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Dear Alex,

Ofgem Consultation: Key Enablers for DSO programme of work and the Long Term Development Statement (6 December 2019)

SP Energy Networks owns and operates the electricity distribution networks in central and south Scotland (SP Distribution), and Merseyside and North Wales (SP Manweb). We serve 3.5million distribution customers. We also own and maintain the electricity transmission network in central and south Scotland (SP Transmission). We are the only DNO group to operate across all three GB political administrations.

The role of the DSO is critical to the delivery of a safe, efficient, reliable and decarbonised energy system. We therefore welcome Ofgem's consultation on Long Term Development Statement (LTDS) reform and other DSO enablers, and we look forward to the opportunity to engage with Ofgem on these on an ongoing basis. We, like Ofgem, want to deliver major progress to DSO now – we cannot wait until ED2 commences in 2023. Addressing these DSO enablers will encourage that progress.

When developing our responses, three overarching themes emerged:

Cost benefit analysis of making data available
We agree with the qualitative rationale that opening up data will deliver benefits, but we must better quantify the costs and benefits of different data parameters so that we can:

- Understand what areas of data should be prioritised for being made public. There are multiple data fields and parameters to make open, and some of them require lengthy enabling works – knowing their benefits would inform which to prioritise.
- Some data may have significant enabling costs (e.g. Common Information Model (CIM)). In these instances we need to have confidence that we are delivering sufficient benefit for the investment of customer money.
- Understand which parties realise the benefits of open data, so that we can decide where it is fair for the costs to fall. If only a particular sub-group of network users disproportionately benefit from the data, then it might be appropriate for those users to bear some of the costs.

Ofgem's proposed industry working group should prioritise the quantification of the benefits to know what areas to prioritise opening up, what costs can be justified in doing so, and where the costs should fall. The working group should follow the Energy Data Taskforce (EDTF) method of considering this both for data that has already been made available and new data.

LTDS interaction with other data sources

We think that an essential data provision principle is to minimise the number of channels and formats in which data is provided. This is to:

- **Keep costs low**. Every parameter of data that industry makes available and every format we provide it in costs money. Removing excess data channels and formats would mean that the same data is still available to users, but at a lower overall cost to society.
- **Keep data simple**. If the same information is provided from multiple different sources in different formats, it risks confusing the users of that data (especially when valid data differences arise because of different publication dates).

This principle of minimising the number of data channels and formats gives rise to two outcomes that Ofgem's proposed industry working group should consider:

1. LTDS reform should aim for a single common LTDS FoS with data published in a single common interoperable format. This format should be capable of supporting other data that DNOs make available outside the LTDS. This single common FoS and format will keep costs efficient and retain data clarity.
2. LTDS reform must understand what is already provided via the myriad of existing data channels[1] to avoid creating unnecessary duplicated data obligations. Of these, the new Digital Systems Map[2] is of particular note – whilst it is at an early stage, this has the potential to deliver a broad dataset to users in a user-friendly format.

Ofgem's proposed industry working group should coordinate with WS4 Product 6 of the Open Networks project, which is seeking to establish what network data is already published, what additional data exists which could be readily published, and where there are data gaps.

We would propose that this working group should also consider whether there is merit in a fundamental review of how data is provided by all industry parties. This would encourage a more joined-up cross-sector approach to data, reducing overall costs and increasing data usability by removing duplication. Providing the trials are successful, the new digital systems map could be a suitable delivery mechanism for a joined-up pan-industry approach to data provision.

National security and customer confidentiality

We welcome the recognition of the importance of data, and of that data being visible, accessible and interoperable. To ensure that data provision is delivered effectively and beneficially, and in line with the EDTF triage process, two factors must be considered as part of any data reform:

1. **National security**. Electricity networks are nationally significant infrastructure. The current threat level to the UK is Substantial, meaning an attack is likely. Cyber-attacks against infrastructure, from both state and non-state actors, are on the rise. Publishing more data about networks can only increase their vulnerability. Ofgem's proposed industry working group should consider how LTDS reform can deliver the advantages of more open data, without opening up the electricity networks to materially increased risk. This will likely require engaging with expertise outside the energy industry. The National Underground Assets Register (NUAR) and London's Underground

[1] DNOs make data available to customers through a number of sources: LTDS, budget quotations, heatmaps, safe dig plans, connection offers and the system wide resource register. The new digital systems map may also provide a broad range of information. DNOs send similar information to National Grid via the week 24 and Appendix G processes. There are also multiple non-DNO sources of data, such as BEIS's Renewable Energy Planning Database and Ofgem's Feed-in-Tariff database. Finally, signals around network availability are also sent to users by connection and use of system charging pricing.

[2] The creation of a Digital Systems Map was one of the five highest level recommendations from the EDTF. The ambition is for the Digital Systems Map to eventually be a full digital twin of the UK energy infrastructure. The aim is for it to be open access. Its development is being delivered by the ENA Data Working Group.

Asset Register (LUAR) projects will provide useful learnings and precedent on this issue, and makes clear the importance of coordination with the Centre for the Protection of National Infrastructure (CNPI).

2. **Customer data**.
    a. We make data available to help users understand the network. The more data we publish, the more accurate that understanding can be. However some data (e.g. simulations of individual customers sites within power flow models) could be viewed as being commercially sensitive. Ofgem's LTDS reform should consider the balance of the rights of individual sites to data privacy versus the benefits to all users of data availability. The relevant clauses of the National Terms of Connection can then be updated to reflect the agreed position.
    b. Just as there is value in DNOs opening up data, there will likely also be value in customers providing DNOs with more data about the operation of their sites. This will help DNOs more efficiently plan and operate the networks in an increasingly complex system. We therefore support the findings of the EDTF to make all parties' data more available.

Next steps

We welcome the recognition of the importance of data, and of that data being visible, accessible and interoperable. We agree that this is required for efficient markets and transparent decision making. Our six core objectives[3] in our recently published Digitalisation Strategy demonstrate that we have a clear plan to make this a reality, and we look forward to continuing to work with you on this issue. Given RIIO-ED2 timescales, this work to LTDS and DSO reform must push forward and deliver outputs quickly – for all reform programmes we need a decision on key policy outputs by 2020 at the very latest in order to accommodate the outputs within our ED2 submission.

If you have any questions about any part of our response please do not hesitate to contact me. We look forward to continuing to engage with you and delivering LTDS reform and the DSO transformation.

Yours sincerely,

Graham Campbell
Head of Distribution System Operation and Whole Systems
SP Energy Networks

[3] Page 19 of SP Energy Networks' Digitalisation Strategy: https://www.spenergynetworks.co.uk/userfiles/file/RIIO-T2_SP_Energy_Networks_Digitalisation_Strategy.pdf?v=1.3

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

We consider that the views of LTDS users are more relevant than our own on what data should be shared in the LTDS.

One area where we think current data provision in the LTDS could be improved is that, as network visibility and monitoring become more established, it should be possible to share more granular information on existing network loading. At the moment only annual maximum demand information and typical load profiles are included. Additional loading information would give users a better understanding of how the capacity in each area of the network varies throughout the day and year. This information is likely to be useful to potential new connectees and service providers.

With regard to the suggestion to share more DG and LCT information, we were surprised that neither the main nor supplementary consultation documents referenced the new System Wide Resource Register (SWRR), which went live January 2020. This contains information on all assets connected to their network which are ≥1MW or provide flexibility services. From July 2020 it will also contain information on network reinforcements required for connecting generation. Any proposals to publish more DG and LCT information must consider the information already published within the SWRR to avoid duplication.

In all cases, the improved visibility of DG and LCTs is dependent on this data being reliably recorded by the relevant party in the first place. This may be by parties other than the DNO, for example:

- For G83 solar PV, our experience from 2012-2016 shows that many providers did not fulfil their obligations in notifying DNOs about new solar PV connections. However these same providers did register for the Feed-in-Tariff (FIT), so Ofgem's FIT register proved to be a more complete database.
- For demand LCTs, DNOs may not be notified about new installations (e.g. EVs). Again, other parties involved in the process may have more complete databases (e.g. OLEV's grant scheme for EV charging infrastructure).

Proposals to improve DG and LCT visibility must reflect which party holds this data and so is best placed to own the obligation to (i) reliably record this data, and (ii) provide it to users and to DNOs to be included within the LTDS (please see our response to question 29 about DVLA record keeping methods). It must also consider whether existing obligations on users to provide data are sufficiently rigorous, as the G83 solar PV experience shows that this is not always the case.

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

We consider that the views of LTDS users are more relevant than our own on this point.

We think that the Digital Systems Map, one of the five main recommendations from the EDTF which is now being delivered by the ENA Data Working Group (chaired by SP Energy Networks) has the potential to improve the presentation of network information. This will become clearer with the first deliverable: a heatmap covering the whole of Scotland, due to be presented to

stakeholders in March 2020. Ofgem's LTDS working group should take into account these stakeholder views when considering this issue of LTDS information presentation.

3. 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 see benefits in making HV and LV information publicly available. As such, we have been working on tools which allow us to share LV and 11kV data both internally and externally. We were recently able to share an extract of our LV network connectivity model with the Innovate UK Modernising Energy Data Access competition. We feel this will be beneficial in the short term in encouraging innovation through better understanding of our network, particularly in LV management. We will be using this capability to ensure a consistent data set is used in our own systems and in developing a solution for sharing information with third parties.

However, one challenge is that the use of this information is limited without understanding the dynamic loads and constraints of that network area. Active monitoring of demand is currently sparse in LV networks, meaning DNOs often don't have this information ourselves. Whilst this remains the case, we don't think there is value in creating a formal sharing mechanism ahead of ED2 and the greater monitoring that will bring. One factor which may change the situation is if the smart meter rollout remains on track and delivers information from which this dynamic load and constraint data can be inferred.

Once the necessary network monitoring is in place to capture this HV and LV data, we think there is value in having a common sharing mechanism to create a common and consistent experience for users across all DNOs.

4. 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?

We agree that dynamic data would provide richer and more useful information on the behaviour of the network, so we support this principle. So that users get a common and consistent experience across DNOs, we think that a common format to exchange this data would be required. The IEC Common Information Model provides a suitable baseline to build upon.

Before mandating this, there are some issues that need to be considered and addressed given the complexity of the task; this is to ensure that any change is effectively delivered. From our own experience of using multiple power flow software programs, we know that the following technical and commercial challenges of the exchange and calibration of power-flow models will need to be addressed:

- In order to be a true representation of the network, DNO power-system models must contain simulations of customer sites. In most cases this is commercially sensitive data for the customer. The alternative is to remove this information from the model, but then it

no longer accurately represents the network. Ofgem's LTDS reform should consider the balance of the rights of individual sites to data privacy versus the benefits to all users of data availability.

- DNOs and users utilise a range of different power-system modelling packages, each with their own strengths. Most only have partial interoperability with other tools, which limits the data and/or functionality which can be transferred between models. For example:
    - Some simulation tools contain components or functionality which are not included in other software packages. Some models or components within the models cannot be transferred. For example, user-defined dynamics models are compiled against a particular tool and cannot be transferred to other simulation packages.
    - Many components must be simplified ("equivalenced") as part of the conversion process and this can lead to erroneous outputs when using transferred models.
    - Tools may operate differently or use different calculation algorithms. In some cases it may not be possible to reasonably match results between tools. Similarly, model transfers are often sensitive to versions of the power system modelling software. As analysis tools continue to develop and evolve, updates to the formats used in transferring models would be required.

  These all mean that another user utilising a different software package may not be getting an accurate representation of the network.
- The costs and timescales can be material. It would therefore be beneficial to clearly articulate the costs and benefits, so that we can identify what to prioritise and whether costs should be socialised.

We do not raise these points to create a barrier; we seek to share our experience to ensure that any change is efficient and well planned. As mentioned in question 3, SP Energy Networks is already developing tools to allow us to exchange data in a common format for LV and HV networks.

5. 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?

We agree on the importance of having interoperable standards. We consider CIM standards to be a good basis for an interoperable standard as the Common Information Model (CIM XML) for three reasons:

1. It is a widely preferred industry standard for data exchange.
2. Many network companies have already adopted the standard as the means to exchange data between corporate systems and, to a limited extent, exchange data between companies.
3. There is a lack of viable alternatives to CIM and it is not considered appropriate to develop an alternative standard.

We, like WPD, have investigated the use of CIM via an innovation project. Based on this learning, industry needs to consider how to overcome the fact that the use of CIM is not currently universal and the default standards can be complex. Given this, there is work to do to understand how

these IEC standards can be realistically and cost effectively applied, but we consider there is no absolute barrier that should prevent CIM.

ENTSO-e (European Network for Transmission System Operator – Electricity) is actively engaged with the IEC to ensure the development of CIM standards that meets their requirements. Similarly, UK network companies will need to establish governance processes to ensure that initial and future requirements for a UK transmission/distribution standard are consistent across the industry and, preferably incorporated into the IEC standard. This governance process could be administered through a standing working group within the ENA. In addition, such a working group could be established to oversee the introduction of CIM.

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

The benefit of the Excel format is best answered by LTDS users.

However, we would urge that we aim to minimise the use of different formats. Holding and presenting data in multiple different formats adds to the cost of data sharing and risks confusing users (especially when valid data differences arise because of different publication dates). We should therefore be aiming to present and share the data in a single common format, which is interoperable with other formats so that users may then change the format if they wish. We support a single common FoS, so that users have a common and consistent experience across all DNOs.

7. 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?

We consider that the views of LTDS users are more relevant than our own on this point.

If Ofgem and stakeholders are supportive and the trial is successful, the new Digital Systems Map could be a suitable delivery mechanism for LTDS heatmaps.

8. 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?

If LTDS user agree, we support a common heatmap format so that all DNOs' heatmaps would be laid out and present information in the same way. This would make it easier for users by creating a common experience.

We support adding information to heatmaps where possible – it helps customers understand the network, which in turn helps us as it might reduce the number of budget quotation requests and connection applications we deliver which aren't then taken forward (the costs of which are recovered from other users).

However both these objectives might be met by the new Digital Systems Map being delivered by the ENA Data Working Group. The Digital Systems Map is planned to be a full digital twin of the UK energy infrastructure. It has the potential to offer users richer data than LTDS heatmaps in a common geographic format. The first step is to create a proof of concept "all Scotland heatmap" combining data from SSEN and SP Energy Networks. This is due in March 2020. To avoid unnecessary duplication, any proposed changes to LTDS heatmaps should be paused until Ofgem and stakeholders have had a chance to assess the digital systems map as a suitable common heatmap format.

One issue that needs consideration is the presentation of cost information on a heatmap. The reason for this is that a user's cost to connect is depended on very project specific factors (e.g. distance from existing network, import and export capacity requirements, fault current contribution, harmonic contribution etc). Given the number of factors which drive connection cost, it is very possible that two similar projects seeking to connect within the same primary substation group may have very different connection costs. We are wary of potentially misleading customers with highly simplified cost data in a heatmap. There is also a better existing route for them to get this data – the existing budget quotation service is free and will give them a much more representative cost.

When presenting information about the ability of the network to accept new capacity, the role of network charging signals must not be overlooked.

9. 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 think that a geographical format is an effective way of conveying a DNO's flexibility requirements; all DNO flexibility tenders to-date have displayed their requirements on a map (using either Piclo or Flexible Power). Given the effectiveness of these existing third-party owned flexibility market platforms in displaying DNO service requirements geographically, we see little benefit in duplicating this information on our own LTDS heatmaps. We also see no advantage to developing LTDS heatmaps in this way whilst the common DNO digital systems map is still being developed, as this could be another way to present the information.

We therefore favour the approach where:

- The availability of the existing flexibility platform maps is clearly signposted to all users – this delivers the same information to users for much reduced cost, they already exist so there is no delay in making this information available, and it avoids any confusion that might arise from duplication. The effectiveness of this approach would be increased if DNOs used a single common platform to tender for flexibility services.
- Further reform to LTDS heatmaps is paused until Ofgem and stakeholders have had a chance to assess the Digital Systems Map.
- A key aim is dataset interoperability: the delivery platform is much less important if the underlying data can be easily extracted (e.g. via API) in a format that enables the user to combine it with other datasets of their own choosing.

When presenting information about the ability of the network to accept new capacity and network requirements, the role of network charging signals must not be overlooked. This is because connection and use of system charging sends similar signals. Given this overlap, LTDS reform must be considered alongside charging reform. Without coordination, we risk sending conflicting signals to users, or not properly signalling their benefit to the network. This would impede the economic and efficient operation of the network. LTDS reform must be considered alongside charging reform.

WS1b Product 5 of this year's Open Networks project is also looking at how DNO network capacity shortfalls and network requirements are described and publicised.

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

We would be interested to know the views of LTDS users.

Our observations are that, based on a FoS that is produced manually (like at present):

- The greater the frequency of updates then the greater the costs.
- The necessary update frequency may vary by voltage level.
- We would argue against EHV heatmaps being updated more frequently than once per month.

Across this consultation response we support the creation of single FoS format. This FoS format must be capable of being automated – if the LTDS can be produced and updated automatically with minimal human intervention, then it would support much more frequent updates.

11. 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?

We consider that a DNO's LTDS forecast should be derived from their DFES forecasts. Given that WS1b Product 2 of the 2020 Open Networks project will develop a consistent approach to DFES baseline forecasts, this approach will naturally result in a more common approach of producing LTDS forecasts. Therefore we do not see a need to introduce a duplicate requirement for commonality.

Our LTDS forecasts are derived from our DFES. The process is:

- To prepare our DFES forecasts we use the four National Grid Future Energy Scenarios (NG FES) as the starting point. The NG FES are intended to identify a range of credible scenarios across gas and electricity on a GB-wide basis. They are developed by the ESO through extensive engagement with stakeholders and are widely recognised as being a reference point.
- We then incorporate regional ambitions and local intelligence. This is because to reach Net Zero, every community will need to make changes, and each community will be unique in their journey – a national plan and view only goes so far. Therefore to create our DFES forecasts we incorporate views from our customers and stakeholders, UK and

regional government legislative targets, and regional and local development plans. We also consider a wide range of factors including existing and future demand, generation, storage trends, forecast adoption of LCTs, and changes in customer behaviour such as the use of flexibility.

- From this process we get four DFES forecasts. The four DFES forecasts are then combined to produce a single five-year LTDS forecast. Our 2019 LTDS was based on interim results from our DFES work. We will be updating our DFES on an annual basis and future LTDS forecasts are expected to be derived from the latest version of our DFES.

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

We consider that the views of ETYS and NG FES users are more relevant than our own on this point.

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

This information should be in the DFES – it would be unhelpful to users to have the main long-term forecasts in one document (DFES) but the assumptions around those forecasts in another document (e.g. LTDS). Given that the DFES already contains most of this information, and that our LTDS forecasts are directly derived from our DFES forecasts, the DFES is the best place to present this information.

14. 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?

There are a number of mature tools and techniques that are commercially available from a range of providers that can help predict load growth, network constraints and potential maintenance activities. The main barrier to the adoption of these tools is ensuring that good quality, accurate and timely information can be provided to them in an automated manner that keeps costs efficient. Through investment in common data management and modelling infrastructure this is what SP Energy Networks aims to achieve. We are already demonstrating this with projects predicting generation and LV network constraints.

Forecasting tools are intrinsically linked with advanced mathematical techniques due to the increasingly complexity of the network, and are increasingly linked with machine learning and artificial intelligence tools. There has been a number of innovation projects that have established some of these techniques; notable examples from SP Energy Networks include our EV-Up, WaNDA and Flexible Networks projects, that are complemented by industry initiatives such as the LCT Uptake Forecasting work by the ENA. During this period of development it is important that knowledge is shared across the industry.

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

To the extent that one of the purposes of the LTDS is to provide information to potential customers about the network and the opportunities to connect, then IDNOs should provide information in the form of an LTDS. This is because:

- the number of new connections iDNOs provide. Having this data available would ensure that developers and customers had access to the same level of information across the network regardless of whether the asset was owned by IDNO or DNO, giving them the ability to assess all possible connection opportunities available to them. It would also enable existing IDNO customers to understand the basis of their connection and evaluate opportunities for an enhanced connection (e.g. to evaluate the option of installing an EV charger).
- IDNO networks are supplied from DNO networks. This data will enable DNOs to design networks that benefit all customers, irrespective of how a connection is provided.

We acknowledge that, as the LTDS is currently mainly focussed on EHV and 132kV voltages and IDNOs rarely have network at these voltages, there may be limited applicability at the moment. Looking forward, any requirements for DNOs to provide network information at HV and LV must be replicated by IDNOs, both due to the proportion of LV connections they provide and because the electrification of heat and transport will primarily impact the HV and LV networks. As IDNOs are primarily involved with these networks and they are directly supplied by DNO networks at these voltages, the provision of network data from IDNOs should be directed.

In summary, if only considering the current scope of the LTDS then the benefits may be limited, but if the scope is extended to cover HV and LV networks then provision of not only Section 1 (Summary Information) information but also Section 2 (Detailed Information) data would be beneficial for all Users of the networks.

16. 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.

The majority of the information provided for in Section 1 of the LTDS FoS (e.g. design philosophies and practices, general network characteristics) will be useful to users and therefore IDNOs should make public this information – please see our response to question 15 for our reasoning for making this information public.

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

The Section 2 data requirements should be the same for IDNOs as for DNOs. Please see our response to question 15 for our reasoning for making this information public.

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

Yes, we agree with the proposed approach.

19. 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.

Yes, we nominate Paul Parry. Paul was central to the development of SP Energy Networks' Digitalisation Strategy. This is highly relevant experience as four of our six Digitalisation objectives are the means to achieve the objectives of the LTDS reform, and so will underpin all data provision into the future. Paul also works within our ED2 business plan development group, which is relevant when it comes to linking this work to the requirement for enhanced monitoring and control on the networks.

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

We expect that questions 20-23 are aimed at users. Our responses set out the benefits we believe enhanced monitoring can deliver to customers.

As a minimum, monitoring voltage, current and phase angle is required. This will enable us to accurately establish spare thermal and voltage capacity to safely operate the network at higher utilisation, near limits. These parameters are required at a sufficient sampling rate to enable us to:

1. deliver quicker and lower cost connections for new customers, by optimising connection and reinforcement solutions;
2. enable existing customers to fulfil their requirements, by supporting existing customers wishing to change their connection agreement / configuration; and
3. more economically and efficiently operate the network for the benefit of all customers, and open it up to more competition, by supporting the procurement of flexibility services to alleviate network constraints.

If these monitoring parameters are received with sufficiently low lag and high reliability, they can also be used to accurately dispatch flexibility services in real-time and respond to network faults. Only with low lag and high reliability communications can network operators make real-time DSO decisions based on monitoring. Currently SP Energy Networks poll EHV and HV network monitoring equipment both instantaneously and at 30-minute average intervals.

In addition to voltage, current and phase angle, SP Energy Networks is pioneering the first real-time fault level measuring device. Understanding fault levels in real-time is a significant development for customers as fault level constraints can be costly barriers to new connections. Widespread understanding of network fault-levels will enable us to provide quicker, cheaper connections to new customers, and more safely operate the network near limits. It will also reduce the socialised cost of such reinforcements, reducing costs for all customers.

Monitoring of certain other parameters for asset management purposes can inform operational practices, asset modernisation strategy and intervention planning. This all lead to more efficient expenditure and high network reliability:

- In some cases, monitoring asset temperature enables use of equipment dynamic thermal ratings, enabling networks to increase utilisation of existing assets in periods of cold weather. This allows DNOs to get more out of their existing asset base and defer investment, reducing the cost and disruption to network customers of conventional network investment.
- Asset temperature monitoring can also provide an indication of end-of-life deterioration for some LV assets; SP Energy Network trials have found that temperature sensors in underground link boxes provide pre-fault indication. This increases network safety, reducing risk to the public and DNO staff. In addition, planned asset replacement is lower cost than reactive fault replacement, resulting in a reduction to the networks component of customers' bills.
- Other sensing equipment which could inform asset intervention strategies include accelerometers or hall-effect sensors on high criticality wood poles (e.g. adjacent to major crossings), these can indicate where poles are beginning to lean and inform timely intervention strategies. These novel solutions improve public safety, avoid customer interruptions through network service failures and reduce network operating costs through the delivery of efficient planned work as opposed to more costly reactive fault repair.
- The use of online acidity and moisture analysis for Primary and Grid Transformers can indicate where internal asset condition is beginning to deteriorate either through advanced insulation ageing or moisture ingress. This could also inform intervention strategy, ensuring maximum value is extracted from assets for the wider customer base and prolonging asset life. There are also environmental benefits of reduced/deferred capital investment due to the environmental life cycle impact of asset replacement.
- Switchgear 'trip-time' monitoring will allow for the timed remote operation of network circuit breakers at all voltages. This test is important as it's used to ensure correct switchgear operation and check that equipment will function safely and correctly if called upon to break fault current. Currently this test usually requires a site visit and disruption to customer supplies. Doing this test remotely will improve network service and reduce operational costs, in turn reducing the socialised costs to customers.

In summary, increased monitoring allows us to better understand network loading and asset condition. This means we can more economically and efficiently design and operate our network, get more out of existing assets, and more intelligently deploy interventions like flexibility. These result in better service, safety and lower costs, which benefit all customers.

When monitoring is combined with control[4] (so is bi-directional) and automation equipment, the operating benefits are significantly improved as it enables dynamic and flexible operation of the network. Benefits include managing network losses, improving network resilience, and reducing the scale and duration of network faults – these provide improved safety, sustainability and network reliability to the wider customer base at lower cost.

Enhanced monitoring and control are at the heart of DSO: it is critical for enabling Net Zero, opening up networks to competition, and delivering enduring benefits for our customers. Given this, the application of enhanced monitoring and control will be subject to detailed cost benefit analysis within our ED2 submission.

[4] Monitoring on its own is unidirectional, i.e. it enables network visibility but does not enable control signals to be issued back to network equipment.

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

There is currently good monitoring of voltage, load flows and other key parameters on the 33kV network.

Opportunities for enhancement include real-time fault level monitoring. This visibility would give a widespread understanding of network fault levels, which will enable networks to provide quicker and cheaper connections to new customers, and more safely operate the network near limits for existing customers.

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

Please see the response to question 20 for the benefits of enhanced monitoring: these benefits would all apply at 11kV.

In addition, two strong benefits for 11kV:

- enabling the connection of more renewable DG. 11kV networks, particularly long rural networks where renewable DG projects are typically situated, can be a barrier to DG due to voltage constraints. Enhanced monitoring and control would enable us to safely operate closer to limits, and so get more out of the existing assets.
- It would facilitate the expansion of the 11kV flexibility market. Across the UK this lags behind the EHV flexibility market, in part because better EHV monitoring enables DNOs to more accurately define service requirements.

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

There is currently minimal monitoring of the LV network. The benefits described below cannot currently be realised with existing monitoring.

Enhanced LV monitoring is primarily required for the delivery of Net Zero. To achieve Net Zero, the UK will have to decarbonise most transport and a proportion of domestic heating through electrification. These new demands will primarily connect on the LV network. Given falling technology costs and the development of supporting technologies like home storage, there will also be more domestic DG. Even with smart charging interventions, analysis shows that the resulting power flows are in excess of network limits. The following are key drivers for enhanced LV network monitoring:

- Investment planning. LV monitoring will provide real-time network loading of both the secondary transformer and substation LV feeders. This data can be used to inform investment plans around reinforcement, strategic investment around EV and LCTs, identify at risk cable and transformer assets, provide greater visibility to connections teams' quotations using real-time data, and to inform our ED2 strategy. By ensuring investment strategy is targeted and optimised, customers will experience improved

network performance for reduced levels of network investment, relative to the levels that would be required without monitoring.

- Safety. Increasing loading on service cables and cut-out fuses (service terminations) due to 'behind-the-meter' LCTs (e.g. EVs, heat pumps) can lead to thermal overload and failure. This can result in house fires. Given the projected uptake of LCTs, this is a potential significant safety issue for UK consumers. Monitoring would enable networks to better identify areas of the network at risk.
- Operational benefits. These are targeted at reducing fault costs, improving on-site efficiency and providing enhanced information to field staff and engineers. Complex algorithms such as "distance-to-fault" and "pre-fault", which are currently in testing, create the ability to improve network repair times, reduce customer interruptions and enable a more proactive response to network issues. To compliment this, automated alarms detail key asset related issues including blown fuses, high/low voltage, transformer and feeder current overload, reverse power, phase imbalance and more. Improving operational efficiency results in improved levels of customer service as fault durations reduce and the effects of disruptive fault repairs are minimised. A reduction in fault repair costs will also realise a saving in the networks' component of customers' bills.

Example Use-Cases of Enhanced Secondary Substation Monitoring

- **Asset Management** – Real-time transformer & cable load data identifying network constraints and areas of required investment. Enables targeted interventions before service level failures occur (reducing fault times for customers) and optimising levels of investment (reducing bills for customers).
- **Connections & Network Design Teams** – Real-time transformer and cable load data informing network capacity, design studies and impact of EV and other LCTs. Possibility of customer's self-identifying viable low-cost efficient connections through data sharing.
- **Customer Service** – Enhanced data to inform operational staff of on-site conditions including blown fuse locations, indicative fault locations and areas of interest ultimately reducing fault cost and creating efficiencies. Ability to act more proactively to network issues particularly when combined with Smart Meter Data. Complimentary overlap with LV Control Room pilots and potential for another BAU process this would benefit.
- **Performance** – Improved network reliability through more efficient restorations and pro-active responses due to enhanced data that is available to field teams to target faults before they occur. This means customers get a better supply reliability.

The benefits of LV monitoring are increased when paired with sufficiently granular smart meter data. This is particularly true for understanding and managing losses on the LV network. LV monitoring in combination with smart meter data will allow for identification of high loss areas of the LV network which could benefit from losses driven investment to reduce overall network costs and realise wider customer savings. It also allows for cases of illegal energy abstraction (non-technical losses) to be identified and remedied early, reducing DNOs carbon footprint and customers' bills.

Smart Metering data, when aggregated by LV feeder ID provides network operators with valuable information regarding the loading patterns and spare capacity of network assets. Without high penetrations of Smart Meter data, investment decisions cannot be made with the same level of certainty as from enhanced secondary substation monitoring. Smart Meter data will also provide DNOs with visibility of domestic demand side response (load offset) solutions in network areas and provide a view of where the LV network may be deviating from statutory voltage levels.

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

A key limitation with collecting network monitoring data is often the availability of communications infrastructure. Circuits which would benefit most from monitoring often coincide with those areas poorly served by communications infrastructure. This limitation can be overcome with telecoms diversity, but solutions must remain cost effective.

The lack of common standards in the past has also led to bespoke methods of collecting information from monitors. Although we see a move towards standardised monitoring solutions, and consequently we are standardising our approach for monitoring communications, this in itself raises issues around cyber security. Each monitor becomes a known attack vector and hence, we must enhance how we secure these devices.

Similar issues apply where both monitoring and control apply. However, whereas generic IoT data collection solutions are applicable for monitoring, where control is also required these would remain managed in the SCADA domain.

Question 25: What operational data is most important to prioritise opening up first and why?

We consider that the views of the operational data users are more relevant than our own.

Question 26: How does a lack of access to this data impact the delivery of flexibility to the system?

We consider that the views of the operational data users are more relevant than our own.

27. 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?

ANM schemes are monitoring and control platforms – they monitor the network to identify constraints, and then ramp down users to avoid those constraints. ANM schemes were developed to provide an alternative connection route for DG (the other route being an unconstrained connection). ANM is popular with users as it provides a quicker and cheaper route to connection if the unconstrained connection requires reinforcements. Participation in ANM schemes is voluntary and is the user's choice – the role of the DNO is to provide sufficient information so that the user can make an informed decision, and then deliver the connection type that the user chooses.

Once operational, the ANM decides which user(s) to constrain based on location, how much constraint is required, and a merit order. The most common merit order used is LIFO (last in first out), i.e. the most recent party to join the ANM scheme gets constrained off first. When

considering what merit order method to use, users value predictability (when they are assessing whether to connect to ANM, they want high certainty as to how much they will be constrained – this is to reduce the uncertainty in their investment model).

One perception of conflict of interest could arise because the DNO is seen to be deciding what users to constrain. This is not the case: the ANM scheme decides based on criteria pre-agreed with ANM users. Once the ANM scheme is live, the DNO does not normally have any operational involvement; DNOs don't use ANM to "dispatch" sites or use discretion – it is an automated system[5].

Another perception of conflict of interest could arise because ANM is seen as an alternative to flexibility markets – the DNO could be choosing ANM over flexibility markets. This is not the case as they are used in fundamentally different scenarios:

- ANM schemes are used to manage **specific identifiable users** where they would cause network constraints (e.g. a wind farm seeking to connect). Like flexible or time-bound connections, ANM is another option offered to users as an alternative to reinforcements which the user would pay for. It is the user's choice, and only the users who have chosen to participate in the ANM scheme are constrained by it. Whatever the option chosen, the costs are born by the user. As a result of the current charging methodology, ANM is used almost exclusively to manage EHV generation constraints.
- Flexibility markets on the other hand are used to manage constraints that have no single attributable user (e.g. to accommodate general load growth). The alternative here is reinforcement (or another intervention) that would be socialised through DUoS (and so paid for by all customers) and enter the DNOs' RAV. As a result of the current charging methodology, flexibility markets are primarily used to manage demand constraints.

It is worth noting that this split is as a result of connection charging boundaries and methodologies, approved by Ofgem, and not a DNO policy.

Building on this point, another perception of conflict of interest could be that ANM is seen as being mutually exclusive to markets and pricing signals. This is not the case – these sites are active members of the energy system (e.g. ANM users are still subject to use of system charging signals, their supply contracts can still contain time-variable energy pricing, they can choose who to trade their energy with etc.). Looking forward, there are two potential developments that could enhance this:

- ANM and markets are not mutually exclusive, indeed ANM could be a technical enabler for flexibility markets. Whilst the LIFO method is currently mainly used, most ANM schemes also have the capability to use a commercial merit order. If ANM users consent, then ANM schemes could move to a commercial merit order, where users would be constrained off based on price.
- There is nothing to say that ANM and markets can't be overlaid. In this arrangement, markets could be used in the first instance to manage the network constraints. Only in the event of market failure, the ANM is the network safety net that would then constrain ANM users off to safeguard the network. Having this safety net could support the development of new markets.

[5] In an emergency, where there may be the ability for the control engineer to manually override as a last resort.

To protect ANM users, one approach SP Energy Networks is using is information transparency. The new ANM scheme being installed in Dumfries and Galloway includes a customer portal. This provides information to ANM customers about every curtailment event they experience. This information protects customers as it enables them to audit each constraint. This portal will also provide constraint information to any prospective customer, to help them form a view as to how likely their site is to be constrained (an essential piece of information for their financial model).

In summary, ANM schemes are cost-effective tools that have enabled the quicker cheaper connection of significant volumes of DG. They have given potential connectees more choice and are not inhibiting the development or use of flexibility markets. Given the significant volumes of renewable DG that will need to be connected to deliver Net Zero, it simply does not seem sensible to limit the use of such an effective tool. Looking forward, they could compliment and support the development of flexibility markets.

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

We consider that entering into an ANM scheme should remain the customer's choice. The role of the DNO is to provide the customer with the information they need to make an informed decision. As it is the customer's decision rather than the DNO's, there is not a need for internal ring fencing.

To retain optionality we would like to see ANM hardware have a high level of interoperability, so that users aren't locked in to using hardware ANM from a single company. For all new ANM schemes, we are only purchasing ANM schemes that have the ability to operate multiple different merit orders, including commercial merit orders, to keep operational optionality open for the future.

29. 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 any relevant evidence and documentation of examples cited.

Please find below three examples where lack of access to data has inhibited our ability to safely, efficiently and economically operate the distribution network. This is not an exhaustive list.

Example 1. SP Energy Networks tried to get information on EV ownership from the DVLA. We submitted a formal request for information for the addresses of EV owners in our two licence areas. This information would be helpful in helping us understand:

- where domestic EV charges were likely to be installed, which would enable us to identify the areas of the network which may need early intervention; and
- more generally, it would help us understand uptake rates across our networks. This could be combined with socio-economic data to create more accurate forecasts that could be fed into the DFES and ED2 submission.

Whilst the DVLA initially responded positively, in the end they notified us that they could not provide the data as it required a lot of manual interventions to extract the data from various

systems. Our point is that Modernising Energy Data Access not only applies to Energy Companies, but other organisations who hold data on customer usage and behaviours.

Example 2. A few years ago a number of DNOs tried to get data that Ofgem held about FIT DG. Analysis of the public FIT register had shown that many G83 solar PV generators had not fulfilled their obligation to notify their DNO about their connection. This meant that DNOs had no information on the location of a large number of DG connections. This lack of information inhibited the safe, economic and efficient operation of the network.

These DG had however registered for the FIT, meaning that Ofgem had the information that DNOs required. It took a significant period of time before Ofgem finally granted access to this information.

Government financial support schemes like the FIT may be a key tool in driving the rate of change that is needed to achieve Net Zero. This scenario cannot be repeated if DNOs are to efficiently and economically accommodate the resulting DG and LCTs.

Example 3. Access to smart data is an ongoing issue. Already the lack of detail provided to DNOs on SMETS1 versus SMETS2 rollout predictions limited our ability to plan resources. Looking forward as smart meters become more widespread, it looks like access to consumption data will be restricted by privacy controls. This means that some methods of loss analysis and load prediction will become less effective compared to if that data was available.

30. 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.

All Ofgem reform programmes must now be coordinated with the development and timescales of RIIO-ED2, and must consider the outputs and decisions made by ED2 working groups. DNOs must be given sufficient time to accommodate any outputs from Ofgem work programmes in their ED2 submissions. As DNOs' first submission to Ofgem's Consumer Challenge Group will be in May 2021, this means we need a decision on the key policy outputs by Q4 2020 at the very latest. For the same reason, Ofgem must also provide clarity around the expect roles and functions of DSOs.

The LTDS consultation does not cover how any outputs from the work programme will be funded (as one example, the capability to collect, format, and publish data will require investment). Across distribution licensee and market activities, it is vital that investors have a clear understanding of how they will make returns. Without these, we risk a lack of investment and higher financing costs. These will increase overall costs for consumers and inhibit the pace of change needed to deliver Net Zero. The work programme must therefore consider the sources of any required investment and funding models.

A key aim of LTDS data is to help customers understand the availability of network capacity (where to connect) and how to operate in a manner which benefits the network. Connection and use of system charging send the same signals. Given this overlap, LTDS reform must be considered alongside charging reform. Without coordination, we risk sending conflicting signals to users, or not properly signalling their benefit to the network. This would impede the economic and efficient operation of the network. Network charging also explains why ANM schemes are

popular with new connectees. LTDS reform and any changes to ANM schemes must be considered alongside charging reform.