Response to Ofgem Consultation on: *Key enablers for the DSO programme of work and the Long Term Development Statement*

University of Strathclyde

Submission by

Department of Electrical and Electronic Engineering

James Whittle, Dr. Ivana Kockar, Gary Howarth, Mark Jenkins, and Gareth Gill

Institute for Energy and Environment (Advanced Electrical Systems)

Technology and Innovation Centre (Level 4)

University of Strathclyde

99 George Street

Glasgow

G1 1RD

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Table of Contents

The Long Term Development Statement

Content of the Form of Statement

Q1. We consider that improvement is required in the visibility of DG and LCTs connected to the distribution network. It addition to DG and LCT connections, can you identify areas for improvement in the current data that is shared in the LTDS?

The inclusion of information of DG and LCT connections on the distribution as part of the LTDS is an important step and will allow for a better understanding of the volumes of generation and other LCTs which may impact decision making by developers. To move further in this direction, we suggest the inclusion of information of other flexibility connections such as flexible demand, energy storage and large (or aggregated) prosumers. In conjunction with data on the location and volume of DG on the distribution network will also inform the development of local flexibility and energy markets on the distribution network.

Furthermore, knowing locational and volumetric data for flexibility, DG, and LCTs will also allow developers to work in tandem with the network operator to site and new developments appropriately to avoid congestion and ensure that any new developments actually improve network efficiency. It may also help reduce workload for DNOs as developers will have better visibility of viable options.

Q2. Can you identify areas for improvement in the presentation of network information in the current FoS?

Currently, network information is well presented through the FoS and is straightforward to interpret. Our only concern is the inconsistency that sometimes arises in units used from sheet to sheet in the Excel form and we would suggest a review of the unit conventions used to standardise. Keeping this information consistent will allow for network users and developers to more easily run their own simulations and models to determine the viability of their developments.

Q3. The EDTF and others have identified the need to collate and share 11kV and lower voltage network data. Is there value in creating a sharing mechanism for 11kV and LV network data ahead of the expected roll out of network monitoring and telemetry in RIIO-ED2 and the limited data availability in RIIO-ED1?

We believe that laying the foundations for a mechanism by which to collate and share data about 11kV and LV networks is an important step in the transition to DSO, creating a more visible and transparent system which can be actively managed and open to fair competition. Whilst the expected roll-out of monitoring and telemetry across the networks as part of RIIO-ED2 is a step in the right direction, it will not automatically bring about full sharing of the appropriate data.

As such, we believe that Ofgem should take the lead on developing a standardised way by which DNOs collate and share data about the 11kV and LV networks with developers, other networks, and interested parties. This should include a standardised format, developed in conjunction with the DNOs and other industrial bodies.

In addition to these groups, we would also recommend the inclusion of views from the TOs and from NG-ESO. As more accessible data on the 11kV and LV networks is likely to improve the visibility of the distribution network on their part, there is the potential for far more efficient TSO-DSO coordination in the future.

Various DNOs have already begun the process of monitoring their LV networks through innovation projects funded through the likes of LCNF, NIC, and NIA. SSE looked at the LV network in terms of increasing uptake in LCTs[1]. Similarly, SPEN's "Flexible Networks for a Low Carbon Future" project considered increased monitoring of

[1] https://www.ssen.co.uk/WorkArea/DownloadAsset.aspx?id=5218

secondary substations to provide more data on demand across the 11kV and LV networks[2]. Similar projects have been conducted, or are being carried out, by the various DNOs across the GB network; learning and data from these projects could inform the format and structure of the sharing mechanism. The data from these projects could be especially useful in providing a means of testing the sharing mechanism.

> Q4. Given the complexity of future distribution networks, static data alone may not satisfy user needs. Should the FoS be enhanced to mandate the development of a common network model to allow power system simulation that each licensee must make available for exchange to users and interested parties? If so, what do you consider to be an appropriate standard?

A standardised network model across the licensees for use by network users and interested parties would, no doubt, be of considerable use to those looking to develop on the network. The standard is dependent on the scope of the model, assuming that it is to be available to all network users and interested parties.

To determine the scope of the model – we have to ask whether it is simply to be network data made available to individual users on request that they are then able to enter into software of their own for simulation, or whether it is something more sophisticated. Furthermore, is the model to be a technical model of the network or a model designed to include economic modelling that developers may use to inform their development plans?

If the model is to be expanded to include economic modelling, we would suggest that it includes factors such as: connection costs, demand growth data, flexibility requirements, price signals and price functions, and existing or planned ANM schemes. This data could prove very useful in providing network users seeking to develop on the network or enter into arrangements with the licensees with information to better inform their business models. It would also likely facilitate the emergence of local energy markets that are fair and transparent.

If the model is simply to be a standardised set of network data available to network users, then efforts should be made to ensure that it is compatible with the various network modelling software suits that network users may be operating. If the "model" in question, however, is meant to be some form of simulation that users are able to acquire, edit, and run, then further questions relating to its scope also arise.

If we assume a "common network model" to be a data set with, for example, line-ratings, forecasted demand, connected generation, etc., with which users may carry out their own simulations, then all licensee must ensure that the format is likely to be compatible with different software suites. Furthermore, the question of the frequency with which the model has to be updated arises.

To answer this, we must consider the purpose of the model – is it for planning or operation? We believe that the most appropriate model would be for planning, allowing developers to analyse the network and better inform their business models and development plans. This would require a technical model of the network, allowing users to see what impact their actions are likely to have on congestion and other network characteristics, as well as an economic model, allowing users to assess the economy of their decisions.

We also believe that any model should be considered down to the 11kV level with a view to increasing granularity down to LV over time in order to ensure that customers connected at all voltage levels are able to effectively interact with the network. This could be done by allowing more granular models for sections of the network, which users may choose to connect in their own simulations, in conjunction with a fuller network model at 11kV level.

[2] https://www.spenergynetworks.co.uk/pages/flexible_networks_for_a_low_carbon_future.aspx

However, given that many DNOs have already looked into fuller modelling of their systems through various innovation projects[3] [4] [5] [6] etc., a new model built using learning developed through such projects could be the more efficient option.

We believe that a standardised model, developed by DNOs and coordinated by the likes of the ENA, which allows users to interact with the network and see the effects of developing, for example, DG at various points on the network on the system overall would be an overall benefit. We do, however, note that this question is somewhat vague, and leaves a lot open to interpretation as to the functionality and scope of the model. We believe that the ENA and Ofgem should take the lead in developing any model in conjunction with industry.

> Q5. From a review of industry publications we consider that interoperable standards will underpin future DSO activities. Should the FoS mandate the adoption of a IEC 61970 CIM and IEC 61968 CIM for Distribution Management, such that data is collated and constructed in a manner similar to WPDs CIM innovation project model? Are these standards mature and what are the likely benefits and costs?

The use of IEC 61970 for electrical system management and of IEC 61968 for distribution management would bring the GB DNOs closer in line with international standards – one could note that ENTSO-E is making use of IEC CIMs for markets as well[7]. We are pleased that Ofgem note the example of WPD's CIM innovation project, this is largely because this project created an Integrated Network Model (INM) to produce CIM representations of data. The INM supports an integration of systems and data from these discrete systems, thus making the use of data between systems more straightforward.

Further, we note that moving to a standardised CIM, potentially built upon a standardised INM, would likely add benefit to all DNOs and other network users by improving the efficiency with which network data can be applied to different tasks.

> Q6. Should the FoS also be retained in its current Microsoft Excel form? Is there value in this format?

This format is a well understood format and is accessible to both the DNOs publishing the FoS and to the users making use of the data. Given Excel's ubiquitous nature, being a format that can be readily converted by users for a multitude of purposes such as to .csv file types; it is already a suitable means of storing and sharing data. We recommend continued use of this format.

We note that, as the LTDS may eventually incorporate a far greater volume of data than at present, the data size limits associate with Excel may become a more pressing issue. At present, given the data represented within the LTDS, we do not see this as an issue, but the limitations of the format should be kept in mind as the data requirements change.

Heatmaps, direct needs identification and hosting capacity

> Q7. Ensuring network information remains accessible is a priority. At present there is no formal requirement for the production of heatmaps. In order to ensure future customer can access the required data, should the scope of the LTDS and FoS be extended to mandate the production of heatmaps?

[3] https://innovation.ukpowernetworks.co.uk/projects/distribution-network-visibility/
[4] https://innovation.ukpowernetworks.co.uk/projects/smart-urban-low-voltage-network/
[5] https://www.ssen.co.uk/WorkArea/DownloadAsset.aspx?id=5218
[6] https://www.spenergynetworks.co.uk/pages/flexible_networks_for_a_low_carbon_future.aspx
[7] https://www.entsoe.eu/publications/electronic-data-interchange-edi-library/

The heatmaps produced by the DNOs are a very useful resource and should continue to be published. However, their publication by the DNOs should not simply be the creation of data for the sake of data and they must serve a clear purpose and ought to be standardised across the network operators for ease of use and access by developers and other interested users. Whether this falls under the remit of the LTDS or FoS should be determined by Ofgem in consultation with the DNOs.

We also believe that there could be scope for a modelling tool outlined through response to Q4. to incorporate elements of a heatmap into it, to allow for a real-time visual representation of the effects of various changes to and developments on the network.

> Q8. Would there be benefit to adopting common guidance or formats on information presentation within heatmaps, including the presentation of technical information and cost information? What are the barriers to its adoption?

In terms of guidance and formats, we refer the reader to the response given to the previous question. We do believe that there is merit in some kind of standardised presentation of information within the heatmaps. The will benefit users who may be seeking to compare information across multiple DNOs, giving them a standard presentation to work with. It may also be easier on the individual DNOs whose own developers will have a standard model on which to base any alterations to their heatmaps.

With regards to including technical and cost information on heatmaps these could be of enormous benefit to developers looking to provide services on the network and to planners looking to highlight areas in need of development. However, depending on the level of accuracy and granularity desired, these figures would have the potential to be highly dynamic, requiring updating very regularly. This could generate large volumes of data which could slow processes down and cause more trouble than benefit.

A balance would have to be struck between providing useful information for planners and developers and keeping the data generated to reasonable levels so as not to impede performance or overwhelm users. As such, provision of guidelines to keep quality and performance similar across the different DNOs' services would likely be required.

> Q9. The core focus of the LTDS is to assist users to enter into arrangements with the licensee and evaluate the opportunities for doing so. Should the scope of the heatmaps include other network needs, such as flexibility requirements? What is the best mechanism to notify network users of opportunities to enter arrangements with the licensees?

We believe that it would be a good idea to have network needs such as requirements for flexibility services shown on heatmaps by the DNOs. In the transition to DSO, this will help with improving transparency and allow for the easier facilitation of flexibility trading and the smooth running of flexibility markets. The question that must be asked, however, is how to accurately display the needs for flexibility services across the network via the heatmap?

One way to highlight the requirement for flexibility may be to have alerts pop up on the heatmap when there are high levels of congestion that could be remedied by flexibility services such as flexible demand or flexible DG. This would, however, require providers of flexibility services to be notified in a timely manner to allow for fair competition for the provision of services – as such, a register of parties able to provide flexibility services across the network would be required.

The inclusion of other network needs into the heatmap to allow network users opportunities to enter into arrangements with the network operator or other network users would also require very regular updates to the heatmaps being used. As such, we believe that potential providers of other network services should be kept on a register and notified as soon as an opportunity to enter any kind of trading arrangement is presented.

It is worth noting that some DNO's heatmaps, such as SPEN[8], already include flexibility tender locations as a visible layer

Q10. On what frequency should these maps be updated? Should they be updated as there are changes to the underlying data or periodically?

The frequency with which the heatmaps should be updated is dependent on the purpose that they are ultimately to serve. If they are to, as we believe that they should, include information such as network capacity, connections costs, connection queues, and presentation of opportunities for network users to enter into arrangements with the licensees for the provision of other services, they must be updated very regularly or whenever there is a change to the network or underlying data. This would allow for the efficient and fair operation of markets in near operational timescales.

In this case, we believe the heatmaps should be updated with some kind of standardised, minimum periodicity as well as whenever there is a change to the underlying data describing the network. If the desire is to tie this in with fair and transparent markets for the provision of network services by third parties on the network, we would suggest that the heatmap should be updated on a weekly basis at minimum.

If, however, the heatmaps were to be used in a planning capacity, i.e., over time-horizons of months-years, the frequency of updating would need to be far lower. In this case, we would assume that the heatmaps were being used by developers on the network to inform their development decisions and business models. This would require the heatmaps to be updated on a frequency of every month to a few times per year. This set-up, however, would not be suitable for informing flexibility providers, for example, when there existed an opportunity on the network for already existing developments to provide services to the network.

Regardless of the specified periodicity of updates to the heatmaps, we believe that they should be updated whenever there is a change to the underlying data likely to change the information shown on the maps. However, in order to inform the likely frequency with which heatmaps should be updated, the regulator, in conjunction with the licensees, needs to decide what the envisaged purpose of these heatmaps is.

Forecasting of Network Needs

Q11. Is there a need for a common methodology or principles for estimating load growth? What potential role could the D-FES play in informing the load growth forecasts on the LTDS?

Similarly to other data that allows for network users, developers of DG and providers of Flexibility Services, etc. to gain a better understanding of the network's development and their own potential to enter into arrangements with the licensees, common principles and methodologies will bring benefits. More standardised D-FES documents across the various DNOs will allow network users and service providers to evaluate their business models in a more efficient manner, being able to better provide their services to the network's benefit.

We further believe that, if the D-FES is to be used in informing the LTDS – a standardised document – then the D-FES itself should be built on a common methodology and principles across the DNOs.

As the consultation document points out, no guidance is given for the preparation of load forecasts by the DNOs, with a variety of different techniques being used. Also pointed out in the consultation document is that load forecasting is a direct part of the LTDS and, as such, is more likely to be standardised in its format and methodology across the DNOs. This is not, however, to say that we do not believe that the D-FES are not of use; indeed, their high-level overview of scenarios around demand growth, LCT uptake and the growth of DG and storage is of great use to parties who may be interested in engaging with the licensees.

[8] https://www.spenergynetworks.co.uk/pages/sp_distribution_heat_maps.aspx

The D-FES, it should be noted, does not seem to need to include numerical estimates on forecasted load growth, where the LTDS includes information forecasting load growth for a five-year period down to secondary substation level. The D-FES, however, does provide background information relating to the predicted growth scenarios, and, hence, allows developers and network users to see where the next opportunities for connections may come from. As such, we believe that it may be useful for the D-FES to be referenced within the LTDS and a section with the background information to predicted load growth included within the LTDS.

In terms of a common methodology for forecasting load growth, we would not suggest forcing this through. This is because the methodology is generally only the concern of the DNO carrying out the load growth forecasts – developers and network users are generally only interested in the final results and potential background information. All information important to network users is likely to be contained within the LTDS and any new D-FES documents. Forcing DNOs to adopt a common methodology of forecasting load growth would, at this point, likely place extra strain on their resources for minimal benefit.

Whilst we can see that there may be benefits to adopting a common methodology for load growth forecasting, these do not appear to significant enough at this point to merit the extra work on the part of the DNOs to develop and implement this. One major benefit of adopting a common methodology to estimating load growth would be allowing users to conduct similar forecasts and mitigate risk in their own development plans. We believe that this could be more easily accomplished by mandating that DNOs publish details their forecasting methodology, such that users planning to enter into arrangements with the licensees can adequately assess and mitigate risk.

Adoption of a fully standardised methodology may also stymie innovation and development in other methods and could be counterproductive. Sharing methodologies, on the other hand, could allow for better and more efficient progress in forecasting development.

Q12. Are there any lessons that can be learned from other industry documents such as the ETYS and the NG FES?

The NG FES is developed by NG ESO with input from industry and stakeholders, allowing all those who have an interest in the development of the network to have input to the document, each providing their own expertise. Such a practice may prove beneficial for DNOs looking to develop their own D-FES. Whilst the NG FES is produced with the help of SHET, SPT and NGET, and similar bodies do not exist at distribution level for DNOs to engage with, stakeholder engagement with the likes of DG operators, flexibility providers and aggregators could prove useful in producing D-FES documents. Such documents may then better inform the LTDS as discussed in the previous response.

Additionally, NG ESO also receive feedback from various stakeholders across hundreds of organisations on their FES document, allowing them to improve the information presented year on year to better match with the demands of stakeholders.

The ETYS also provides insight into the predicted growth of demand and generation with discussion around the kinds of constraints liable to be placed onto the network by these developments. This provides a good picture to all stakeholders of the likely challenges that the network is predicted to face and allows for developers to make informed choices about where to make agreements with the licensees.

As such, we would recommend that the ENA take responsibility for developing some sort of group of advisory bodies with a primary purpose of advising the DNOs in the production of their D-FES documents. Such bodies could be grouped by technology or services provided (this could also allow for one party to sit on more than one advisory body), being able to provide feedback to the DNOs on the content of the D-FES documents. The bodies and sub-bodies forming this group may then form part of the DSO service provision or even a key role within the DNOs themselves.

These bodies could also lead into useful workshop sessions conducted to influence the D-FES as with the FES. This could be useful at economic planning level.

In addition to service and technology providers, we also envisage that DNOs, TOs, and the ESO will have representation on the appropriate bodies within the group. This kind of structure would ensure that the D-FES documents are as well informed and have as full a scrutiny as the FES produced by the ESO.

This may add a further layer of complication and, as such, should be, along with the remit, powers, structure, and governance of this group, would need to be taken into consideration, potentially via a fuller consultation between the ENA and Ofgem and other potentially involved stakeholders. We do however, consider it important to ensure that the D-FES documents being produced are as well informed and scrutinised as possible. This will be all the more important if these documents are to complement the LTDS.

> Q13. Do you agree that the LTDS should be enhanced to present the key assumptions for network requirements forecasting and the uptake of LCTs, or is this role better served by the D-FES or other documents?

As mentioned in responses to the previous questions, we believe that there should be some reference to the D-FES within the LTDS (or vice-versa), with some key assumptions explored within the LTDS as to how various forecasts are achieved. However, we do not believe that this needs to be a full exploration of all assumptions for network requirements, demand forecasting, LCT uptake, etc. This can be better explored within a dedicated document such as the D-FES.

> Q14. Forecasting tools have been a focus of a number of innovation projects. Are there any mature tools or techniques that could be adopted to enhance the transparency or robustness of the load growth forecasts?

While there are a number of techniques for forecasting load growth – both traditional statistical methods and emerging methods using machine learning techniques like ANN and SVR – we are unable to comment on the maturity of these emerging methods for use by DNOs. We would recommend that DNOs continue to develop forecasting tools through collaborative innovation projects – we would stress the need for DNOs to collaborate with other DNOs, industry partners, and academia.

Outside of mathematical or computational tools for modelling, we would suggest that there may be other means of gathering data on load growth for the purposes of forecasting. We would suggest that the DNOs look into conducting stakeholder meetings and open consultations with network users and other stakeholders to determine where load growth – and possibly locations of LCT developments (e.g. larger scale PV schemes, planning for EV charging points, etc.) – is most likely to come from. This will provide the DNOs early on, significantly before official requests, with an idea of likely developments on the network from the perspective of the users to better inform their various load growth scenarios. Such data may be better suited for the D-FES, but could prove useful nonetheless.

IDNOs and the LTDS

> Q15. Do you agree that IDNOs should be issued with a direction to produce a LTDS?

Yes, given their share of new connections and the potential for increased development of DG and LCTs within their networks. However, we do note that, given the difference in characteristics of the IDNOs to those of the DNOs, the content of these documents will vary. This is discussed in the following responses.

> Q16. What summary information should IDNOs publish? This is currently found in section one of the LTDS FoS, such as information relating to the design and operation of all voltage levels of the distribution network. Please explain your reasoning.

We believe that IDNOs must be held to standards comparable to those to which DNOs are currently held, with alternations made to compensate for the nature of the IDNO as not necessarily being fixed in a single location. The nature of IDNOs allows them to operate numerous, smaller networks across a wide spread of geographic areas, with highly varied customers connected. As such, we believe that the following information should be included within the summary;

1. High-level information relating to the design and operation of all voltage levels across all operated networks;
2. A map of the locations of their individual networks and details of the DNO licence areas within which they are operating; and
3. Geographic plans of each network with high-level details of the load and demand connected thereto, along with notes of LCT penetration.

Our reasoning is based on two main factors relating to IDNOs and their operations. Firstly, IDNOs are able to operate multiple smaller networks spread across a wide geographic area and, potentially, operating within multiple DNO licence areas. As such, their LTDS are liable to be of interest to the DNOs to which they are connecting their networks, as planned developments may affect different distribution networks in different ways dependent on network characteristics.

Secondly, the business models of IDNOs tend towards engaging with customers likely to have a large impact upon overall levels of localised demand, embedded generation, and LCT penetration. For example, typical connections to IDNOs might include housing developments (potentially being built with solar panelled rooves), sites for embedded generation, larger demand customers operating at higher voltage levels than residential LV networks, EV charging infrastructure, and storage sites. All of these connections have the potential to have a large localised effect on the distribution network and the wider system and, as such, should be well documented.

Q17. What information on network data should IDNOs publish? This is currently found in section two of the LTDS FoS. Please explain your reasoning.

Following on from the reasoning for our response to Q16., we believe that the information provided in section two must be held to a similar standard as for the DNOs, but also tailored to reflect the nature of IDNOs and customers connected to them. As such, we would suggest that the IDNOs be required to provide much the same data as DNOs, but ensuring that data is given for each one of their networks.

We also believe that in conjunction with load information, information on embedded generation and penetration of LCTs should be provided.

Delivery governance of the form of statement

Q18. Do you agree with our proposal on how the LTDS delivery body should be convened and governed?

We largely agree with the proposal set out for the convening and governance of the body, and welcome Ofgem's suggestion to chair the group to ensure fairness and transparency. We would however like Ofgem to consider the inclusion of academic members of the working group and/or delivery body to provide advice without the inherent bias that may come from industrial parties.

Q19. Would you like to nominate an individual to take part in the LTDS working group? Please set out reasons for their inclusion and any qualifying experience the nominated person has to function as a strong contributor to the group.

No nominations made

Key Enablers for DSO

Network monitoring and visibility enablers

Q20. What network monitoring parameters would you like to have access to? At what frequency?

There are a number of network monitoring parameters which have been experimented with at increasingly lower voltage levels (for example SSE's "Demonstrating the benefits of monitoring LV network with embedded PV panels and EV charging point" [9], used to inform the "New Thames Valley Vision" project [10]). Parameters such as voltage, current, power, reactive power, energy, reactive energy, and harmonic content are monitored at various voltage levels and give a crucial insight into the effects of embedded generation and LCTs on the network.

Whilst these parameters are routinely monitored by the DNOs for the purposes of managing their networks in an ever more active fashion, they are not always disseminated with those network users who may be looking to develop solutions on the network such as DG, flexibility services or other ancillary services. Such data could prove invaluable for both the developers and the DNOs, allowing both parties to work together to determine the sites most likely to benefit them both through development. For example, inclusion of additional PV requiring inverters at certain points on the network may be unsustainable due to sensitivity to increased harmonic contents on that section of the network.

Understandably, this does constitute a large volume of data, and DNOs may still be at a point where they cannot provide this data at 11kV and LV levels. As such, it would be for the ENA and the Regulator to determine to what voltage level information should be provided and on what kind of timescale DNOs should seek to accomplish this. This may require consultation with industry figures likely to have an interest in developing on the distribution network.

Additionally, we believe that, as DNOs make the transition to DSO with services including more granular pricing signals across the network, the DNOs should be sharing information on pricing signals. Our reasoning is that price signals are given as a means to incentivise efficient behaviour on the network and overcome or constraints and, as such, can be used as a means of monitoring the overall status of the network. We therefore believe that access should be given to network users and developers to assess price signals across the network, ideally at similar voltage granularity to the abovementioned parameters.

Inclusion of price signal information with data such as voltage, current, and power quality data, will allow for both developers and the network operators to work in tandem providing maximum benefit for both parties and for the end consumers. However, there could be instances where sharing of price signals reveals lack of competition, and this should be considered.

We do, also, recognise the volume of data that this is likely to generate and, given our responses to questions in the previous section, must consider that we ensure we are not simply generating "data for the sake of data". The frequency with which data is generated and disseminated will largely have to depend on what is of most use to network users and what is most viable for DNOs in terms of the data they collect and their ability to process and publish it.

In the instances where data is able to be collected on a half-hourly or hourly basis, we would recommend that this could be disseminated on a weekly basis for the week past. This would also be acceptable for data collected less frequently. This frequency would provide developers with data sets of a size suitable for inferring daily and weekly patterns from without having to worry about having files of an inconvenient size.

[9] https://www.ssen.co.uk/WorkArea/DownloadAsset.aspx?id=5218
[10] https://www.thamesvalleyvision.co.uk/

Q21. What would enhanced 33kV monitoring enable that cannot be undertaken today?

Enhanced monitoring at this level would likely be of interest to generation customers, EHV customers, and the TOs and ESO. On the part of the TOs and ESO, this would help provide improved visibility of the distribution network and allow them to identify points where the DNO is likely to be exporting to the transmission network. This improved visibility will aid in better T-D coordination and whole-system planning.

One should note, however, that monitoring at this level is traditionally fairly good. However, enhanced monitoring would also likely improve identification of sections of the 11kV network that need improved monitoring.

For customers connecting generation or demand at EHV level, enhanced monitoring would provide the network operator and potential developers and customers with insight into the most efficient and cost effective means of developing the network.

Q22. What would enhanced 11kV monitoring enable that cannot be undertaken today?

Enhanced monitoring on the 11kV network, where monitoring has traditionally been lower compared with the 33kV network, would likely produce benefits for developers and the DNO looking to progress to provision of DSO services. Increased monitoring of parameters such as current, voltage and power quality data would allow the DNO to detect potential issues on the 11kV network and determine the most efficient solutions, resulting in increased active network management (ANM).

Enhanced monitoring at this level, and dissemination of useful data, as detailed in our response to Q20, would also allow for network users to engage more actively with the DNO in the provision of services to the network. This would be achieved by increased visibility on the 11kV network and the potential to increase transparency in any bidding process for flexibility or ancillary service provision.

This would, in terms of customers, likely be of most use to larger customers such as; DG operators, large commercial or industrial customers, operators of flexibility services, and aggregators.

It may also pave the way for implementing more locationally and temporally sensitive pricing mechanisms for distribution pricing – better reflecting the needs of the network to its users – along with more efficient local energy markets.

Q23. What would enhanced LV monitoring enable that cannot be undertaken today?

In much the same way as above, the LV network has traditionally been very poorly monitored due to assumption that all customers are load only and that power should only ever travel in one direction down the feeders. With increased customer interest in smarter energy usage and participation in selling energy back through their supplier, these assumptions are no longer valid. More customers are making use of their own generation and some are using EVs to sell energy back to the grid when it is not needed by means of *vehicle to grid* (V2G)[11,12, etc.].

Whilst, owing to the size and complexity of the LV network, the rollout of enhanced monitoring of parameters such as voltage, current, power, reactive power, harmonic content, etc., is liable to be the most difficult of the tasks, it stands to present benefits in terms of fullest customer engagement.

For example, it is known that there is an increasing volume of PV being installed at domestic level, with peak generation times tending to coincide with minimum local demand (i.e., midday during high summer), resulting

[11] https://octopus.energy/blog/vehicle-to-grid/
[12] https://theenergyst.com/evs-v2g-vehicle-to-grid-battery-storage-smartgrid/

in export of power to the network. With high enough penetration, this can result in a reverse flow of power along the LV feeder. Furthermore, increased penetration of power electronic reliant devices such as PV can increase the harmonic distortions seen on the network[13] [14], though this is still an area of active research.

However, with the increasing engagement from domestic and other LV customers in managing their own energy, along with growing interest in participating in local energy markets (LEM), the requirement for improved visibility and transparency at LV level cannot be ignored. The enhanced monitoring of the LV network would improve the ability of the DNOs to send accurate price signals to individual customers dependent on location and time, providing signals for improved participation in LEMs or flexibility markets by customers.

This data would also be able to inform the DNO of what issues are likely to face the network as a result of developments on LV feeders, such as installation of PV across many homes or predicted uptake of EVs along certain feeders.

Q24. What constraints in data systems architecture do you perceive are limiting network monitoring and visibility?

One may consider the NIC Project proposed by SPEN, INSPIRE[15], which highlighted the seeming lack of coordination of multiple disparate data sources throughout the DNOs. At present the DNOs seem to be taking steps to address the lack of coordination in their data sources. As SPEN note in their proposal document[16], segmented data and existing IT system architectures will inhibit the use of data analytics – a key component to delivering a more efficient network. They also note that the rapidly changing energy network will require ever more accurate and dynamic network information to be available beyond the static data offered as part of the LTDS. As such, a more efficient, integrated data systems architecture is needed to deliver the data analytics required to provide increasingly dynamic network information.

Flexibility trading enablers

Q25. What operational data is the most important to prioritise opening up first and why?

In order to enable the trading of flexibility, there needs to be transparency on the part of the DNO in terms of demand and generation forecasts, information on the electricity markets, and issues on the distribution network that are likely to impact upon the demand for flexibility services. We therefore believe that it is important to prioritise opening up data on accurate forecasts of demand, generation, and resource availability, and, if advantageous, any predicted constraints on the network. This should be aided by the inclusion of data on network topologies and configurations, but with a caveat that they should not encourage/enable exercise of market power.

This data, with pricing signals, as discussed hereinabove, should be opened up so as to ensure that markets for the trading of flexibility are able to operate in as transparent and fair an environment as possible.

Q26. How does a lack of access to this data impact the delivery of flexibility to the system?

In order to ensure that a market is both fair and transparent, it is crucial that those trading via it have access to all the relevant data on the market and the environment in which they are trading. In terms of trading flexibility services, this requires information on the network to which traders are connected, the likelihood of congestion or conflicts on that network, the forecasted levels of demand and embedded generation, the pricing structures,

[13] https://ieeexplore.ieee.org/abstract/document/4579061
[14] https://www.cired-repository.org/handle/20.500.12455/13
[15] https://www.ofgem.gov.uk/ofgem-publications/107912
[16] https://www.ofgem.gov.uk/ofgem-publications/107912

etc. – this also must include any regulations and market rules and design. This kind of data allows service providers to evaluate how they believe the network is likely to change and develop and where the needs for flexibility are likely to arise, thus allowing them to make an informed business decision.

Without access to this data, the providers of flexibility services are hampered in their ability to make informed business decisions and many may be deterred from offering their services within that network or market. This leads to drop in the number of flexibility service providers and, thus, a drop in market liquidity; this may result in the DNO having to accept bids from providers who may not provide the best value for money, or whose services are not as efficient as they could be. Hence, by not providing adequate data, the DNO may be creating potentially harmful distortions to the emerging flexibility markets.

Flexibility dispatch and control enablers

Q27. Are there any real or perceived conflicts of interest with DNOs owning and operating ANM platforms at scale? What additional protections could be required for ANM customers?

Much of what Ofgem does is to ensure value for money and to supervise the development of markets and competition[17]. As such, there have been moves to ensure that more services are provided in a fair method that promotes a level playing field for all market actors. We believe that ANM should be one of these areas. With DNOs owning and operating ANM platforms across their network, they may seek to make use of their own assets for managing the network before seeking to contract with private service providers – whether intentional or otherwise, this has the potential to result in solutions being chosen which are not necessarily the most cost-effective or efficient. The end result could be harmful distortions to local energy markets. One way to get around this whilst allowing the DNO to operate the ANM platform could be to prevent DNOs from owning equipment that may be used for the provision of ancillary services.

The curtailment of load and generation could be run through a market structure, with curtailment or non-curtailment bids, i.e. flexibility bids, from firm and non-firm generators or loads respectively. In other words, a user connected on a firm contract could be incentivised by the DNO to offer curtailment (greater flexibility of connection). Similarly, a user on a non-firm connection could bid not to be curtailed. The values of these contracts could then be based on the state of the network (at that point in space and time) and expressed as a price signal. Such a signal could reflect the price of electricity or of flexibility.

We believe that a similar structure could be expanded to include other providers of ancillary services, if appropriate. e.g. energy storage facilities, and so on – providing that the DNO does not have the means of providing these services itself.

This market set-up should be built on the open and transparent sharing of information as discussed in the responses to the first half of the consultation. It should offer a level playing field for all market participants and allow all participants to be able to make sound and well informed business decisions. It should not be enough for the DNO to be able to simply command generation or load and compensate ex-post, the mechanism by which the network is actively managed must, in our view, be fair, open, and competitive. Only as a last resort, should the DNO be able to curtail load or generation, or make use of its own assets outside of the market, or issue compulsory ANM notices to network users.

Q28. In order to preserve optionality over ANM scheme operations, what technical and commercial protections, such as technical ring-fencing, may be required?

When considering technical and commercial protections, these must be considered for both sides – the market actors who are providing ANM or flexibility services, and the operators of the network who are required to provide a secure supply of electricity to consumers. In our response, we consider each side in turn.

[17] https://www.ofgem.gov.uk/about-us/who-we-are

In terms of protections for the providers of ANM and flexibility services through the market, one means of protecting the interests of the market actors would be to prevent the DNOs from operating any equipment for the provision of ANM services already provided through market mechanisms. Steps should also be taken to ensure that markets for ANM and flexibility services on the network are kept as transparent as possible using data sharing techniques discussed elsewhere in this consultation response. To this end, the markets should be operated by neutral parties – this may be a role taken up by one of the parties responsible for delivering DSO services as a neutral market facilitator.

Technical protections for the providers of ANM and flexibility services could be a limit on the kinds of technology that a DNO is allowed to operate and ensuring that, where viable and efficient, ANM providers are afforded a connection to the network.

From the point of view of the DNO, commercial and technical protections that we consider are based on the requirement to provide a secure and efficient network in a cost-effective manner. As such, the DNO must be able to place certain standards and minimum expectations on the providers of ANM and flexibility services. Measures such as a minimum volumetric flexibility to be delivered by a provider built into their connection agreement could be an example, with providers having to pay the network operator if they are unable to meet these levels.

Similarly, a flexibility price cap could be introduced to prevent providers from overcharging the network operator for services – which would result in increased costs being passed along to the consumer.

In the case where flexibility or ANM services are required and the market participants are unwilling to supply them at the maximum prescribed price, the DNO may be able to take action to enforce compulsory participation from providers. In this situation, the DNO should compensate the providers affected, but at a level lower than the maximum price.

Both the market players and the DNO must be protected various means to ensure that the consumer is protected.

> Q29. Please provide real world examples where lacking timely access to usable network data, or regulatory barriers, have limited your ability to provide a DSO function or support service. Please submit and relevant evidence and documentation of examples cited.

Not applicable

> Q30. Are there any other issues related to enabling DSO that have not been considered that you think are important? Please provide details of your considerations.

We note that the Position Paper on DSO as published by Ofgem[18] brings into consideration many key points that are crucial to delivery of DSO. In our view, however, there remain two questions that we would like to see answered.

The first of these questions surrounds the markets at distribution level – specifically local energy markets and flexibility markets. We allude to this somewhat in our response to Q27, however, the role of the DNO in such markets is not fully discussed. We are of the opinion that there needs to be more discussion around how distribution level markets for energy, flexibility and other services are likely to function, as well as who is to be

18 https://www.ofgem.gov.uk/system/files/docs/2019/08/position_paper_on_distribution_system_operation.pdf

responsible for operating them. If it is not to be the DNO operating these markets, then what role does the DNO take on? Are they simply another market participant, or do they remain a passive operator?

This point leads on to the second question that requires answered. What is the overall role of the DNO within a DSO future? In the position paper[19], Ofgem states that there are "roles for a range of parties to deliver DSO", with no single party needing to be the DSO. As such, there may still be a DNO operating the network, but as for their other roles, this remains to be seen. This is especially important when considering their role in the market – either as a market operator, or another service provider. This also opens up discussion on whether a body similar to the ESO is then required at distribution level?

Whilst these questions are, themselves, not enablers for DSO, they are important in that their answers will determine; a) what DSO looks like and b) what further enablers are required to realise DSO. There is a great deal of discrepancy between various parties as to what a DSO future should look like, between DNOs, academia, industry and the regulator. It is our opinion that there needs to be further discussion as to what exactly DSOs are to look like and how they are to be implemented on the GB system such that they deliver value for money, security of supply and sustainability for all customers, and efficient competition and markets. Only then, will it be possible to identify fully the required enablers for DSO.

We realise, as outlined in the position paper, that there is a desire from the regulator to avoid a so-called "institutional lock-in" of the DSO function; however, there must be a more robust definition of DSO functions and, crucially, the roles that we expect to see the DNOs play.

We finally draw attention to two enablers not covered by the second section of the consultation, these being *Forecasting and Planning enablers*, and *Data Exchange enablers*. Whilst these are, to some extent, covered by the first section of the consultation in terms of the LTDS, this consideration may not provide the input desired from other industrial partners outside the DNOs. The DNOs are, at present, likely to take the lead of these two enablers through the LTDS and dissemination of network information to developers and other network users. That being said, if the delivery of enablers is to be the responsibility of industry, there should be room to consult with non-regulated industrial partners on these enablers and the services and structures required to deliver them.

In terms of these enablers, we draw the reader's attention to the response given to Question 12 where discuss the potential to set up bodies under an umbrella group overseen by the ENA to advise the DNOs on their D-FES documents. This sharing of information between DNOs and other parties under the oversight of the ENA would allow for a better informed D-FES and, hence, a better idea of where load growth and network evolution is likely to go. This new group of advisory bodies would likely fit well between the *Forecasting and Planning* and *Data Exchange* enablers.

19 https://www.ofgem.gov.uk/system/files/docs/2019/08/position_paper_on_distribution_system_operation.pdf