

Appendix A Format for submissions

Submitter	EA Networks
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Kia ora,

Thank you for the opportunity to provide this submission on the future operation of NZ's power system.

Please contact me if you wish to clarify anything in relation to this submission.

Ngā mihi, Pete

Peter Armstrong

General Manager Network



Questions	Comments
Q1. Do you agree with the explanation of the distribution system operator (DSO) role/entity, and the explanation of the distribution system operation (DSO) functions that one or more DSO entities would be required to perform?	In general, we agree with the DSO explanation and functions stated, however, the AEMO DSO definition appears to associate responsibility for DSO functions to a single entity. The Ofgem definition recognises that the DSO is a set of functions, and they may be provided by a range of parties. That approach supports a hybrid DSO, where for example Transpower could provide the economic dispatch function which is allied to the wholesale electricity market, while a distributor would have systems and local knowledge well aligned to dealing with local congestion management. A single entity DSO model may have some difficulty with the integrated distribution system planning function (Ofgem item (c)), as this is effectively directing efficient investment in distribution networks, which is currently a core function of an EDB asset owner and operator (DNO). If the DSO is not the DNO, they could have a role in identifying network capacity needs and illustrating the ability for DER or the network to meet those needs. This could be similar to a "Statement of Opportunities" that identifies the need for

	<p>investment that could be met by either a non-network or network solution. In some cases, the most economic solution may be for the DNO to note the DER option but invest in capacity required over a longer future timescale via a network solution, because there are economies of scale in that investment that cannot be matched by DER. There are some practical drawbacks of a single DSO with an integrated distribution system planning function across potentially many DNOs. The role of local knowledge and being close to the assets, demography and customers associated with the network means that a remote, large DSO may not fulfil this role as effectively as a local DNO.</p>
<p>Q2. Do you think we are correct that the themes we identified in submissions to the initial consultation paper mean we should focus mostly on system operation at the distribution level, and on the new functions required for effective distribution system operation?</p>	<p>Yes. However, there is an issue that perhaps has been simplified in the situation where DNOs may have a DSO carry out DSO functions on their behalf. Aside from the data about the active parts of the network (load, output from DERs, voltages and currents on the network elements) there is also data about the network itself – the network equipment, the rating/capability and operational limits of that equipment, the configuration of the network that changes from time to time. A DNO needs to be able to communicate the network information to the DSO, so that they can manage network congestion, calculate dynamic operating envelopes etc. To make this as seamless as possible, thought should be given to standard data formats to exchange this type of information. This concept has been incorporated into the EPRI Common Information Model (CIM), created to provide a solution allowing full compatibility of data definitions and exchange of data running countless applications across company boundaries and departments. This has been incorporated into the IEC 61968 (Distribution) standard. Similarly, the data</p>

	<p>standard and communications protocol for DSOs to communicate with the TSO needs to be standardised in order for this to work efficiently.</p>
<p>Q3. Do you think we have accurately covered the main changes to the distribution system in this section? If not, what have we missed or where have we gone wrong?</p>	<p>It is a minor point, but in section 4.15(b) distribution voltage is only stated as 11kV – some networks (including EA Networks, Powerco and Counties Energy) also operate 22kV as a distribution voltage.</p> <p>In the section “Distribution networks may be congested”, paragraph 4.26 notes that “DER may seek unrestrained operation”. The converse is also true, in cases where network capacity expansion to allow unrestricted DER operation is unattractive, the DER owner may prefer a DERMS system to impose a DOE constraint that only binds under some circumstances, and the cost of the DERMS system may be much less than the network solution. The DER owner may assess the degree of constraint and prefer the partial constraint than the economic penalty of an unconstrained network solution. Paragraph 4.27 suggests that it is the DSO’s role to provide such a DERMS service. EA Networks is looking ahead with regard to our network, where we have recently connected the Lauriston Solar Farm (47.2MW) and the Gartartan Solar Farm (6.5MW) within our network. We will soon connect a further 4.5MW solar farm to a distribution feeder. Both the Lauriston and Gartartan connections have effectively fully allocated the DER export capacity in those locations under the worst-case conditions, blocking further DER connection without substantial network investment or a DERMS system in order to constrain further DER connections at times of congestion. We are also looking ahead to a future where there are a multitude of solar farms and it may not be possible for a human network controller to ramp back solar farm outputs quickly enough to manage network</p>

	<p>conditions (e.g. high voltages or overloaded equipment) following a network fault. Real-time management of the network using a DERMS system may be required, quite aside from use of DERMS for steady state DER constraint management. Under these network-driven DERMS use cases, EA Networks would only be fulfilling some of the DSO functions but may need to develop DERMS before any or many other networks require that capability.</p>
<p>Q4. Do you agree with how we have defined the problem, as the need for a more coordinated framework of integrated system operation?</p>	<p>Yes.</p>
<p>Q5. In your view, what aspects of the Australian and British deliberations around DSO models are relevant to New Zealand?</p>	<p>We think that the discussions around the benefits of the hybrid DSO model are particularly relevant. Transpower as TSO already has systems and expertise in security-constrained economic dispatch, so a model where the TSO carries this responsibility, but the DSOs advise on network constraints appears advantageous. Given the high cost of a total DSO model from each DSO developing their own systems, it doesn't seem advisable that this is pursued if the majority of DNOs in NZ were to become DSOs. A total TSO model appears difficult, given the higher level of complication, interconnection and reconfiguration that can happen in a distribution network, it would be a significant task for the TSO to take over detailed operation of all DER management functions across all the NZ DNOs.</p> <p>The Baringa analysis of costs and benefits for the different frameworks is interesting and given that at the low end of the benefits these appear to match the cost range very closely, it would be helpful to look at this aspect in the NZ context as well. It would be unfortunate if a complex</p>

	<p>system was devised and implemented only to find that the costs outweighed the benefits.</p>
<p>Q6. What do you think about the direction of research conducted in New Zealand by bodies such as the ENA, NEG and SIDG on the challenges of preparing to perform DSO functions?</p>	<p>We think that the ENA FNF DSO work has been well thought out, comprising work in defining roles and functions to enable flexibility, DER enablement modes and the Baringa research into UK and Australian DSO approaches that could be considered for the NZ industry architecture.</p> <p>The discussion of “neutral” DSO capabilities by Counties Energy and the NEG is worth considering. It is important that if a DSO is administering flexibility services that it is doing so in an impartial manner, and any DER resources in which the DSO has an interest are not treated preferentially. It could be that an economic test is applied to determine the selection of DER resources, allowing an impartial selection by the DSO, and the results of this test be reported to interested regulators. That would be preferable to the suggestion that DSO team members involved in administering DER be entirely ringfenced from other DNO activities – this can be difficult to achieve in smaller organisations and may result in wasteful duplication of effort as a result of the ringfencing. Another suggestion is like Part 6A to do with generation and retail, there could be a cap on how much DER/flexibility that the DSO could self-source, to allow hot water load to continue to be used without a costly arm’s length arrangement. Likewise, if DSOs are prevented from owning and operating DER entirely, potentially highly useful flexible load like hot water load control will be lost or degraded because alternatives like retailers with smart meters do not have the same coverage or incentives to respond to requests for flexibility capability.</p>

<p>Q7. What is your view about the need for an independent DSO (iDSO)? Should we consider an iDSO now as an option to perform all DSO functions, or a subset of functions related to market facilitation? Or can that decision wait until the market for flexibility services is more developed?</p>	<p>We don't believe that an iDSO is needed now, as DER and flexibility services are relatively immature and there isn't enough requirement for those functions to justify setting it up at this point. Furthermore, it appears an expensive way to provide DSO functions due to duplication of resources in the TSO and distributors and the need for three-way information exchanges under this model. iDSO could be an option to fulfil a subset of functions related to market facilitation, but only if an iDSO would provide this at lower cost and greater benefit than DSOs doing this function but treating all flexibility providers in an even-handed way.</p>
<p>Q8. What do you think about the three DSO models proposed by the Authority?</p>	<p>Option 1: Total TSO model. We are concerned about the ability of the TSO to expand its systems across all the NZ distribution networks. While the number of distribution constraints that may need attention currently are relatively low, as this changes with greater levels and unpredictability of DER import/export it is probable that this will change in future. The tier bypass issue noted is a significant flaw, in that in response to say price signals like high wholesale electricity prices, BESS could be selected to discharge mode and overwhelm the available network capacity as they seek to export into the distribution networks. If the constraints of the distribution network are not applied because of tier bypass, the distribution system is potentially exposed to asset damage.</p> <p>Option 2: Hybrid model: The important role of the DSO in validating DER bids avoids the tier bypass issue noted above, as network constraints will be considered by the DSO, who has the systems and knowledge to best assess them. Modern Advanced Distribution Management Systems (ADMS) available to distributors</p>

	<p>are suited to validating DER bids and carrying out the DSO function.</p> <p>Option 3: Total DSO model: This model does have some advantages in that there is no need for the DSO to exchange operational data with the TSO, and that all constraints and network needs on the local network are met without duelling for resources or infeasible dispatch with the TSO. However, the role of determining security-constrained economic dispatch on the distribution network is not a familiar one for distributors, and systems and expertise would have to be developed. Also there are a number of DER already connected to NZ distribution networks that exceed 10MW, so these would be exceptions to the 10MW cap for DSO management proposed.</p>
Q9. Do you prefer one model over the others?	We see the Hybrid model as the best of the three options considered.
Q10. Given the hybrid model can take several forms, what do you think would be the best allocation of DSO functions between the TSO and one or more distributors as DSOs?	<p>We think that it is essential that DSOs validate the DER bids to ensure that they are dispatchable within the constraints of the distribution network and adds in any DER requests that are needed to manage the distribution network. If the TSO performs the dispatch, then they can optimise the national and local requirements in one step and avoids the DSO needing to be involved in security-constrained economic dispatch of DER at a local level. With the TSO doing the dispatch of DER, it is possible that DSO owned DER could be offered along with other DER and be dispatched impartially by the TSO. The only question related to the DSO acting even handedly in this situation would be to ensure that the validation of DER bids is done in an impartial way, which should be possible to demonstrate by simulation and inspection of the algorithms used.</p> <p>With regard to the number of DSOs required, it would be a significant step to</p>

	<p>have a single DSO for all of NZ, requiring a tremendous amount of DNO network data and local knowledge to be communicated from DNOs to the DSO for them to be able to carry out their function. Conversely, it is likely that a DSO acting for a group of DNOs will have significant economies of scale in developing the systems required, and we cannot see 29 DSOs in NZ being a tenable position. There may be an advantage in a DSO acting for a number of DNOs where there is already a common SCADA/ADMS system in use, since this should assist in interfacing the required data and systems together to consider the network constraints when validating the DER bids. Having a common SCADA/ADMS system may be a more logical basis for paring DSOs to DNOs than a geographical basis. The capability of the SCADA/ADMS system to support a DSO is likely to be very important, as high quality decision support will be enabled by a high level of asset capability information and network detail.</p> <p>EA Networks sees a strong need for DSO validation of DER bids. We are already considering how to manage maintenance outages on some of our 66kV subtransmission circuits. There is potential to constrain the Lauriston 47MW solar farm during 66kV circuit outages, particularly if the Lauriston area irrigation load drops off due to rain and the export from the solar farm out into the subtransmission network increases as a result. EA Networks will need to model the proposed network outages and advise any generation limits to the Lauriston solar farm, so they can incorporate them into their electricity market dispatch bids for the affected trading periods.</p>
<p>Q11. How would you rank the DSO models in terms of enabling the process of price discovery in the market for flexibility services</p>	<p>1. Option 2 Hybrid model: The TSO does a single security-constrained economic dispatch based on both</p>

to approach the wholesale market ideal of security-constrained economic dispatch?

transmission and distribution needs and constraints.

2. Option 3: Total DSO: Security constrained economic dispatch is achieved in distribution first then transmission. Potentially not the most optimal outcome.
3. Option 1: Total TSO: Security constrained economic dispatch is achieved in transmission by the TSO but because of the tier bypass issue, DER dispatched in the distribution network may cause congestion because distribution network constraints are not considered. The significant amount of detailed systems required for the TSO to administer all distribution networks with adequate decision support and network capacity information is a barrier for this option.