

Open Energy Networks

Horizon Power's Submission to AEMO and Energy Networks Australia Consultation

August 2018

HORIZON POWER
energy for life

Executive summary

Horizon Power welcomes the Australian Energy Market Operator (AEMO) and Energy Network Australia (ENA) consultation on how best to transition to a future grid that optimises integration of Distributed Energy Resources (DER) for the benefit of all customers.

The Open Energy Networks paper outlines progressive and conceptual leadership that combines the structures, functions and requirements of both our energy market operations and our network infrastructure.

The key considerations outlined in the consultation paper align with Horizon Power's recommendations to the recent *Inquiry into Microgrids and Associated Technologies in WA*[1], being progressed by the WA Parliament.

As a vertically integrated electricity utility with a portfolio of microgrids and interconnected networks across regional and remote Western Australia, Horizon Power is acutely aware of the challenges, as well as the opportunities, presented by increasing penetration levels of DER. Given the nature of its operations, Horizon Power has been facing these challenges ahead of Australia's larger markets and grids given the nature of its operations. With only one customer per 50km², Horizon Power's service area is home to diverse demographic groups across a wide range of terrains and climate zones, often requiring small and isolated systems with relatively high cost to supply. The geographic expanse also presents limited interconnection opportunities, resulting in hosting capacity considerations, system design considerations and network implications impacting on the business.

Horizon Power agrees with the seven key principles articulated in the consultation paper, but the trade-offs between the principles should not be underestimated. There will be no silver bullet for a smooth and secure energy transition for Australia – indeed there will be a myriad of winners and losers as regulatory frameworks, investment criteria, tariffs and new products and services evolve. The entire energy supply chain must collaborate to ensure these key principles underpin decisions going forward, and that these decisions are made in a timely manner given the rapid uptake that is already occurring in consumer led DER markets.

In particular, Horizon Power would like to emphasise the following three messages for further consideration through this consultation process:

1. **We welcome the opportunity to work with AEMO and the ENA to share our learnings for wider industry benefit, and will continue to promote the advantages of using our isolated microgrids as a useful research and development sandbox within which to trial and test innovative platforms before their wider deployment.**

   Horizon Power has been evolving its networks, and its retail, generation and customer interfaces for almost a decade. We understand a collaborative approach is essential to maintain a secure system and realise the benefits for all consumers. We are already progressing an open innovation approach to deliver our current DER projects in Onslow and Carnarvon (with associated DER management and operating systems), innovating

[1] Horizon Power's full submission can be found at: https://horizonpower.com.au/media/4469/2018-wa-microgrids-inquiry.pdf

pricing reform taking into account hardship customers, and have developed a custom DER microgrid regulatory framework to ensure network incentives are aligned going forward.

2. **Customer value propositions should become, and remain, front of mind.**

   Compared to traditional network utility models where customers are passive recipients of electricity, DER offers customers an increasingly critical role in the efficient design of future energy systems.

   Cultural, regulatory and financial barriers can hinder the pace and extent of regulated network utilities to innovate in this space, and it is important to leverage all parties and markets: private; public and customer-led; to ensure new value propositions are created in the interests of individual customers as well as the system as a whole. Through innovative financing, products and services, all customers should be able to participate in the advancement of DER.

3. **Network businesses have a significant opportunity to unlock new sources of value, if they can shift focus beyond current operating models.**

   In an industry facing rapid technological advancement, corresponding regulatory and business models are struggling to keep up. Network businesses, currently incentivised to build out physical assets, are facing increasing pressure to meet customer expectations and system reliability with stricter expenditure requirements. As revenue streams transition away from traditional sources, DER provides network businesses with the opportunity for new growth, and allows them to play a critical role in a safe and secure new energy future.

Please find Horizon Power's specific responses to the consultation paper below. Should you have questions or require additional information relating to our comments, please contact Sami Zouad - General Manager Commercial Services & Finance, at sami.zouad@horizonpower.com.au or (08) 6310 1562.

Yours Sincerely,

Mike Houlahan

Acting Chief Executive Officer

Horizon Power

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SECTION 1: Path-ways for DER to provide value

Are these sources of value comprehensive and do they represent a suitable set of key use-cases to test potential value release mechanisms?

As a retailer, generator, network and system operator across the expanse of regional Western Australia, Horizon Power is uniquely placed to observe and actively drive the emerging value by integrating DER in our electricity systems.

The consultation paper captures both primary sources of value in passive DER – self-consumption, and passive exports. It should be noted these value streams are relevant in the historical context of pricing and regulatory frameworks, largely based on centralised infrastructure and basic electricity tariffs with large variable components. However as tariff and regulatory reform evolves, these value streams, in both quantum and frequency, becomes increasingly irrelevant.

An implied value stream, not explicitly articulated in the consultation paper, is the potential avoidance of centralised generation capacity and associated infrastructure. By improving the information exchange between AEMO and DNSPs, this will also enhance value and facilitate planning and resourcing going forward.

Horizon Power's regional customers will likely be limited from participating and providing value to markets common to the larger grid, so our focus is less on driving wholesale energy and ancillary services market values. Nevertheless, bilateral agreements and the value streams therein may be increasingly relevant in regional service areas, where embedded networks could provide trading opportunities, or customers could contribute to network support and voltage regulation control if appropriately incentivised.

Whilst 'value' should be considered Horizon Power recognises the significant investment in our existing infrastructure, and consideration must also be given to the potential impact DER may have on eroding this value.

An additional value stream (particular to the WEM) to consider is how the reserve capacity market will optimised and coordinated as the penetration of DER increases.

Are stakeholders willing to share work they have undertaken, and may not yet be in the public domain, which would help quantify and prioritise these value streams now and into the future?

Horizon Power welcomes the opportunity to work with AEMO and the ENA to share our learnings for wider industry benefit, and will continue to promote the advantages of using our isolated microgrids as a useful research and development sandbox within which to trial and test innovative platforms prior to any wider deployment.

Horizon Power, as a unique utility with a vertically integrated structure, light touch regulatory framework, and advanced metering infrastructure for all customers, has been grappling with evolving not just its networks, but its retail, generation and customer interfaces for almost a

decade. We understand that a collaborative approach will be essential to maintain a secure system and realise the benefits for all consumers.

Horizon Power has embarked on several initiatives to enhance its DER development and operational capabilities.

Our key microgrid project in Onslow heralds a new era in energy. The project will provide more than 50 per cent of the town's energy needs from renewable DER, and is being developed with investment from Chevron. The Onslow solution is likely to comprise more battery storage, behind the meter solar, appliance control and smart energy products per customer than any microgrid in Australia – all being controlled via intelligent control systems as needed to maintain system security and reliability in a high-DER environment. The project will deliver mutual benefits for consumers and the utility.

Other trials and demonstrations underway or planned in our service area include air conditioner load control, roof leasing, community solar, community battery, embedded networks, and alternative regulatory frameworks and pricing models. Horizon Power is also involved in developing feed-in-management platforms, predictive analytics, weather forecasting (in partnership with ARENA), grid automation, demand response trials, customer archetypes, and renewable Micro Power Systems.

We are progressing an open innovation approach to delivering our DER projects, and, on the proviso of our partners support, are willing to share our technical and commercial solutions to drive wider benefits across all Australian energy markets.

Horizon Power has developed a customised DER microgrid regulatory framework to ensure network incentives are aligned for the future.

As with all network businesses, Horizon Power continues to pursue large capital investments and protect its revenue base, with current regulatory settings limiting commercial incentives (outside its high cost to serve towns) to proactively transition to DER. Acknowledging the increasing misalignment of this approach with the forecast energy future, we have developed an innovative regulatory framework to support DER microgrids. This framework is structured to protect customers and provide appropriate incentives for utilities to embrace new technology to drive the lowest sustainable costs across the system.

Horizon Power welcomes the opportunity to share the design of its microgrid regulatory model identified from a pilot being conducted in regional Western Australia. The model looks to provide a fit for purpose framework for microgrids that protects the long-term interest of consumers, promotes efficient investment in and operation of utility services, avoids cross-subsidisation between classes of consumers, and provides investors with a requisite level of certainty.

Horizon Power's regulatory model could be used as a case-study for other regulators, helping to quantify and prioritise DER value streams, and in collaboration with ENA, share insights to drive the regulatory reform required across other systems and other jurisdictions.

SECTION 2: Maximising passive DER potential

Are there additional key challenges presented by passive DER beyond those identified here?

Horizon Power's operations comprise a wide array of power system equipment with small diesel and gas generators, hybridised thermal power stations augmented with renewable energy, large combined-cycle gas turbines, small distribution lines, large transmission lines and terminal substations, and a variety of customer-connected facilities.

Based on Horizon Power's experience and expertise, we believe the greatest challenges to the uptake of DER in regional WA are:

- The inability for customers in financial hardship to pay an upfront cost for DER solutions should they have access to them.
- The comparatively high cost of supply and installation of DER products - a typical 5kW system in the greater Perth metro area retails for about $4,500, in regional centres such as Karratha, an equivalent system costs about $10,500.
- Tenancy arrangements – 68 per cent of all Horizon Power customers rent their homes. Tenancy introduces split incentives, which erect barriers to the uptake of DER. Split incentives occur when those responsible for paying energy bills (the tenant) are not the same entity as those making the capital investment decisions (the landlord or building owner). In these circumstances, the landlord may not be inclined to make the necessary upgrades to building services or appliances when the benefits associated with the resulting energy savings accrue to the tenant.

Many eastern states distributors and the larger SWIS operate within the context of an 'infinite pool', where the network operator effectively sees the power system as an endless supply of energy and interconnectivity amongst loads and supply sources. Horizon Power does not have that luxury - because the microgrids it operates are small, it encounters technical challenges long before larger grids see the same problems.

In addition, because Horizon Power's systems are remote, the costs to operate them are high (and subsidised), so Horizon Power is always looking at ways of improving system efficiency and reducing costs. DER plays a significant role in reducing costs, but this must be balanced with pricing reform (out of scope in this consultation) and flexibility within the regulatory framework to keep pace with technological developments.

Is this an appropriate list of new capabilities and actions required to maximise network hosting potential for passive DER?

To ensure continued reliable operation, Horizon Power currently calculates hosting capacities for each system to ensure technical issues can be managed. In large power systems, hosting capacity calculations are typically based on network limitations. In Horizon Power's case, and because of the many microgrids in Horizon Power's portfolio, constraints can also relate to generation.

Few utilities globally have had to curtail the take-up of DER along the distribution network. Utilities in Hawai'i have taken a similar approach to Horizon Power and defined a strategic

roadmap, which will push technical limits while improving the affordability and reliability of their microgrids. New York utilities are also working to increase the amount of DER that can be accommodated whilst maintaining reliability. Their work is focused on investigating the technology (storage), communications (monitoring and control), and developing approaches to increasing hosting capacity by resolving voltage, thermal and protection expectations that limit additional DER.

Horizon Power's hosting capacity methodology, which gives rise to publicly posted limits, has been endorsed by engineering consultants GHD and AECOM as a prudent approach to managing the technical challenges. Horizon Power welcomes the opportunity to work with other utilities to maximise network hosting potential for passive DER through this consultation process.

What other actions might need to be taken to maximise passive DER potential?

Horizon Power has considered a range of solutions to the technical challenges arising from increasing levels of DER integration.

As a response to market demand for solar energy, Horizon Power released an updated technical standard in 2012 which outlines the requirements for DER systems with generation management. This standard is an Australian first and enables customers to install DER systems with batteries that perform renewable energy smoothing, to mitigate the effect of cloud events on the power system.

Horizon Power's standard specifies a ramp rate curve with which the customer's installation must comply, to ensure the fluctuations do not affect the power system. We have now connected many systems with this functionality.

Horizon Power has also introduced feed-in management to large installations to manage the effects of reverse power flows. The consultation paper notes that feed-in management systems are not anticipated to be called upon very frequently (less than 1% of the time in 2025, and less than 4% of the time in 2035). Based on Horizon Power's experience with smaller, isolated microgrids, these forecasts appear low unless there are additional assumptions for solutions being put in place. Further discussion on the role of feed-in management would be welcome to ensure the roadmap for achieving dynamic DER management reflects the most practical and cost-effective option.

Feed-in management and ramp rate specifications are working effectively to manage the levels of DER connected to Horizon Power's systems thus far. The path to much higher levels of penetration depends on the ability to monitor and control the output of all DER on the system (i.e. active DER) and to employ a range of other new technologies.

The table below outlines the range of problems encountered with higher levels of DER penetration, along with the range of Horizon Power's existing passive and active solutions, and those that we are developing for use in the future:

Problem	Existing solutions	Solutions under trial and development
Reverse power	Feed-in management (large DER systems)	Feed-in management (small DER systems)
Cloud event management	Generation management (customer battery storage with renewable energy smoothing) Feed-in management (large DER systems)	Feed-in management (small DER systems) Solar forecasting Cloud cameras
Voltage rise	Change transformer taps Change system voltage levels	New DER standards Improved inverter power factor performance & voltage control
System stability	Existing DER standards	New frequency control strategies New voltage control strategies New DER standards Improved inverter fault ride through performance
System network loading constraints	Network reinforcement	Optimised charge coordination of energy storage
System black start and energisation	Power station operating guidelines	DER network black start control schemes
System protection sensitivity	New protection philosophies New protection relays	Advanced sensing (e.g., travelling wave) relays Utilise system monitoring (DER, advanced meters)

Table 1: Horizon Power DER management solutions – existing and proposed

As a first step, if the integration of passive DER is implemented well, the resultant management system creates new benefits for the power system as a whole: through better provision of network support services; avoidance of network augmentation; diversification of funding sources for large infrastructure projects; optimisation of energy production and consumption; and minimising outages and disturbances using load prediction algorithms.

SECTION 3: Maximising active DER potential

Are these the key challenges presented by active DER?

The key technical and network challenges are all presented, however the economics of the changing market are not considered (see next response).

Would resolution of the key impediments listed be sufficient to release additional value available from active DER?

Horizon Power notes that it has additional impetus to pursue active DER management given the nature of its small and isolated systems, high cost to supply, and customer appetite already resulting in hosting capacity being reached across many towns. We commend the AEMO and ENA's motivation to progress consideration of DER impacts on the larger grids and integrating optimisation functionalities into existing markets.

We recommend consideration be given to appropriately incentivise market participants whilst centralised frameworks and regulatory environments play catch-up. Where operators and network owners are prevented from unlocking the full benefits and capabilities of distributed generation, challenges will remain in appropriately incentivising all participants in the power system (local utilities, third-party aggregators, communities, and end-customers) to recognise the value DER can contribute.

Under WA's existing uniform tariff system, customers pay for electricity based on a small daily supply charge (the fixed component) and a much larger energy consumption (the variable component). This structure does not reflect the cost of the system, and DER is exacerbating the distortion.

It is important to properly incentivise DER according to the needs of the community and facilitate customer-owned DER from the onset of a microgrid. Incentives for DER should deliver fair value for both energy and ancillary services.

Where policy incentives, regulatory frameworks and financing mechanisms begin to unlock these new value streams, and business models accelerate the installation of distributed generation, DER management solutions (and market platforms in the case of larger grids) must adapt to ensure that DER can add value, not just shift costs from one user group to another. As policies and regulation change, the DER management systems must be able to extract from the same underlying architecture and DER capabilities, values that simultaneously complement different business strategies.

An additional key challenge Horizon Power has recognised is the importance of accessing, sharing and using consumer data in facilitating the development of innovative DER products and services across the industry. This can involve retailers providing consumer metering data to distributors; how to make it easier for any party with consumer approval to obtain data that can be recorded by the meter; how different parties manage cyber-security and privacy of consumer data such that data provided to distributors is not shared with affiliates that could harm competition.

What other actions might need to be taken to maximise active DER potential?

With the increase in microgrid integration across all energy systems, utilities will firstly need to develop a DER management system (DERMS) and build them into their asset management platforms. Some off-the-shelf DERMS solutions already exist in the market, but their applications and operationalisation needs to be investigated and demonstrated. Horizon Power is focused on doing this in Carnarvon and Onslow.

By sparking a national conversation on the distribution system operator (DSO) topic, this consultation could use this as an opportunity to explore standards for DERMS and associated communications platforms across all markets in Australia. This process would ensure interoperability, streamline the deployment process for utilities and customers, and minimise the risk of obsolescence should a definite product or service gain preference.

The development, integration and commercialisation of these applications to DSOs and customers will require a combination of power system engineers, IT specialists and commercial experts.

In addition, these DERMS will need to be supported by a robust and modern telecommunications network, in particular in regional WA and at the fringe of grid in the SWIS. Initial efforts should involve exploring the potential of coordinating efforts with Telstra, NBN Co, and other telecommunications providers to upgrade the infrastructure needed to accommodate more DER.

Thirdly, Horizon Power comments on the importance of the lead implementation authority conducting engagement activities educating consumers on how to make informed decisions, particularly to promote more effective retail competition, and assist consumers with the complexity that may emerge from the introduction of more efficient distribution pricing in the electricity market.

What are the challenges in managing the new and emerging markets for DER?

Whilst the regional WA service environment is unique given the role Horizon Power plays as the vertically integrated utility that also holds system operation functions, the experiences being garnered advancing these regional grids into high penetration DER systems may also provide insight to the larger grids and the WEM and NEM. As such, this section provides more of an overview of Horizon Power's technology roadmap for broader context, without proposing specific actions that will evolve through the consultation process.

Horizon Power is well advanced in addressing active DER challenges and opportunities. In various regional towns of Western Australia, the level of DER is approaching or has exceeded the size of the largest conventional generator in those towns. In some cases, the installed DER capacity is either reaching or is capable of reaching the town's total electricity demand. This raises the possibility of the solar PV back feeding the power station, presenting a risk to the electricity supply and potential damage to and/or instability of the generation infrastructure.

Horizon Power is developing a solution that will allow us to orchestrate all DER on our networks, which will be critical for us to continue to provide relevant products and services for our customers.

In particular, with a focus and expertise in remote and isolated microgrids, Horizon Power is looking to introduce a commercial DERMS package, firstly by rolling it out in Onslow, as part of our DER upgrades across the town, as well as two other microgrids in early 2019.

Similar to the platforms outlined in Stage 2 and 3 of Figure 10 of the consultation paper, the DERMS will obtain and analyse near real-time information about generators, network load, and other power system factors, to which it can then apply control schemes to dynamically balance supply and demand, maintain system stability and achieve optimal system outcomes.

DERMS will also include a suite of algorithms and functions, which dispatch the connected DER systems to ensure the power system constraints mentioned above are mitigated. Under normal circumstances, the DERMS limits the total power that can be produced by each remote DER system to prevent the power station generators from overloading, or the load on the generators from falling below the minimum designated load.

DERMS will ensure Horizon Power can continue to maintain safe, reliable, and efficient networks - which benefits both us and our customers. It will also be integrated with our current systems, providing a coordinated management solution.

The DERMS will be deployed in Horizon Power's production environment, physically located in Horizon Power's data centre, and interfacing with Horizon Power's SCADA Network and Network Management system. This will facilitate communication with remote devices using Horizon Power's SCADA Network, external APIs, and public APIs through which third-parties, such as DER systems and DER aggregators, can integrate to the DERMS.

For its fringe of grid and remote power systems, Horizon Power believes that a DERMS which fully integrates DER can unlock valuable benefits to customers, service providers and grid operators alike. Where commercially relevant, Horizon Power is aiming to enable DER proliferation to a variety of customers and for a variety of business models through a DERMS platform by being the distribution system operator (DSO) for both utility-owned and non-utility-owned DER.

Horizon Power envisions the following roles for its DERMS:

- Aggregate – take services from individual distributed energy resources and aggregate them in a manageable number
- Organise – manage DER settings and provide simple grid-related services
- Optimise – harness the multitude of DERs economically and enhance reliability
- Translate – communicate to many resources that may use different communication protocols, but interface cohesively through DERMS.

In the immediate term, Horizon Power is conducting DER trials in Carnarvon that will continue to investigate, and aim to overcome, the technical and operational constraints associated with a high-penetration of DER on our remote networks. The learnings and

bespoke solutions that result from the Carnarvon trials will be integral to our future system solutions, including the DERMS. These learnings could also inform the additional actions and challenges for the wider market impacts being considered as part of the AEMO/ENA consultation.

One key takeaway that Horizon Power recommends AEMO and ENA keep front of mind, is ensuring simplicity for end customers, no matter how complex the technical management systems and software processes become.

At what point is coordination of the wholesale, FCAS and new markets for DER required?

Given the isolated nature of its microgrids, and the uniquely integrated structure that sits outside any requirements for wholesale, frequency control and ancillary services markets with regional and remote WA, Horizon Power does not have specific recommendations on wider market coordination impacts. As a general principle, seeing how quickly new technology evolves, it will be sensible to ensure coordination across and between markets occurs as soon as possible. For example, battery storage technologies are beginning to highlight their potential to provide valuable services across wholesale energy and ancillary markets, as well as additional system security benefits with respect to frequency regulation, fast frequency response, and rapid ramping. This value needs to be able to be monetised to ensure the right investment signals and incentives are being represented to technology vendors, network utilities and generation developers today.

To enable this monetisation to occur as soon as possible, key clarifications must occur within existing regulatory frameworks. For example, clear articulation of who does what across the electricity supply chain, noting that network businesses are already facing regulatory hurdles and stringent ring fencing arrangements when it comes to accessing wholesale markets, or deploying non-traditional network solutions such as batteries. This consultation must recognise that coordinating the ability of participants to access wholesale, FCAS and other new markets will ultimately underpin the choice for the DSO model.

SECTION 4: Frameworks for DER optimisation within distribution network limits

How do aggregators best see themselves interfacing with the market?

Acting as the network utility, system operator and retailer, Horizon Power has a unique model with which to integrate and coordinate with other DER optimisation participants. Without having the perspective of an individual aggregator, Horizon Power supports any general principles that promote simplicity, transparency and lowest total system cost for framework design.

As a customer facing organisation, Horizon Power also recommends that whichever model is preferred – AEMO's single integrated platform, DNSP led, or independent DSO – the customer experience must remain central to the decision making process to ensure optimal outcomes are achieved. This may also require flexibility in the system to provide for any behavioural aspects that may not be able to be addressed (or predicted) through upfront technical system design.

Lastly, given the nascent nature of aggregator / platform models in the electricity sector, it is an area that will require participants to innovate and experiment and therefore barriers to entry should not be too high.

Have the advantages and disadvantages of each model been appropriately described?

As the role of the customer is recast in a DER world, so too is that of the role of network utilities. The DSO role will greatly evolve to achieve a customer-centric electric power system, in which customers, aggregators, and other third parties invest in and derive value from DER. To ensure grids do not become the 'new solar' for unprepared utilities and government, a clear strategy with an end-role already mapped out for DSOs should be defined and adopted from the onset of the rise of high penetration DER grids.

Upfront, additional considerations should recognise that the role and requirements of the DSO may vary greatly depending on geographies and customer demographics covered. For example, on the one hand the management of a large grids and embedded microgrids within e.g. WA's South West Interconnected Network provides one range of challenges and complexities, and on the other hand islanded and fringe-of-grid microgrids in regional WA may require their own bespoke solutions. Large grids are likely to progress opportunities such as multiple value arbitrage settlements, and potentially offer more avenues for embedded networks to explore peer-to-peer trading. In contrast, remote systems may predominately view DER integration and optimisation as a network and generation cost reduction opportunity.

East-coast markets and the larger scale and interconnected qualities of the NEM highlight yet another context to be considered. There is not likely to be one perfect model for all systems and geographies. The States of California and New York have already acknowledged these differences and started to develop alternative regulatory models between the large grids and isolated microgrids.

Are there other reasons why any of these (or alternative) models should be preferred?

At this stage of the consultation process, and being largely separated from the intricacies and impacts of AEMO market designs, Horizon Power is less concerned about 'who does what' in the implementation models, and more focussed on ensuring a successful architecture is set up. We agree that enforcing the principles for framework design are essential to ensure positive outcomes for system operators, network utilities, and customers are delivered.

As Horizon Power progresses its own unique model for DER optimisation (the DERMS platform) in towns such as Onslow and Carnarvon, we are keen to share learnings and knowledge of functionality benefits, risks, challenges, customer perceptions and other impacts arising from its deployment.

In Horizon Power's view, a DERMS would be required to associate with each "market-based" DER and ensure network constraints are managed. In effect, this would make the DSO a supervisor above the DERMS, or to sit and be included within the DERMS product itself. This architecture naturally lends itself to the two-tiered model 2 proposed in the consultation paper.

Model 2 also avoids the complexities inherent in Model 1. Under the AEMO centralised model, firstly, AEMO would have to grapple with a volume of transactions that far exceeds normal operating parameters of a typical ISO. Secondly, a DSO is tightly wedded to the underlying distribution network and associated DER, hence, the distribution network operator is fundamentally needed to offer up the topology and real-time operating constraints and this would be more streamlined if it were also enabled as a DSO. Lastly, our observations from California show that significant regulatory rules would need to be changed to allow Transmission network operators to exercise control over the distribution network businesses, and this in itself would be a significant implementation battle.

As additional context, Horizon Power notes that in New York, the government produced a transformation roadmap supported by regulatory changes in the "Reforming the Energy Vision" (REV). In this transformation roadmap, the role of DSOs changes from asset managers to platform providers. The Distributed System Platform Provider (DSPP) provides the interface between the wholesale market and the customer. DSPPs are not allowed to provide DER products and solutions except for ancillary services: that is the role of competitive energy-service providers.

In contrast, in California there is a move toward stronger integration of distributors and DER retail solutions within the DSOs. Indeed, the market regulator and investor-owned utilities (IOUs) are working together toward the renewable goals and tackling the following areas in priorities for high DER:

- Measure hosting capacity at a circuit level;
- Define an Optimal Location Net Benefit Methodology to identify locations at which DER deployment is a viable substitute for conventional distribution investments; and
- Transition operational practices toward control of DER.

It would be useful for Australia to keep a close watch on progress being made overseas in this context, to ensure that we do not unnecessarily re-invent the wheel and introduce

unneeded complexity; and ensure inter-operability where possible, particularly as DER products and services are being designed with global audiences in mind. This is particularly relevant for the large grids and established markets (i.e. NEM and WEM).

The role of the DSO in the customer-dense part of the WEM and NEM, with dynamic wholesale markets and pockets of optimisation, is more closely aligned with the models being promoted in New York. It is evolving toward a transactive platform with economic optimisation as an ultimate goal. The greater size of the metropolitan South West Interconnected Network and interconnected east-coast grids provide for any number of possibilities and arrangements for DER, virtual power plants (VPP) and embedded grid formations which, if appropriately coordinated, will all drive towards an optimum value for the entire system.

Similarly to the principles of New York's REV, the design principles should be enforced to ensure that new market players with innovative business models can participate in the aggregator space, and consideration must be given on whether it will be prudent to prevent incumbent DNSPs from creating barriers to these new players (e.g. via ring-fencing arrangements), or at least prevent any possibility that innovation gets stifled in order to protect traditional business models where aggregation was not previously considered.

It is clear that Australia will only be able to realise a future as outlined in the Transformation Roadmap if and when existing market participants are no longer incentivised by frameworks that encourage large scale generation and network infrastructure, at the expense of existing DER alternatives that may deliver more benefits, but whose financial benefits are not yet able to be captured. This transition should be made somewhat easier once network and retail businesses recognise that even though some additional capabilities are required, there are significant value opportunities to be realised. As all network businesses grapple with the transition of our energy industry, the potential for DNSPs to act as DER platform providers or leading participants (as outlined by all three models) should not be understated, and should complement the parallel work being pursued in regards to off-grid systems, alternatives for network services, and the importance of microgrids even within large, interconnected systems.

In remote and fringe of grid areas, the role of integrating DER into microgrids is first and foremost a cost management exercise. Wholesale markets usually do not exist and vertical integration provides a way to optimise overall system costs across the different roles that would exist in a disaggregated energy system. In the most costly systems, DER and off-grid solutions should be a key focus, with fit for purpose centralised generation layered around the distributed resources. In that sense, the Californian approach may be more relevant to remote and fringe of grid areas in WA and elsewhere not served by the NEM. Here, while aggregators might still be able to reach required economies of scale to provide value to the overall system, it is less likely given the spare customer density and demographics, and therefore disintermediation should be explored if it results in cost reductions and improved customer outcomes.

Horizon Power recommends a clear distinction between designing DER optimisation models and markets for large grid systems, and creating appropriate models for remote and fringe of grid areas and customers that may otherwise be excluded from all the benefits that DER can provide.

SECTION 5: Immediate actions to improve DER coordination

Are these the right actions for the AEMO and ENA to consider to improve coordination of DER?

Horizon Power supports the next steps outlined by the AEMO and ENA including all 'no regrets' actions identified. Whilst some actions (e.g. the development of the information exchange and sharing information with AEMO) is less relevant to Horizon Power's service area and operating model, given Horizon Power acts as its own system operator for its isolated microgrids, other actions can and should be progressed through collaborative pathways.

In particular, Horizon Power's portfolio of microgrids provides end to end visibility of the connection, generation, system impacts, network effects, and financial implications of DER being integrated into the grid. This has the potential to offer industry with a unique opportunity to progress the piloting and testing of aggregation, marketing and mediation platforms before they are deployed on larger grids and before they impact AEMO's more complex operating frameworks.

Are there other immediate actions that could be undertaken to aid the coordination of DER?

Where possible, Horizon Power recommends developing arrangements to use some of regional WA systems to ensure concepts evolve accurately and efficiently towards appropriate delivery, and that DER can be optimised and coordinated as intended and also interact with customer behaviours, weather conditions, or unforeseen impacts. This will need to be done with enough flexibility to ensure it does not compromise subsequent deployment into other market structures with different operating models (i.e. the WEM and NEM). This may result in trialling functionalities that ordinarily would not be suited to regional areas but have broader market benefits.

Pathways for evolving the DER marketplace should also ensure that benefits accrue to stakeholders whose needs the traditional system has not adequately addressed. A combination of distributed renewable generation, storage, and more efficient network infrastructure heralds a much cleaner energy system that will reduce pollution and carbon emissions, with significant potential financial benefits for customers who actively participate. Customers with limited options in their energy choices (such as renters and low-income customers) must not be forgotten, and should also be able to participate in investment in clean generation and storage by way of innovative financing, products and services.

Whilst the technical requirements and immediate actions have been outlined in the consultation paper, a clear gap remains in how a market would be set up to monetize the energy flows – i.e. to provide appropriate value to customers who would be offering their systems into the grid.

As a final consideration, Horizon Power recommends AEMO and ENA also canvas specific views on the economic implications that new DER markets and systems will create for investors and customers. Some initial comments were included in the AEMO-led single integrated platform model that highlighted the need for additional resourcing and funding,

which touches on a broader issue to be addressed – who will conduct the economic evaluation to ensure that initiatives are efficient and indeed worth the investment, and do not adversely impact electricity affordability in what is already a contentious environment for the industry. There is undoubtedly substantial financial benefits to be gained from optimising DER and ensuring a coordinated approach is taken to grid design and operation, as clearly outlined by ENA's Electricity Network Transformation Roadmap 2017.

To ensure delivery of a future envisaged by the roadmap, the industry must be sure to abide by the key principles expressed by AEMO and ENA, and hold each other to account. This is particularly relevant in jurisdictions such as Western Australia that have large State-owned electricity utilities, with additional complexities and implications resulting from rising costs or requests for upfront capital.