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Dr Ron Ben-David
Chairperson, Victorian Essential Services Commission
Essential Services Commission
Level 37 / 2 Lonsdale Street
Melbourne Victoria 3000

Via email: DGInquiry@esc.vic.gov.au

Dear Dr Ben-David

Re: Distributed Generation Inquiry Stage 2 Draft Report
The Network Value of Distributed Generation

Introduction

AusNet Services welcomes the opportunity to make this submission in response to the Essential Services Commission's (the Commission's) Stage 2 Draft Report, on the network value of distributed generation.

The draft report concludes that distributed generation does provide network value, and confirms that this is highly variable, for example by location, time, and non- permanence. We agree with this conclusion.

The Commission's analysis also concludes that mechanisms in the national energy framework for remunerating network support (or grid) services do not lend themselves to small-scale provision of these services. Accordingly the report proposes that the next phase of work is to identify principles and mechanisms that would most effectively underpin a market for grid services provided by small-scale distributed generation.

AusNet Services submission addresses this question of appropriate market mechanisms. In summary, we view the market for network support services as an evolving process, driven by innovation on the part of networks and distributed energy resource (DER) operators and agents. Getting the regulatory incentives for networks right is a key factor for these markets to develop. Technological capabilities, in terms of DER service capability to interact with and support networks, and for facilitation of relevant markets, are developing quickly and incentives on the parties will most effectively drive the development of markets for small scale providers.

The remainder of this submission is set out as comments in respect of the Commission's draft findings.

Draft Findings

The inquiry has reached some important draft findings. The Commission's work corroborates the findings from related, recent and current, inquiries and analysis. These include the similarly

comprehensive review being conducted by the AEMC in its assessment of the Local Generation Network Credit rule change proposal.

The Commission's draft findings are summarised below, and our comments on these provided.

Draft Finding 1: Network value of distributed generation

Distributed generation can and does provide network value. The value is primarily derived from reductions in network congestion, which can lead to the deferral of network augmentation expenditure and reduce the quantity of expected unserved energy. Distributed generation can also provide other network benefits but these are not currently material with respect to calculating network value for the purposes of this inquiry.

AusNet Services agrees that the principal area in which distributed generation can provide network value is in reducing network congestion, and accordingly reducing the quantity of expected unserved energy. If a DNSP is able to access support services from distributed generators or from demand reduction sources, in locations where and at times when the value of expected unserved energy is high, this may enable the DNSP to efficiently reduce the level of expected unserved energy, which may also defer or avoid network augmentation.

A DNSP would assess the merit of non-network solutions whilst risk of unserved energy persists and the cost to customers can be mitigated. However, there will be practical thresholds of benefit and perhaps necessary aggregation of sources, below which the administrative burden will outweigh the benefits. Operating efficiency drivers and targeted regulatory incentives would lead DNSP activities toward efficient and effective approaches.

The draft report discusses whether the ability of distributed generation to defer the need to procure network support services from larger generators is a .distinguishable benefit (page 61). We concur with the Commission, that these are one and the same service, only differentiated by scale. DNSPs would take account of appropriate scale and any cost differentiation in its value assessment for reducing expected unserved energy.

The draft report also discusses whether the management of voltage regulation and power quality are services that distributed generation provides to the network, concluding that this is not the case at present. We concur with the Commission. There is potential for smart inverters to provide this kind of service in the future, however the draft report notes the inherent need for distributed generators to incorporate this capability, observing that *"indeed, the value of voltage regulation in distribution systems will increase as solar PV penetration rises, so there will be an increasing incentive for distributed generation to provide voltage control if only to secure its delivery to the grid"* (page 65). This capability and contribution to distribution system operation could become a hard wired obligation in the future.

We also refer the Commission back to our submission of 29 July, into the previous phase of consultation, where we noted that the operation of generation embedded in the network affects the operating conditions of the network which can lead to action being required to ensure stable power system operation within those limits (in our response to Question 5 of that discussion paper, page 4). In other words, at the current time, distributed generation delivers a cost, not a benefit, in respect of voltage regulation services.

Draft Finding 2: Network value is highly variable

The size of the network value of distributed generation is affected by:

***Location** – the value varies based on the distributed generator's location within the network, specifically in terms of its proximity to areas of the network that are congested, or nearing congestion.*

***Time** – the value varies according to the extent to which the electricity generation coincides with the periods of peak demand within the section of the network to which the generator is connected.*

***Asset life-cycle** – the value varies based on when in the network operator's cycle of upgrade projects the value is being measured. If the measurement is conducted annually, this means the value varies year-on-year, subject to the timing of network upgrade projects, as well as the supply and demand for energy in the area of the network to which it is connected.*

***Capacity** – the generation capacity of the distributed generation.*

***Optimisation** – 'optimization' refers to the extent to which the generation is optimised for delivery of grid services, which is largely a function of being both predictable and responsive to the needs of the network. A system that is highly optimised for network benefits is one that reliably produces output at the time it is most needed by the network.*

We agree that the factors identified by the Commission are key distinguishing features that will influence the value that may be provided to the network by individual distributed generators. The variability of value by location and by time and asset life-cycle is illustrated via the Network Opportunity Maps presentation developed by the University of Technology's Institute for Sustainable Futures.

Optimisation for the network is also an important factor. We know that DER can have multiple applications and serve multiple markets. The AEMC study on integration of energy storage identifies a number of uses for that form of DER[1]. For network support, it is important that the network can rely on its availability, and assigned capability for that market, when required.

In respect of capacity, this is a critical factor when considering network augmentation and alternatives, as would be conducted in accordance with the regulatory investment test. To illustrate, if a zone substation has 2 transformers, then the investment decision revolves around the time when the value of expected unserved energy exceeds the cost of installing the 3rd transformer. Alternative non-network solutions will be considered which have sufficient capacity to defer this investment. At this point in the investment cycle small scale network support options are unlikely to facilitate deferral, especially as, in the circumstances, load is growing.

However, at an earlier point in the asset investment cycle, there will be load at risk prior to the scale efficient network investment reaching a point of net benefit. In these circumstances, any reduction in load at risk, which would lower the value of expected unserved energy, is beneficial. Practically however, the transaction costs in identifying the solutions and establishing arrangements with individual parties will outweigh the benefits where these are not significant. A well-functioning market will find ways to reduce such thresholds, through innovative approaches. For example, to attract larger generators one to one negotiation is likely appropriate, however to attract a large number of micro-generators the development of a rebate scheme with on-line sign-up may be effective.

[1] AEMC, October 2015, Integration of Energy Storage, Regulatory Implications, Discussion Paper, page 25

Ultimately, highly sophisticated distribution market platforms can be expected to evolve which provide the price signal transparency and access for DER to a dynamic network support services exchange market, as envisaged by the Electricity Network Transformation Roadmap (ENTR) being developed by CSIRO and Energy Networks Australia. Whilst the ENTR project envisages realisation of such a market as outside of the next decade for Australia and most jurisdictions, it identifies practical steps to advance DER to network markets.

In conjunction with initiatives to develop network support markets for DER there is a need for cost reflective pricing to be embraced. Effective price signals are fundamental to achieving customer response to optimise network capacity utilisation.

Draft Finding 3: 'Firm' distributed generation has significantly more network value than 'intermittent' generation

Distributed generation can provide significantly more network value when it is 'firm'. The greatest value is created when distributed generation can provide firm output in capacity increments that match the extent of the network congestion.

We agree with the finding that firmness of generator capacity is an important consideration for network value. In accounting for the effect of embedded generation on a network it is necessary to take a scenario approach. Network loading on a day conducive to maximum DER output would not represent the loading conditions that the DNSP is required to plan for. A view as to network loading on a peak demand day under environmental conditions which may diminish the output of DER is necessary to achieve expected network reliability levels. There is potential for instance, that intermittent generation, in the circumstances that its output reduces (e.g. a passing cloud shades the locality), could leave the network overloaded as it picks up shortfall. This reduced level of firmness can be addressed and valued statistically as part of the probabilistic planning process.

Network support commercial arrangements should provide for compensation not only on the basis of measured capacity contribution when called upon, but weighted having regard to assurance of firmness that can be demonstrated when the arrangements are entered into.

Draft Finding 4: Technology can transform intermittent generation into firm generation

When intermittent distributed generation systems are supplemented with additional technologies – such as energy storage (batteries) and energy management technologies – they may be capable of operating as firm generators, which would increase their potential value. Technology also exists to coordinate, or 'orchestrate', multiple small-scale distributed generators in order to produce larger increments of firm generation and thereby maximise their network value.

We agree with the Commission's finding. Examples are emerging of this kind of orchestration by various DNSPs in conjunction with market participants such as aggregators and other innovative market 'actors'. AusNet Services is undertaking a mini-grid trial which, amongst other things, will explore how aggregated DER, including battery storage, is able to optimise the operation of the mini-grid itself and support the network. This also provides an early exploration of conceptual distribution system operator functions. The ENTR project foreshadows these advances and includes milestones facilitate market development.

Draft Finding 5: Social and environmental benefits of network effects

Distributed generation may provide a benefit if it provides a lower cost alternative to network projects undertaken for the purposes of bushfire mitigation. This could occur in circumstances where deploying distributed generation in a remote area, and thereby enabling the linking network to be de-energised during high fire risk days, was a more efficient alternative to other bushfire mitigation steps, such as undergrounding wires. The Commission did not identify any regulatory impediment to this value being realised.

We agree with the Commission that this value stream should exist if the network can be de-energised. AusNet Services is currently investigating bushfire mitigation approaches for network fringe situations and this includes a supply option incorporating de-energisation of local network.

Draft Finding 6: Sources of grid services

Reducing network congestion is a form of 'grid service'. Network congestion can be reduced by a number of means, of which distributed generation is only one. Measures implemented for the purposes of remunerating distributed generation for the provision of grid services could be designed in a way that does not preclude the remuneration of other means of delivering grid services, such as demand response.

We agree with the Commission's finding. Commercial arrangements to compensate generators for network support services will, generally, be technology neutral, and capable of being subscribed by demand management sources as well as distributed generation.

An interesting observation is that, in some cases, demand reduction sourced network support contracted by AusNet Services is itself supported by stand-by generation. The services can be considered effectively one and the same.

Draft Finding 7: A well-functioning market for grid services

Distributed generation in Victoria could be remunerated for its network value through a well-functioning market for grid services, assuming the market for grid services provided adequate opportunities for the participation of small-scale grid service providers, including distributed generation.

We support movement in the direction proposed by this finding. Our comments on earlier questions have reflected this, and we have noted actions to advance this. A number of market actors are already stepping into this new market area, and the networks sector, via the ENTR, has shown how this can be achieved. There appears to be strong support from the breadth of stakeholder groups for activation of the roadmap initiatives to achieve its milestones and deliver benefits for customers.

To incorporate opportunities for small scale DER, DNSPs are able to initiate mass-market programs that directly target broad customer groups, or otherwise access market actors who can aggregate the services available from source providers. DNSPs should be free to procure the most cost efficient grid services via either channel, as the cost and value equation will be highly case specific. For example, an aggregator has incentive to extract other than network value from the resources, thereby increasing the overall value of the DER. However, the aggregator will also incur costs in operating the software, systems, and contractual arrangements in order to manage the portfolio of DER customers. These costs are not trivial

and depending on the circumstances, can outweigh the additional benefits of value-stacking that an aggregator can bring.

Although the network support services market is currently in its infancy, AusNet Services has established a portfolio of grid service providers in the period from 2012 to 2016. The providers are typically commercial or industrial customers that have the ability to temporarily reduce electricity demand, or switch over to backup generation at times when AusNet Services requires support. One provider is an aggregator that manages a number of end-customer sites.

A factor that may be contributing to this market not developing rapidly to date is that there is very little incremental load growth on the networks. Load growth is centred around new subdivisions in urban fringe growth corridors, where supply does not exist, and where deferral of augmentation in the upstream network is challenged by the high rate of load growth.

Draft Finding 8: A broad-based feed-in tariff is unlikely to be an appropriate mechanism to remunerate network value

A broad-based feed-in tariff is unlikely to be an appropriate mechanism to support the participation of small-scale distributed generation in a market for grid services. If a network value FiT was calculated with sufficient granularity to reflect the underlying network value it would be disproportionately complex and costly to implement. If it were made simple enough to implement, it would be inadequately reflective of value and could lead to payments to distributed generators who were not providing benefits while, at the same time, not sufficiently rewarding those who were.

We agree with the Commission's finding and reasoning that a broad-based feed in tariff would not be an appropriate mechanism to support participation of small-scale distributed generation in a market for grid services. This is also the conclusion of the AEMC in its draft determination on the Local Generation Network Credits rule change proposal.

The establishment of cost-reflective network tariffs, and progress toward more locational price signalling, when these are achieved, may provide a basis for further progress toward more value based transactive markets. This form of market is envisaged by the ENTR, but is not a clear goal for the Australian context, and is outside of the 10 year horizon.

Draft Finding 9: Opportunities for the grid services market in Victoria

For reasons including but not limited to the roll out of advanced metering infrastructure, there may be opportunities in Victoria for the development of a well-functioning market for grid services that are not currently available in other jurisdictions. This inquiry presents an opportunity to identify the principles and measures by which a market space can be developed in Victoria that provides adequate opportunities for small-scale grid service providers, including distributed generators, to be remunerated for the grid services they are capable of providing.

A range of opportunities exist and being advanced to foster and accommodate DER markets. We discuss these opportunities in this section.

Electricity Network Transformation Roadmap

The ENTR project discusses the objective of orchestrating DER to optimise the value this resource can provide. The ENTR explores the ultimate dynamic distribution services market

platforms that may evolve, but focuses on those things that can be practically achieved in the immediate 10-year period to create an integrated power system at the distribution level.

In its chapter on Pricing and Incentives, the ENTR Key Concepts Report, released in December 2016, includes an important milestone on networks buying grid services from customer power systems as an alternative to grid investment. The milestone is that:

> *By 2027, network orchestration using distributed energy resources on a dynamic, locational basis, results in one third of customers selling their distributed energy resources services to networks, directly or through their agents. Dynamic and locational network orchestration of distributed energy resources in many areas provides a lower cost solution to a traditional distribution service expenditure, as it either augments or replaces the existing grid*[2].

In its chapter on Grid Transformation, the ENTR identifies an element of the Resilient 2027 Future State as:

> *Micro-grids and distributed energy resources provide credible non-network alternatives, which where required, can deliver equivalent firmness as would otherwise be provided by network augmentation, but at a lower cost*[3].

The ENTR program identifies that a range of market design features must be applied to ensure that customers, networks and society benefit from distributed energy resources orchestration. These are discussed in the chapter on Network Optimisation and Platforms[4]. The ENTR envisages evaluation of cost benefit analysis of procuring these services through a digital market platform as the need arises and the capabilities of such systems develop further. A related milestone is for:

> *By 2027, $16 billion of customer savings and economic benefits are being achieved through orchestration of distributed energy resources procured on a dynamic, locational basis, with one in three customers participating either directly or through their agents*[5].

The ENTR also identifies that realising much of the potential benefit of DER also relies on the implementation of pricing reform across the breadth of network services. The chapter on Pricing and Incentives envisages:

> *A fairer system through active implementation of tariff reform and modernised regulation and competition frameworks. More customer oriented outcomes are supported, ensuring those without distributed energy resources are treated fairly, while those with distributed energy resources are able to receive incentives for providing network support services that improve the efficiency of the grid for all*[6].

The ENTR recognises that cost reflective pricing can only be achieved with the roll-out of smart meters. For jurisdictions other than Victoria, the take-up of smart meters is customer led, and cost reflective tariffs are linked to this take-up. Notwithstanding, the ENTR milestones are for the rollout of meters be provide for assignment of cost-reflective network tariffs to residential and small customers by 2021, on an opt out basis[7].

As recognised by the Commission's finding, Victoria already has smart metering rolled out, and a plan to achieve early transition to an opt-out cost reflective network tariffing arrangement is

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[2] CSIRO and Energy Networks Australia 2016, Electricity Network Transformation Roadmap: Key Concepts Report, page 42.
[3] Ibid, page 66
[4] Ibid, page 80
[5] Ibid, page 82
[6] Ibid, page 39
[7] Ibid, page 42

necessary. This will require lifting of the current period government imposed constraint that demand based tariffs be opt-in. We note that the Victorian Government will review the arrangements in 2020, however the prospect for change in policy which would enable application to tariffs for the next regulatory period commencing 2021, is unclear. However, the evidence coming from projects such as the ENTR, and implementation actions arising in the near term, should demonstrate the merit of lifting the constraint.

Principles for a DNSP led market

Tariffs tend not to lend themselves as a mechanism for mass market compensation for DER services. They are typically unable to target and be contained to the locations of network constraint and hence there is considerable leakage in value. In an environment of low load growth in particular, this will result in inefficiency and additional costs to consumers with no resulting benefit. However, they provide a fundamental role in providing price signals to customers for their use of electricity and therefore provide a critical link, influencing the extent to which DER or network augmentation is required.

The more that the network value can be targeted (in place and time), the higher is the financial incentive to DER proponents, and the more likely it is that an efficient response to the incentive is achieved. Therefore, a DNSP should have the means to pass a significant incentive to only relevant customers. The data for this is provided by smart metering, and additional technologies such as the 'Internet of Things' may also play a role.

For larger generators, negotiated service agreements may be the appropriate mechanism. This may also be effective in some instances for services procured from aggregators. However, to capture a large number of localised resources an incentive approach may be effective. This type of incentive could be passed through as a real-time rebate, or in the case of control of the DER being granted to the DNSP (e.g. air conditioning control), as an up-front rebate.

Greater transparency on local constraints will also assist the market. We note the AEMC final decision on the Local Generation Network Credits rule change proposal, which has established some new requirements to enhance and provide consistency to constraint information. However, potentially more innovative and market friendly forms of information led by the networks themselves will better advance DER markets.

The Network Opportunity Maps developed by the Institute for Sustainable Futures at the University of Technology Sydney, under a grant from the Australian Renewable Energy Agency, is illustrative. The Network Opportunity Maps provide a readily accessible, geographically visualised presentation of information on the capacity utilisation of the network, forecast change over time, planned investments to address constraints, the timing of investments, the value of deferral, etc. The tool provides important information for proponents of non-network solutions, and may be valuable in focusing DER providers on opportunities that are particularly suited to them, and hence facilitate engagement with DNSPs.

The Network Opportunity Maps tool has now been developed and populated with initial data, demonstrating its potential. Now that the development phase has been achieved, maintaining current data will be important for stakeholders. The networks sector, through Energy Networks Australia, plans to undertake this function. This will ensure this tool becomes a primary information source and engagement enabler between DNSPs and prospective network support service providers.

Ideally DNSPs would have access to alternative sources for non-network services, i.e. not just a market, but a competitive market. Currently, DNSPs make the value of deferral transparent, and therefore non-network solutions may offer services up to the value of network investment. Whilst DER priced in this way does not provide an efficiency value to consumers, it provides additional option value in that the commitment to long term funding of infrastructure is deferred.

However, a mechanism whereby networks could negotiate a commercial price for compensation would better support the interests of consumers and provide greater incentive to DNSPs.

Other incentive mechanisms are also important and require improvement. These include the Demand Management Incentive Scheme to be developed by the AER in accordance with the Demand Management Incentive Scheme rule change determination, published by the AEMC in August 2015. The AEMC's final determination states that the revised incentive scheme will provide benefit by "*providing a framework to guide the AER in developing and applying a demand management incentive scheme and innovation allowance to help balance the incentives on distribution businesses to make efficient expenditure decisions …*"[8]. The AER is currently commencing consultation to establish the new incentive scheme.

Another potential advance would be the establishment of a Totex regime for determine expenditure allowances. Totex focuses on the lowest cost solutions over the whole life of the asset, reducing focus on the initial outlay expenditure, and perceived bias toward capital expenditure. The ENTR Key Concepts Report notes that Cambridge Economic Policy Associates, in expert advice to the Roadmap, have suggested the strong potential for TOTEX (Total Expenditure – both capital and operational) based approaches. These TOTEX approaches assess regulated networks proposed expenditures in a more holistic manner to benefit customers[9]. The ENTR includes a milestone for trialling of TOTEX, and adoption as the default approach by 2027.

In conclusion, we return to our opening observation, being the Commission's conclusion that distributed generation does have the ability to provide network value, and that this is highly variable, for example by location, time, and non- permanence. AusNet Services agrees with this conclusion and in this submission we have discussed considerations to improve the way in which this value can be efficiently exploited, for the benefit of consumers.

We would be pleased to discuss any aspects of this submission with the Commission. Please contact Kelvin Gebert, our Manager Regulatory Frameworks, if we can assist you in this way. We also look forward to continued involvement with the Commission in the course of the inquiry.

Yours sincerely,

Tom Hallam
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[8] AEMC, 20 August 2015, Rule Determination, National Electricity Amendment (Demand Management Incentive Scheme) Rule 2015, page 12
[9] AEMC, October 2015, Integration of Energy Storage, Regulatory Implications, Discussion Paper, page 48