



THE GRID
AS WE KNOW IT
MUST TRANSFORM
TO MEET THE NEW USER

Tukio Intelligent Infrastructure Pty Ltd
ABN 60 625 568 354
Level 1, 172 Roberts Street, Fortitude Valley 4069, QLD

Response to Consultation Paper – NEM VPP Demonstration
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Executive Summary

Tukio have developed an innovative and novel approach to the market that will assist with some of the barriers to harnessing the opportunities presented by the proliferation of Virtual Power Plants (VPPs) that manage Distributed Energy Resources (DERs). We have already been working with core market participants to define an approach to the management of DER and DR while considering the needs of various stakeholders through provision of a platform that will provide the best economic outcome for society and thus customers. This approach will inherently support AEMO's aim of uplifting its capability to register, forecast and monitor VPP's in order to better understand how the services can be extracted from these facilities to better manage the grid.

To achieve this goal, Tukio has embarked upon a multi-pronged channel strategy to deliver this vision with Tukio providing the glue for the resultant value streams, namely:

1. Generator & wholesale market focus - artificial intelligence driven forecasting of load and renewables supporting scheduling of thermal generator, renewables and energy storage asset fleet optimisation scheduling and dispatch as well as portfolio optimisation and trading
2. Leveraging AI driven optimisation of end customer assets to maximise the value of distributed energy resources and demand response in embedded grids, virtual power plants and the DSO
3. An energy platform focus – in our work with DNSPs and AEMO we are driving up the complexity curve to ensure build and deployment of a platform that will support the dynamic control of DER both centrally and at the grid edge
4. A flexible storage management capability that can scale right up to FCAS relevance and down to grid or customer level

Tukio has focussed recent efforts on the development of our platform or ecosystem to suit portfolio applications such as those that would be required by capabilities like the DSO. The management of and forecasting for resources for a VPP is a subset of what we have been developing and this puts us in a position to contribute significantly to this VPP program. For example, Tukio has proven specialist capabilities in forecasting, scheduling and trading which supports the base orchestration capabilities that would be applied to the operation of a VPP or portfolio of VPPs and relevant assets. This will allow us to contribute significantly to the AEMO and DEIP program as we understand what it takes to achieve best in class management of a suite of assets both in concentrated and portfolio sense.

Our approach to this project is to apply our full capabilities to the management of major VPP in South Australia and Queensland supplied in the form of grid scale DER and storage. It is our intention to engage with our close partners to participate in the trial as it applies to both the energy and FCAS markets. We will partner with a Retailer and provide VPP capability to participate in the energy market and we intend to operate as a MASP to participate in the FCAS market.

This response will:

- Briefly describe our capabilities with regard the physical VPP which can be operated for the Demonstrations;
- Provide a response to your questions in the consultation paper;
- Provide an overview of our platform as it pertains to the DSO which is synonymous with the operation of a VPP or a portfolio of VPPs and other assets for the market operator; and
- Be structured with a high-level project description, a response to the consultation paper and a detailed response as an appendix to this response that is confidential in nature.

We are excited about the opportunity to bring our strong partnerships, assets and platform together to participate in this program. We are confident that we can contribute significantly with regard to informing AEMO and the DEIP about the best in class operation of the market in light of the penetration of DERs and the entry of significant VPPs across the country.



Projects

Tukio is partnered or is a party to several projects which will form part of this submission to AEMO. Each project is exciting in its own right and will demonstrate how different facets of grid control and operation across connected and aggregated DER can be managed and interacted with to the benefit of the grid and customer as a whole.

In summary the projects are as follows:

- Tukio VPP: a multi-phased VPP consisting of diesel generators providing access to dispatchable, reliable generation with further expansion to include Tukio Energy Storage Systems (TESS) to deploy large scale energy storage systems at appropriate locations around the grid in order to provide storage and power at grid scale; and
- Tukio grid edge solutions: The Tukio grid edge solutions encourage customer participation in the local network. The granularity of control and interaction with the customer will be AI and technology driven and will become increasingly sophisticated in terms of its ability to influence communities as a VPP.

Project Summary

This proposal outlines how the Tukio capability will be built out progressively over two projects that will enable both discrete asset management and highly efficient portfolio management demonstrated in geographic and market diverse environments:

Grid Edge

Tukio Grid Edge is deploying our capabilities on an embedded network with 200 customers currently under construction in Queensland. Tukio will access the customer DER resources and leverage 3MWh's of storage and 850+ kW's of solar generation providing a basis for automation of customer asset orchestration and execution of orchestration commands. This project is based on the objectives of this process and is a valuable project for demonstrating technology use and deployment.

The project has been planned in a way that minimises risk by taking a very practical, staged approach to the introduction of technology. This technology can immediately be deployed on a grander scale on Projects with larger VPPs/embedded grids to further prove that the customer can participate successfully in a VPP and the technology is applicable at both the larger customer DER level and at the home.

The Tukio Ecosystem has been designed to bring additional value streams to customers in return for access to DER / DR / VRE resources by various stakeholders including the market operator. The power of Tukio's Ecosystem is its ability to manage the various capabilities of participating parties (prosumers and key industry providers) allowing them to trade the true value of their product at a point in time, whilst providing visibility of the real time state of DER resources and maintaining distribution network power quality.

SA Virtual Power Plant

A VPP in SA that will be delivered in three phases and consisting of diesel generators and large-scale energy storage systems. Geographically will start in South Australia and subsequently these phases will be included into a portfolio approach incorporating further assets in NSW and Queensland. Tukio is willing to work with AEMO to allow for the demonstration of our core tools in forecasting, scheduling and dispatch of assets to optimise performance and commercial outcomes.

Answers to Consultation Questions

1.1 The primary focus of these trials is to demonstrate VPP aggregating battery storage systems. Do intending participants envisage incorporating demand response resources into your aggregated portfolios, and should this be incorporated into the VPP Demonstrations?

Tukio have developed an approach to the market that will support the engagement and penetration of distributed energy resources (DERs), renewable energy and demand response (DR). We are already working with various market participants to define an approach to the management of DER and DR while considering the needs of various stakeholders through provision of a platform that will provide the best economic outcome for society and thus customers.

The best outcomes for consumers in Tukio's opinion cannot be achieved fully without the consideration of value streams from multiple participants and future mechanisms to harness these. Tukio can support such processes and intends to engage customers in DR within VPPs through effective but measured direct interaction with clients.

A consultation evaluating the need for a market for DR is in process. It seems likely that DR will continue to grow in relevance and may be encouraged at the grid edge. It is conceivable that in aggregate it may have some impact on the operation of the grid. AEMO should consider whether it should use the opportunity to include the operation of DR whilst also ensuring the distribution network reliability and quality.



2.1 Are the VPP Demonstrations objectives logical and achievable? Should any other objectives be considered for these VPP Demonstrations?

Tukio agrees with the objectives as outlined but would like to explore how multiple value streams from AEMO and networks can be provided to customers. During execution Tukio would be prepared to become involved with scenarios investigations that go beyond the process as defined should any be presented as AEMO learns.

2.2 How can the VPP Demonstrations projects better capture consumer insights and improve customer experience and outcomes?

Firstly, there is a wealth of information available from current utilities and leading programs that have developed successful demand management programs that can be leveraged in this program, to ensure that we are not starting from scratch and re-learning for VPPs. A very good example of a successful program from which learnings can be drawn was the Energex PeakSmart program for air-conditioning which had many facets and achieved the highest customer and manufacturer uptake of any national demand management program. PeakSmart developed channels to market outside traditional utilities and put an incentive in the market for customer uptake. That in-turn provided a clear signal to air-conditioning manufacturers that volume can be achieved in the market for PeakSmart, which resulted in the standard being available in all air conditioners in the market. In parallel the electricians and installers were trained and provided information to help customers during the installation. These are some of the factors helped drive customer participation.

Key specific items that also need to be considered for small customers in these demonstrations are:

- a) Understand how much storage capacity is available for AEMO market events from small customers and what might influence customer behaviour in this area. Currently customers acquiring storage capabilities are using it to manage their excess solar production in the middle of the day (charging) and then they use that stored value to displace grid delivered energy at peak times. This behaviour also drives how much capacity a customer is willing to invest in for their needs. Predominately the default mode of operation of these assets is to charge in the middle of the day and discharge at peak, which aligns to the customers tariff and provides greater value for their excess solar production.
- b) What market mechanisms (value) can be made available to small customers to encourage them to acquire larger capacity which would ensure that AEMO has volume available for the market.
- c) Understand the trade-off between having control of large volumes of small storage, verses introducing standards and default configuration modes for storage, which is both deterministic and meets evolving network needs.
- d) Leverage learnings: Learnings from demand management programs in Australia and the world demonstrate that a true value proposition needs to be made available to customers, confusion needs to be removed (remove market relationship complexities), installation and supply chain processes need to be aligned and integrated to achieve the highest number of participating customers in a market.

2.3 Is AEMO's high-level approach to the VPP Demonstrations appropriate? What other arrangements could be tested under the VPP Demonstrations framework?

Tukio is satisfied that the proposed arrangements will allow for the testing and associated learnings for most scenarios that might be associated with the operation of and interaction with VPPs.

Tukio is cognisant of the current industry consideration of market roles such as the SGA that will potentially cater for both FCAS participation and energy trading. However, we are confident that by participating with a FRMP and as a MASP we can cater for any scenarios required at this time.

We also believe the customer items covered in 2.2 should be considered as they may compliment this program.

4.1 AEMO would like the aggregated VPP dataset to be refreshed every five minutes to align with its operational forecasting function. Are VPP operators able to provide this data on a 5-minute refresh basis?

Tukio considers 5-minute data to be a minimum benchmark required to manage electrical assets particularly when FCAS participation is the intention. As this data will be collected then it can be provided to AEMO. Tukio acknowledges there may be ICT barriers to overcome in certain circumstances and geographic areas that may mean the cost of data provision in five-minute intervals outweighs the benefit. This can be judged on a case by case basis; however, it is important to strike the right balance between a 5-minute active control market and passive approaches to achieve the same outcome, as noted in 2.2.

4.2 Should the values be reported as an average value across the 5-minute interval or an instantaneous value at the end of the 5-minute interval, or both?

Information should be provided in accordance with AEMO's management of the market. More information might be useful for AEMO but could be costly. This can be judged on a case by case basis; however, it is important to strike the right balance



between a 5-minute active control market and passive approaches to achieve the same outcome, as noted in 2.2. Tukio believes that this may depend on the customer contract, customer asset capability, metering access and configuration and size of the customer.

It is important that we do not drive up metering costs by forcing early replacements or changing configurations as this adds considerable costs to the customer. This program needs to consider the items in 2.2 to maintain costs at an appropriate level and this needs to be included in the design and high-level financials. As outlined a balance need to be maintained to achieve the right outcome for access to 1000's of storage units and Tukio has appropriate tools and channel strategies to achieve the outcome.

4.3 What is the appropriate frequency for VPP operators to submit the device level dataset to AEMO? Is there a material difference in resources required to upload the data on a daily, weekly, or monthly basis?

This will depend on the granularity of data that is required to be submitted as VPP's and aggregators will each have different customer acquisition strategies, processes and channels to market, Tukio would propose that they are made available as new customer resources are contracted / connected to the aggregator / VPP. Data sharing processes need to maintain the privacy of the customer that is providing access to their resources and AEMO needs to ensure the customer and VPP owner are not put at risk, from the information potentially being shared with other VPP's or market participants or publicly in general.

Tukio has built its ecosystem to deliver high frequency decision making, logging and reporting that is fundamental to leverage the full capability of AI portfolio management capabilities to satisfy the base requirements of functions such as VPPs. As such, the frequency of sharing is largely dictated by the needs of AEMO for the management and interaction with VPPs and to test these needs, we would be willing to work with AEMO in addressing not only the frequency needs, but the level of granularity required to protect sensitive information.

4.4 Are there any regulatory or other obstacles to participants facilitating the data sharing arrangements contemplated in this section?

Tukio is not aware of any such obstacles provided the FRMP is involved. Data Privacy and Security implications will have to be considered carefully in order:

- to protect the consumers; and
- protect the agreements or contracts that customers have with their aggregator / VPP.

Regulation and Market Operation Considerations

The AEMO VPP Demonstrations Program will present a number of challenges to the current rules with regard to how small scale DER value can be accessed by multiple parties. It is expected that this project will help AEMO and other stakeholders to understand the challenges first hand and help provide clear evidence on how electricity markets can evolve to improve customer value, whilst supporting the NEM, DNSP functions and customers. An outcome of the proposed projects could be the development of key principles to guide future changes through learning and below are draft items that can be included in that framework:

Customer

- How to provide access of their DER to DNSP's and AEMO.
- How to optimally arbitrage capabilities when resources are not required by other parties.
- How to provide a simple process to give access and transact with 3rd parties.
- How to grow participation rates, whilst ensuring their investment in DER doesn't impact the direct needs
- How customers may be rewarded should their direct needs be impacted due to use by AEMO or DNSP's.
(e.g.: DER is not available for customer use at Peak ToU times, as the resource was depleted by AEMO for a peak event at 4pm.)

Procurement for access of DER / DR Resources

- DNSPs could utilise DERs through VPPs for network support which may/may not be part of a network tariff.
- DNSP used a risk adjusted value for access to DERs through VPPs
- Value calculations for DER need to be transparent and available for VPPs to function efficiently
- Locations where DER can be used and VPPs can be engaged also need to be available
- How a DNSP may use DER needs to be simple and effective

Co-optimisation between multiple markets

- Grid integrity is priority and is included in all DER/VPP decision frameworks
- Decision-making rules will be agreed on how DER/VPPs is utilised between the customer, DNSP and AEMO



- Orchestration of DER services is in a manner consistent with efficient outcomes and best value for the customer

Network tariff setting

- Provide compensation for network value delivered by DER
- Promote efficient investment in DER
- Customers are provided with tariffs which are simple, easy to understand and have the ability to respond
- Alignment of risks and rewards
- Understand that customers may respond differently to price signals and events
- Consider how diversity within large volumes of customer DER can still deliver firm outcomes

Access and Connection

- Connection agreements do not constrain a customer's ability to achieve maximum value
- Connection agreements with DER are integrated and support network planning
- DNSPs will select the most efficient solution irrespective of whether it is a network or non-network solution

Access to wholesale energy market

- Customer should be provided access to wholesale energy markets
- AEMO should not have to make significant investments to utilise small scale DER resources
- Sufficient DER scale needs to be achieved via third parties or aggregators/VPPs
- AEMO should be able to leverage aggregated volumes of DER in the same manner as a large generator through VPPs
- Information exchanged between markets is done so transparently, mitigating any conflicts