AEMO
Market Ancillary Service Specification (MASS, MASS DER) Consultation Submission

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Date: 11th March 2021

AEMO MASS Consultation, General Review:

Frequency Responsiveness of FCAS:

Planet Ark Power (PAP) assumes that based on the outcomes from the various VPP trials, particularly on the aggregated response of the ancillary service loads to deliver contingency FCAS during a frequency disturbance being relatively ineffective, this is the driver behind a change in the proposed specification.

PAP in Australia currently addresses the Commercial and Industrial sectors (C&I) where the Renewable Energy generation generally starts at 100kW up to 5MW. Therefore, our submission comes from this background.

As the PAP eleXsys technology stack addresses the issue regarding frequency at the point of connection to the grid, any potential issues from a power system point of view are addressed. Therefore, our product **already complies** with AEMO objectives.

Whilst initial measurement is essential to ensure participants and paid for response the larger issues that need to be solved for aggregated VPP within a DNSP are:

1. Voltage management, in particular voltage rise due to generation in the lower voltage levels on the network,
2. Voltage fluctuations from intermittent generation,
3. Network reliability,
4. Voltage balance between phases,
5. Harmonic mitigation,
6. Fault identification and location.

As outlined by AEMO in various VPP FCAS trials, a major concern / problem was that small generation sources connected to a Distribution Network, were unable to sustain the energy level for a long period of time, as the voltage caused instability issues.

For this reason, we believe it is essential that a secondary measurement period be included to ensure that a secondary frequency event is not caused by small scale generation backing off or being curtailed in some form. See link below:

https://arena.gov.au/assets/2017/02/virtual-power-plants-in-south-australia-stage-2-public-report.pdf

The eleXsys is an advanced four quadrant, three phase, 4 wire device, and has the following features relevant to responding to **FCAS**:

- The eleXsys is a four-wire device with the neutral being modulated to simulate 3 independent phase outputs. Each phase output can have different voltages and currents up to the rating of the phase.
- It can be configured as a 3 phase 4 wire or single phase 2 wire. 2 phases can be paralleled to produce a single phase and neutral inverter.
- Full 4 quadrants - capable of sourcing/sinking VARs and import/exporting kW to **full** rating.
- Four wire three phase with individual phase current balancing. By modulating the neutral, power can be shifted between phases to balance phase voltages and act like a power conditioner.
- Variable frequency or fixed 50Hz - 60Hz. The eleXsys frequency can be fixed at 50Hz or 60Hz to suit existing networks.
- Power conditioning compensation for grid sag/swell and voltage fluctuations. The eleXsys can be used as a power conditioner to improve the quality of supply. It can regulate the phase voltages to a particular voltage and bandwidth. Sags and swells will be corrected by first sourcing or sinking VARs to correct voltage excursions and if a battery is present will correct the voltage by generating or consuming real power, and increasing DER Hosting Capacity.
- Power factor correction. The eleXsys can be configured to be a fixed leading or lagging power factor correction device or a variable leading or lagging VAR generator with droop curve if required.
- Programmable harmonic sink. The eleXsys can be programmed to sink harmonic frequencies up to 25kHz.
- Power flow regulation. The eleXsys can be programmed to limit import or export to specified levels.
- Directional sequence protection. Being a true four wire device, the eleXsys can calculate the positive, negative and zero sequence voltages and current which can be used to detect line to line and line to ground faults and isolate from the network.

AEMO MASS Consultation, DER Review:

DER:
Increasing DER generation can cause a range of issues on existing distribution networks, especially as you move further away from transformer locations, where most residential and small commercial customers are connected. Our technology stack can solve these issues.

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AEMO has addressed this via various means, including DER Registration, and the current Market Ancillary Service Specification (MASS) amongst other enabling specifications and processes.

As outlined by AEMO in various VPP FCAS trials, a major concern / problem was that small generation sources connected to a Distribution Network, were unable to sustain the energy level for a long period of time, as the voltage caused instability issues.

For this reason we believe it is essential that a secondary measurement period be included to ensure that a secondary frequency event is not caused by small scale generation backing off, or being curtailed in some form.

1. Ongoing measurement arrangements:

The current specification regarding measurement may not be adequate when considering network security @1 second.

Planet Ark Power **would** support option two (under the MASS DER consultation process) at either 100 milliseconds or 50 milliseconds, to provide the system operator with required transparency around FCAS contingency events.

PAP already has a project in South Australia located in the Adelaide Airport precinct with project approval by SAPN and AEMO currently under execution.

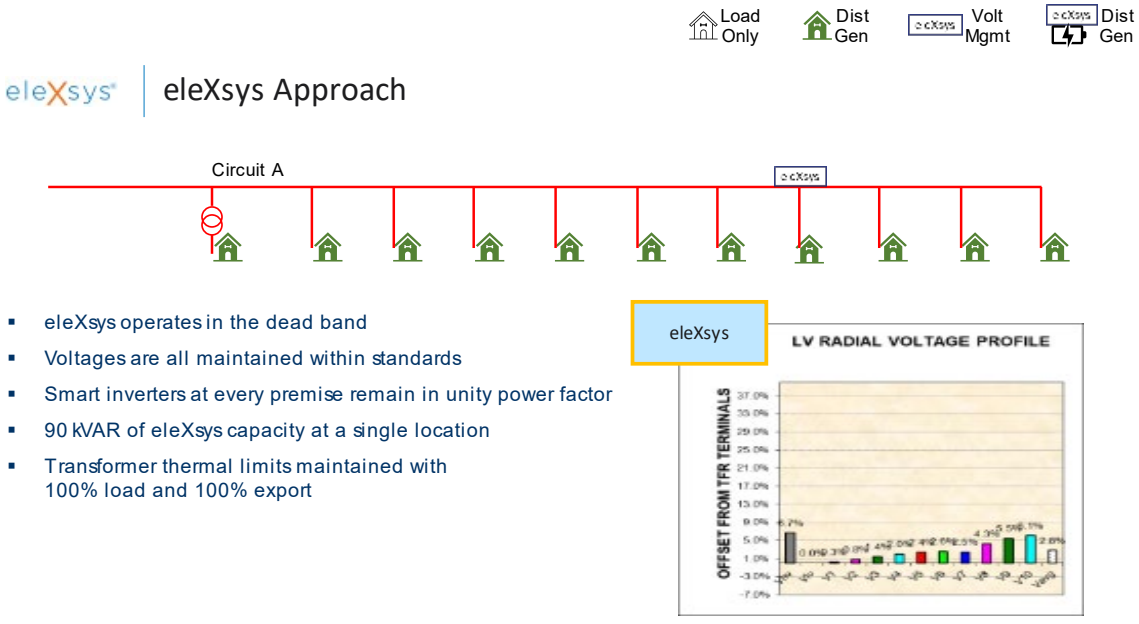
As part of this project scope, eleXsys will provide SAPN and AEMO with a NMI sampling at 100 milliseconds consistent with the AEMO requirements.
Whilst our customer is a super fund who owns the solution and the assets, for offtake of PV Solar is Ikea for self-consumption and Epic Energy for excess power.

2. Implementation Cost:

PAP in Australia currently addresses the Commercial and Industrial sectors (C&I) where the Renewable Energy generation generally starts at 100kW up to 5MW. Therefore, our submission comes from this background.

In the C&I space, where the generation starts at 100kW, the cost to implement meters is negligible. These meters will obvious cost more, but as a percentage of the solution cost, it is manageable.

Coming from a residential perspective, the relatively cost to comply can be quite high.
However, by combining residential loads in a VPP and using eleXsys as part of the solution at an appropriate place on the feeder circuit, it is also manageable.
See high level graphic below:



eleXsys
Enabling Smart Grids

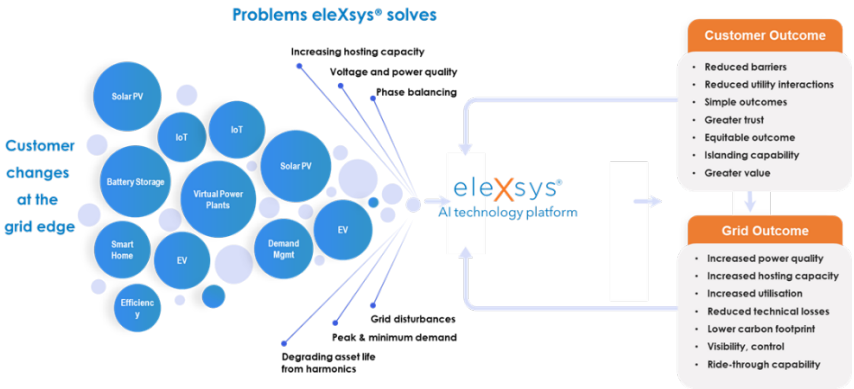
About Planet Ark Power:

Planet Ark Power (PAP) has a technology 'stack' called eleXsys, that enables two-way flow of power to and from the grid and battery storage optimisation, without the need for curtailment by the DSNP and within the statutory limits set by AER, AEMO and the DSNP.

This technology is in essence a dSTATCOM, power conditioner, IVVC and battery PCS optimizer that can handle Reactive Power / VAR creation / absorption and that can enable Smart Inverters to operate at Unity Power Factor. eleXsys creates required VARs before any Smart Inverter reaches set trigger points.

eleXsys® Technology Overview:

The eleXsys is an advanced AI driven dSTATCOM technology, that was designed to solve power quality problems in the low voltage network, overcome peak and minimum demand issues and enable significantly more volumes of distributed generation (solar / wind / biogas) onto distribution networks and maximise real energy for the NEM. These are summarised below.



Whilst utilities today are concerned about solar PV, it is only the start of many disruptions coming from the edge such as IoT, smart homes, VPPs, stationary storage and electric vehicles. This means that networks need new tools available to them to manage these impacts, protect their assets, and grow the utilisation of their networks.

The eleXsys enables networks to provide an agnostic edge interface as there is no need to introduce new tariffs or control interfaces to customer inverters, which removes considerable cost for utilities and indirectly end customers.

The eleXsys radically improves the effectiveness and economic return of solar and battery storage investments and unlocks the full potential of electricity grids. eleXsys links the technical and commercial elements of any clean energy project through 24/7 system performance monitoring, the three core components are:

dSTATCOM

- Combines battery charger, voltage control and power factor correction into a single, compact package,
- eleXsys is modular and can be scaled up to accommodate large scale solar installations,
- Battery (Optional)

- Lithium Ion able to store the excess power generated by the solar panel system making is suitable for FCAS,

- Modular and scalable and therefore can be commissioned to any sized installation,
- Enclosed in outdoor IP rated enclosures and temperature controlled to extend the life of the storage,

AI Platform

- Sophisticated software controls that use AI to monitor and predict energy generation and consumption,
- Delivering voltage management to keep voltage always within statutory limits.