Partly.

We would recommend that other forms of electric heating other than heat pumps (e.g. electric storage heating) and thermal energy storage (e.g. hot water) are also added to the list for wider evaluation.

Do you agree with our assessment of the technical characteristics of each?

Yes.

We note that in Table 2, DG: Large scale onshore wind will also have an increase in peak thermal load on distribution networks as evidenced by existing projects such as the Orkney RPZ, Low Carbon Hub and Flexible Plug and Play Low Carbon Networks. In Table 2, large scale wind is also included twice, once under DG and once as a standalone with biomass.

Are there any other technologies that could have a significant impact on the value of smart grids?

Yes.

As already highlighted above other forms of thermal storage such as electric storage heating (as currently in millions of UK homes for teleswitching of demand) and hot water storage (as being trialled as part of the Northern Isles New Energy Solutions project) should also be considered. It is possible that these may be incorporated within the scope of smart appliances. However, the definition of smart appliances is usually reserved to describe loads associated with white goods (e.g. freezer, washing machine, etc.). The list might also be expanded to include aggregated demand side management, which may exploit various types of technology at the user level but will only be facilitated by new infrastructure for co-ordination.

Our analysis suggests that the most important factors to vary across the scenario will be: the pace of electrification of heat and transport; the increase in distributed generation; and the increase in intermittent and inflexible generation. Do you agree? Are there any other variables that we should look to vary across the scenarios and why?

Yes.

We agree that the pace of change and localization (clustering) of change in both distributed generation and new demand are the most important variables. However, we would disagree with some of the content in Table 3.

Evidence from a number of projects that SGS are involved with would indicate that the increase in distributed generation is a more significant value driver than is presented in the table. We believe that the increase in distributed generation should be classified as a HIGH value driver. Furthermore, while the ongoing drive for network efficiency will remain important we believe that this should be re-classified as a MEDIUM value driver as the impact on future DNO reinforcement costs versus the increase in distributed generation or changes to demand profiles is comparatively less.

Section 4

Out of the options presented, which set of assumptions should we make on smart meter functionality?

We would expect half hour latency from the smart meter functionality.

It should be noted that with half hour latency the operational management of grid constraints (thermal, voltage or fault level) using smart solutions will be very restricted. SGS anticipate that more dedicated network monitoring as well as smart solutions such as ANM will be required in order to avoid network reinforcement. This is likely to include, for example, the instruction of DNO-led demand side response which may result from peaks only identifiable within half hour windows.

Do you agree with our proposed approach of including smart appliances in the business as usual?

No.

We do not believe that there is currently sufficient evidence to suggest that consumers will widely adopt the inclusion of their white goods in demand side response practices in the short to medium term without significant incentives (which would have to be factored as a cost in the evaluation framework).

Do our proposed smart grid strategies capture the main deployment options?

No.

We believe that the options presented, 'top down' or 'incremental', over-simplifies the likely reality. In our interaction with many Distribution Network Operator customers, both in the UK and in Europe, a more hybrid approach is more widely preferred. For example, ANM can be enabled enterprise-wide or over a geographic area with multiple feeders allowing economies of scale, but deployed in a targeted incremental way with the specific smart commercial and technical solutions to deliver the most cost effective method to resolve the technical constraint on the individual area of network (e.g. feeder). We would therefore suggest that the model take account of the possibility of a more hybrid approach. We also recommend that the model reflect the reality that in many cases multiple smart solutions will require to be combined in order to deliver an overall solution to any particular network area or feeder.

Have we captured an accurate overview of the main services that smart grid technologies can provide?

No.

We note the omission of ANM as a technology or smart solution. ANM is concerned with the real-time and autonomous management of constraints on the distribution network and is therefore a fundamental enabler for the smart grid services as described in 5.2.1. ANM observes network conditions, parameters and the operation of devices within its scope of control, and automatically issues set-point control instructions to these devices to manage network constraints. An example of this is the online, autonomous calculation of wind farm set-points to manage thermal capacity constraints on networks or the constraining on of generation in urban networks to remove congestion driven by high demand for electricity. ANM can also be used to coordinate and limit the access to the network of various devices due to other constraints such as voltage and fault level.

The omission of ANM as a technology from the model highlights one of the key weakness of the proposed modelling approach. The modelling approach assumes that individual technologies can be deployed to release headroom following a traditional 'fit and forget' approach. Technologies such as ANM do not explicitly release 'headroom' in a passive sense but instead release latent grid capacity by managing distributed energy resources (e.g. generation, storage and demand) to the real time instantaneous conditions on a given area of network.

We believe that ANM should be identified as a key smart grid technology and should not be related solely to the connection of Distributed Generation. We believe that the modelling approach is oversimplified and the omission of key technologies such as ANM is evidence of the limitations of the proposed approach.

SGS would welcome working further with the consultation team to improve the understanding of ANM as a technology, how it can be used and why it is separate to the other smart grid solutions listed. SGS are already involved in Workstream 3 activities.

Do you agree with our proposed assumptions on the characteristics of these technologies?

No.

Annexe C of the consultation makes various claims and assumptions about technologies which are not supported by references or evidence. For example, it is claimed that 'Each kW of storage invested in (batteries) would release one kW of thermal headroom. At a constant 1% growth in load, this would provide 6 years of load-growth-deferral for an 800 kVA transformer.' This claim has no reference or evidence to support it and from our experience of implementing a control system to manage large scale storage this assumption does not hold true. For example, the energy storage capacity of any battery is a crucial aspect of its performance in releasing thermal headroom.

Another example is the claim that 'Considering daily cycles used for peak lopping over one-quarter of a year, the various technologies would have calendar lives (determined from cycle numbers per year) of up to 15 years for lead-acid and up to 30 years for sodium metal-halide.' Without evidence or references to support this it is likely that electrical energy storage may appear overly attractive as a solution and undermine the credibility of the output from the methodology.

Section 5

Are there any other groups in society that we should consider in the value chain analysis?

Yes.

We would suggest a wider consideration of customers be included in the value chain analysis. The analysis identifies and presents the primary benefit to the customer as being ultimately through lower utility bills. However, this fails to recognize the wider interaction that electricity networks have with customers who are the ones that ultimately use the electricity network to derive economic value (e.g. through the acquiring, connecting and operating of low carbon technologies).

As a simple example, SGS is aware of various projects, representing both new electricity demand and new generation capacity, which have either been delayed or cancelled as a result of untimely or overly expensive grid connections. These include existing connected sites and entirely new developments, all of which could have contributed to the overall successful attainment of the UK's carbon reduction targets. SGS would therefore recommend that wider consideration be provided to the benefits associated with providing customers with more cost effective or timely grid connections.

Do you agree with our conclusions regarding the distribution of costs and benefits?

Yes.

Do you agree with our proposed approach to assessing the costs and benefits for the transmission network?

No comment.

Section 6

How suitable is the proposed network modelling methodology which uses representative networks, with headroom used to model when network investments should be made on feeders?

As an exercise to review the very high level benefits case for smart grids we believe that using representative networks and the concept of headroom, as methods of simplification, appear to be reasonable. However, it is important that the recipients of the output from the modelling clearly understand this simplification, the limitations of the approach and its implications. There is a risk that without this clarity the model and its outputs may be used to make individual investment decisions (e.g. inform RIIO-ED1 submissions) when practical, operational and issues of a wider context also require to be considered as to what, if any, smart solution is appropriate to deploy in any given circumstance.

A good example is the potential to use technologies such as ANM to release latent capacity from existing networks even ahead of creating additional 'headroom'. This technology or approach to network management and operation is not proposed to be considered in the model. In the opinion of SGS, this is an oversimplification that reduces the effectiveness and credibility of the proposed approach.

Are the voltage levels being considered by the network model appropriate, or should the model be limited to focus on any particular network voltages?

SGS believes that the network voltages being considered are appropriate and that focusing too specifically on certain specific voltages runs the risk of failing to acknowledge the important link between voltage levels.

For each of the voltage levels we are considering, are current methods sufficient to recognize available headroom and the cost of releasing additional headroom in these networks? If not, is the approach considered to be too simple or too complex?

For a UK wide assessment a simple and indicative method of assessing headroom is appropriate. Again, we would note that this should focus for each voltage level on the constraints that are likely to require resolution under each scenario.

We strongly disagree with proposal to pre-populate the illustrative priority stack (Table 10) with the four example smart solutions identified. This is because these are not actually solutions that can be deployed on their own to achieve additional headroom and are therefore likely to set a false cost expectation. This also indirectly implies that these selected four smart solutions are those favoured by the industry for creating additional headroom.

Is our approach to estimating the clustering of low carbon technologies appropriate? Is any other evidence available in this area?

We believe that this estimation is appropriate.

Are the proposed generation model assumptions suitable?

No comment.

Should a simple representation of interconnection be included in the model?

Yes, particularly given the intention to increase the amount of interconnection to mainland Europe and Ireland.

Does the model represent DSR appropriately?

No comment.

In conclusion, Smarter Grid Solutions welcomes the opportunity to comment on this ambitious task and are keen to help further with the activities of the Smart Grid Forum. Whilst it is a complex and challenging exercise to evaluate the benefits of smart grids on this scale, and therefore simplifications will be necessary, it is incumbent that any evaluation framework has the scope and flexibility to consider all smart solutions, recognises the interactive nature of many of the solutions, focuses on the constraints that require to be resolved rather than particular smart solutions as chosen by the study team and more widely considers the beneficial impact of smart solutions on the users of the grid (who are the ones that ultimately derive economic value through connection to, and use of, the grid).

We hope that our contributions are of use in helping shape a very important piece of work for the sector.

Best regards,

Alan Gooding

Managing Director