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Thursday, 11 October 2012

Australian Energy Market Commission
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To the Administrator,

RE: ZEN Energy Systems Submission to AEMO

Power of choice - giving consumers options in the way they use electricity
Reference: EPR0022 Draft Report

1. Background:

We are an Adelaide based renewable energy company that has worked hard to educate home and business owners on the value of solar and energy storage. We believe the future of renewable energy will be predicated on a range of intelligent systems that can provide both user and utility control of energy flows. As an example a very simple wireless Bluetooth monitor we provided with our solar systems helped consumers understand how their solar system interacted with their home, when it was generating, what their level of consumption is etc. The ability to provide instantaneous 'dynamic' information that was readily available on the kitchen table provided a strong and tangible method of education.

We understand that there are significant opportunities to leverage the concept of generating and storing energy at the same point as consumption and the purpose of our Submission to AEMO is to bring these matters to your attention.

Together with Greensmith Systems in the USA, ZEN is the Australian developer of a portable distributed energy storage technology which has been deployed at scale in the US and is now ready for deployment into the Australian market.

These include the Freedom PowerBank unit and the Grid Support PowerBank (see attached datasheets).

The Freedom PowerBank unit is designed for the home, to store solar power generated on the roof and enable the user to use this on demand. The technology is based on an 'Energy Automation Centre' concept where interactive devices communicate with the energy storage device to achieve higher rates of energy efficiency in the home and reduce demand on the network (note device interaction architecture below).

<u>Figure 1: Interaction of 'smart devices' (DRED's) with the energy storage unit.</u>

Some of the features of the system include:

- Parameters defined by customer before purchase
- Based on location of customer and existing tariff regime
- System determines whether to source from grid or PV
- System finds the cheapest source of power based on that time of day
- Uses range of intelligent algorithms that learn over time and can make decisions dynamically or based on manual input.

2. Summary of Key Recommendations from Draft.

We indicate our level of support or otherwise to each of the recommendations.

A. Rewarding DSP in the wholesale market: SUPPORTED

If consumers or an aggregator is able to trade electricity on the wholesale market, this enables owners of energy storage devices to provide important benefits including:

- Enable discharge of their electricity to the grid at peak times.
- Enable discharge to service the load of the immediate home at peak times.

Either one of these benefits would reduce the demand on the network at that given point and reduce the load on the local zone transformer that may be reaching its thermal limit (an outcome of which may be grid destabilisation and blackout or an acceleration of the aging of the asset).

<u>As an example:</u>

John and Trudy arrive home from their 9-5 office job at 5.30pm. The couple owns a small townhouse in Blakeview, a new property development in Adelaide. It is January 21 and the temperature at 5.30pm is recorded at 30 degrees. The couple invested in a 6kW solar system which has generated 24kWh of electricity during the day and this energy is now stored in their 20kWh PowerBank system. 4kWh was used during the day by their refrigerator and the balance was used to replenish the energy storage that was reduced from the previous night.

As the couple arrive home Judy turns on the lights, central reverse cycle airconditioner, the television and John turns on the stereo and hops onto the treadmill for some exercise. Judy then turns on the oven, uses the microwave and turns on the exhaust fan in the bathroom in readiness for a shower.

At 6.30pm the National Electricity Market is trading at a wholesale price of $40 a MWh and the network is under significant stress. The PowerBank has been programmed to discharge electricity at any rate above the peak tariff price that John & Trudy would ordinarily pay for electricity at that time of the day which is the wholesale price of $25 a MWh. The PowerBank algorithm identifies a price arbitrage event is occurring and runs an internal program to determine if sufficient charge exists to carry the household for the next 1.5 hours of energy consumption. If it identifies that sufficient charge exists then it will dispatch (export) this energy to the grid and timestamp this event and the corresponding market value of the electricity in its database.

An Aggregator may use this functionality to perform the same function but do so based on an agreed contract.

<u>As an example:</u>

John and Trudy may have purchased the PowerBank from Aggregator X. The couple bought the 20kWh system knowing that between March 1 and November 30 of each year, they are able to access 100% of the stored electricity. However from December 1 to February 28 the Aggregator has identified that there may be peak electricity wholesale pricing events above $25 a MWh. As such the Aggregator has asked that the couple release 50% of the available capacity of the system to be controlled by the Aggregator. In essence the couple signs over at least 10kWh a day for the Aggregator to use at its own discretion.

On the 21st of January when the wholesale price peaks at $40 a MWh, the Aggregator will (under the terms of its contract) seek to recover the 10kWh and sell this into the spot market at market value. The PowerBank will have been pre-programmed to deliver the electricity to the market and this may even be the home itself. However the Aggregator will be reimbursed for this event at the market value. The benefit of this arrangement is that it reduces the complexity of having multiple consumers accessing the spot market and instead can have licensed Aggregators acting in this capacity. It also enables the Aggregator to negotiate with a DNSP which may seek to reduce load on its network in a particular location.

In this situation the DNSP may have identified that postcodes between 5100 and 5105 are located close to a constrained feeder or 12MVA zone substation transformer needing upgrade. The rate of growth of new homes has placed this strain on the network and there are capacity concerns on existing assets if the temperature hits 30 degrees on a summer's day and the load rises by more than 50%. The value of upgrading the transformer is $1 million. The DNSP may consider deferring their investment for 1 year if retail customers equipped with energy storage can contribute electricity back to the grid or at least look after their own load in which case they do not contribute to the problem. In this case this $1 million could be used to pay for each MWh that is 'self supported' by the community at large.

The basic driver behind this concept is that feed in tariffs are an artificial market. If John and Trudy head to Hawaii on holiday in July and there are no feed in tariffs their solar system will continue to export for nil benefit. If an Aggregator was involved the couple could call the Aggregator (or send an email) confirming they will be absent and that 100% of the electricity will be available. They do this hoping to achieve a credit on their bill. The Aggregator agrees however the wholesale price may only be $20 a MWh and as such the Aggregator remunerates the couple for $10 a MWh. If the DNSP is able to derive benefit and the Aggregator is able to quantify this it may remunerate John and Trudy $15 a MWh.

B. Gradually phasing in time varying network tariffs:
Focusing only on introducing time varying prices for the network tariff component of consumer bills. Retailers would be free to decide how to include the relevant network tariff into their retail offers.
SUPPORTED

Segmenting residential and small business consumers into three different consumption bands and applying time varying network tariffs in different ways. Large residential and small business consumers would be required to have a time varying network tariff as part of their retail price.
SUPPORTED

We would also consider that higher retail charges coinciding with traditionally higher peak loads i.e. 4pm – 8pm is supported.

C. Protecting vulnerable consumers: SUPPORTED
We believe that energy storage will enable vulnerable customers to access 'retail' electricity at a discount rate.

<u>As an example:</u>

Judy and Tom are retirees. She uses approximately 10kWh a day and is at home most of the day and night. The bulk of their cooking and cleaning occurs during peak hours and it is unlikely this will change in the short term. Energy storage would enable them to reduce their cost by over 50% by giving them access to energy sourced from the grid during off-peak times and then discharge this energy during traditional peak times. It also removes the couple from being a 'contributor' to peak loads during summer.

D. Separating DSP actions from the sale and supply of electricity: SUPPORTED

We believe that a market exists for Small Generation Aggregators to acquire assets for the generation and storage of renewable energy (solar and wind) at a small scale. These Aggregators may own assets such as battery systems and solar panels and offer them to residential home owners or small businesses and act as a retailer by charging the customer less than or equal to the existing retail standing contract rates. We believe that several larger Aggregators operating in the market is a more manageable set of participants than having the average household consumer sell in directly to the wholesale market. We also support participants who have the financial security and integrity to enter into long term commercial supply contracts and absorb risk.

Alternatively consumers can purchase these assets and sell surplus electricity to the Aggregator at arm's length. An example is available in the John and Trudy case study above.

E. Enhancing consumers' ability to access consumption information: SUPPORTED

F. Enabling technology: SUPPORTED

We support commercial investment in products where the metering may operate independently of, or be an approved component integrated into DSP products.

G. Distribution network incentives: SUPPORTED

We believe that numerous utilities are attempting to find ways of moving away from traditional investment in poles and wires. Especially when the capital cost of this investment in additional capacity only services .0004% of the total hours of peak demand in a given year. Following is a schematic of what we believe to be a more viable business model.

Figure 2 below demonstrates the concept where at 2am there is spare capacity in a standard 22kV feeder servicing a suburb. However at 7pm this spare capacity is replaced with full capacity which is often extended beyond its boilerplate capacity (shortening the life of the asset being used). There is a chance that undersupply could occur if the grid is destabilised by the load i.e. 7pm on the 21st January and a hot summer's night.

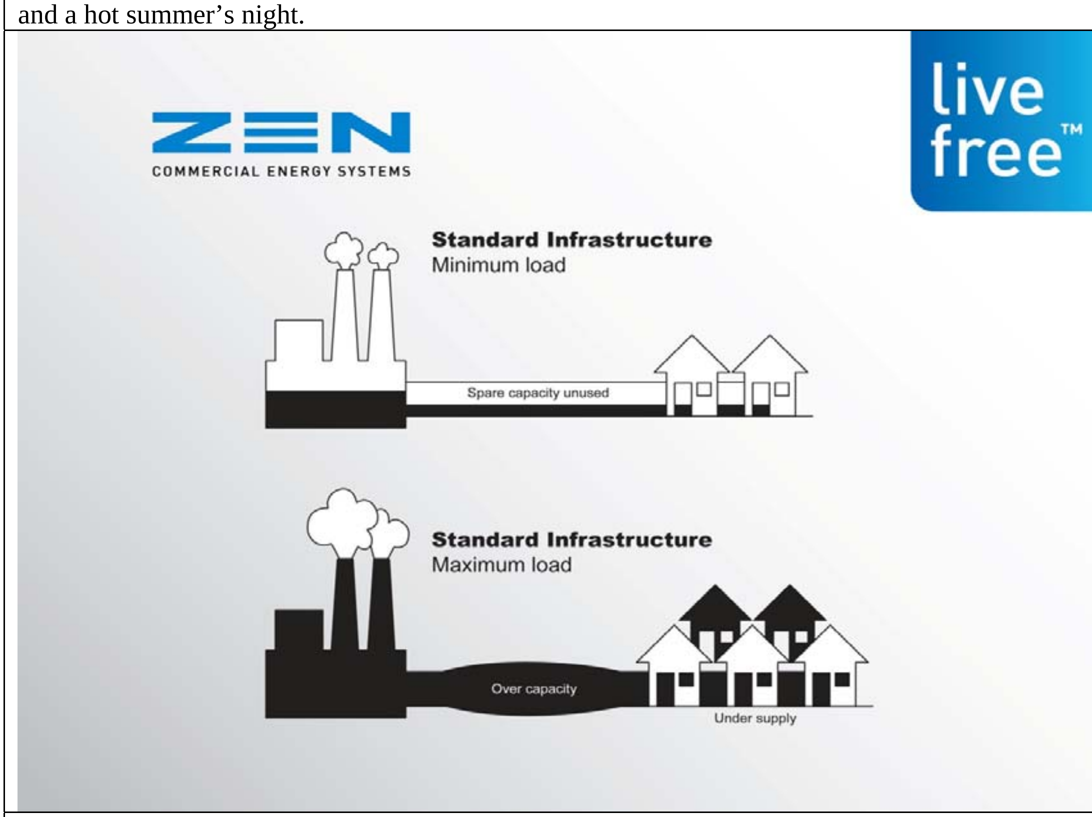
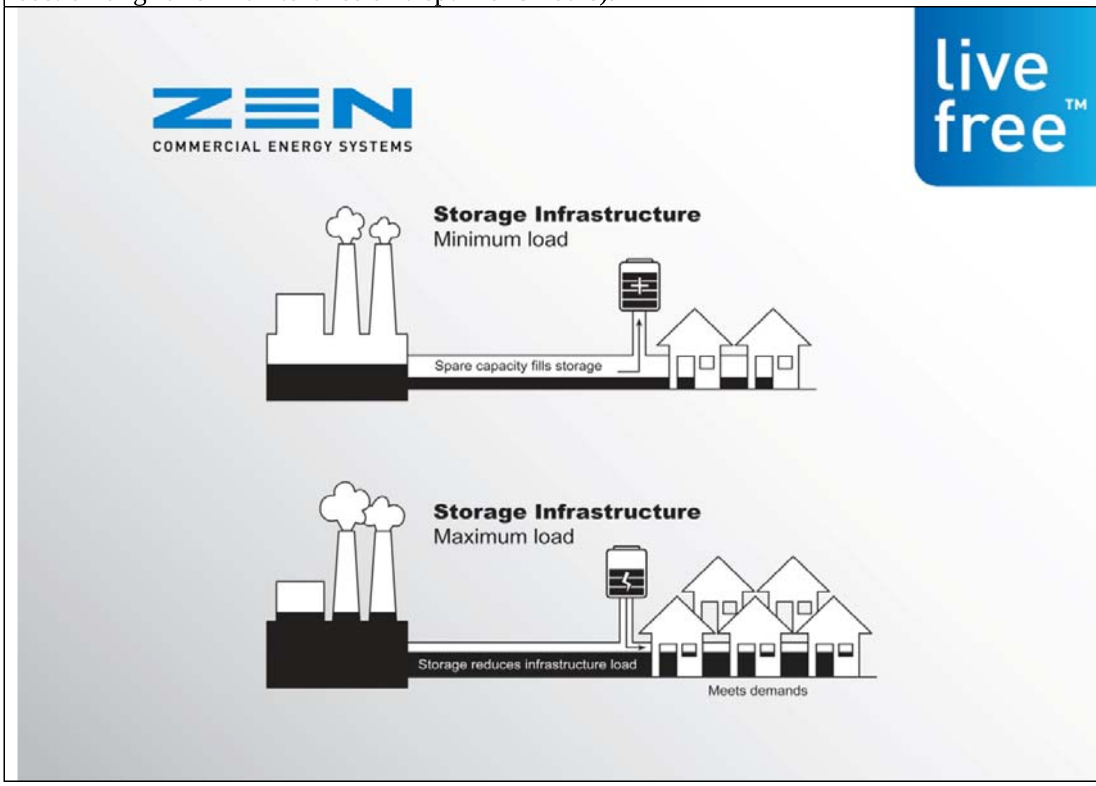


Figure 3 below then introduces the concept of energy storage. The device is charged at 2am when the spare capacity is available and these devices could be located at a zone substation or out on an easement in a community that is expected to have high demand. At 7pm on the 21st of January this energy is then released from the energy storage device as the load and demand comes on from customers. The existing transmission assets do not then need to work as hard and thermal limits can be protected as the energy is being provided by the energy storage device. Investment is therefore able to be made in energy storage devices which can service the load on the 21st of January in that given location and then put on the back of a truck and moved to another function on the 22nd of January (such as supporting the power for a suburb/rural town where the line team will need to turn off a section of grid for maintenance on a spur for 3 hours).



H. Establishing formal consultation when setting network tariffs: SUPPORTED

We believe that if DNSP's and retailers were aware that commercial opportunities existed for greater energy generation and storage at the point of consumption for a business or home, there would be greater engagement with both vendors and consumers.

We also believe these consultations should press for an outcome with the lowest overall emissions for the delivery of electricity over 25 years, not just a 'Reasonableness Test' that considers $ per kVA.

We also believe this test should be paired with a range of agreed assumptions such as the forecast cost of electricity on a year upon year basis i.e. conservative at 2.5% or aggressive at 10%.

I. Energy efficiency measures and polices: SUPPORTED

We believe consumers should be rewarded for either making investments in renewable energy, metering assets or energy storage. We also believe that the grid will always be required as a backup to any renewable energy and that network operators (DNSP's) should be rewarded for maintaining this asset.

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There are a range of business models we would enjoy the opportunity to further discuss with AEMO. We believe there is a novel new set of risk and reward mechanisms and participant categories that could be introduced to the Australian electricity regulatory framework with the introduction of affordable energy storage to the market.

Sincerely,

Marcus Keller
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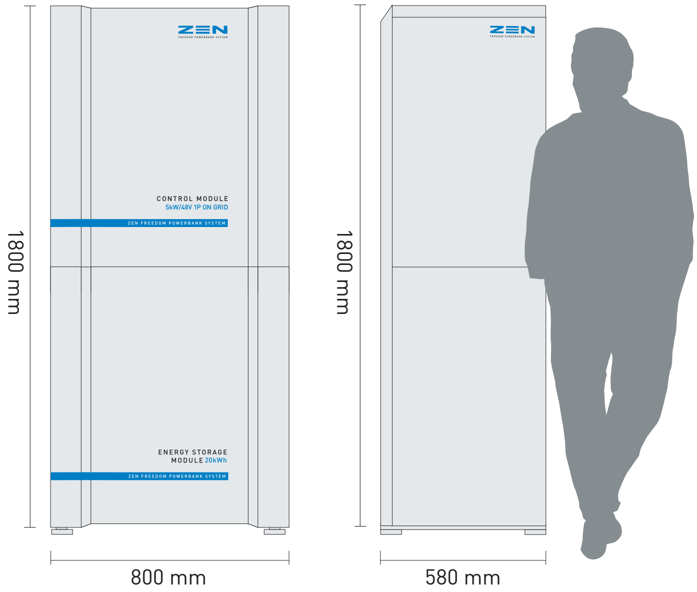
live free™

ZEN Freedom PowerBank Systems

ZEN ENERGY SYSTEMS

FREEDOM POWERBANK BATTERY ENCLOSURE



FRONT VIEW SIDE VIEW

COMPONENTS

- Grid connect battery backup Control Module
- Maintenance free batteries
- Battery enclosure
- Battery fuse
- AC panel

* 0% - 100% State of Charge (SOC).

** Offset: Indicates that 100% of load is supported by battery unit.

COMPONENT DETAILS

Phase type	Single Phase
Power	5.0 kW
Energy*	20 kWh
Voltage	230/48 volt
Inverter	Australian made AS4777 approved
Battery type	Lithium Iron Phosphate
Battery C rating	0.5C
Battery warranty	3 years
Control System warranty	5 years
Control Module	CM-5/48F
Control Module dimensions	900H x 800W x 580D mm
Energy Storage Module dimensions	900H x 800W x 580D mm
Max continuous backup power	5.0 kW
Offset backup time with 500 watt load**	36 hrs
Offset backup time with 1kW load**	18 hrs
Offset backup time with 5kW load**	3.6 hrs
Solar options (Max AC coupled)	5.0 kW
Solar options (Max DC coupled)	4.0 kW

GRID SUPPORT POWERBANK GS100

300kWh Distributed Energy Storage Unit

ZEN Grid Support PowerBank GS100
60kVA / 100kWh

ZEN Grid Support PowerBank GS400
200kVA / 400kWh

ZEN Grid Support PowerBank GS1200
1000kVA / 1200kWh

POWER		
AC voltage options	240V, 415V	
Maximum continuous power options*	Charge or discharge to full inverter rating	
Maximum reactive power options	Full inverter rating can be used in capacitive or inductive quadrants	
Maximum power ramp time	←5 seconds	Ramp rate adjustable
Number of phases	Single or three phase	
Power factor	→ 0.99 (if required)	
Normal grid frequency	50Hz	

*Single Phase: Multiples of 20kVA
Three Phase: Multiples of 50, 100, 200 and 500kVA

Standard Greensmith Battery Operating System III

Uniform battery operating environment, communication and control protocols across all ZEN units.

Advanced 'Active Balancing' BMS

Real-time battery cell measurement and report: voltage, current, temperature, cell capacity, SOC and SOH.

Active balancing that keeps all cells balanced at all times.

Cell protections against under / over voltage, temperature and over current.

In-field configurations: DOD, voltage protection ranges, power ramp rates and charge rates.

Dynamic, real-time power control. Switch between charge and discharge in less than one second (excluding comms delays).

Ethernet, serial and web-based communication and control.

System-to-system integration across multiple units to form larger, virtual unit.

Support drop-in custom modules.

Smart Grid ready.

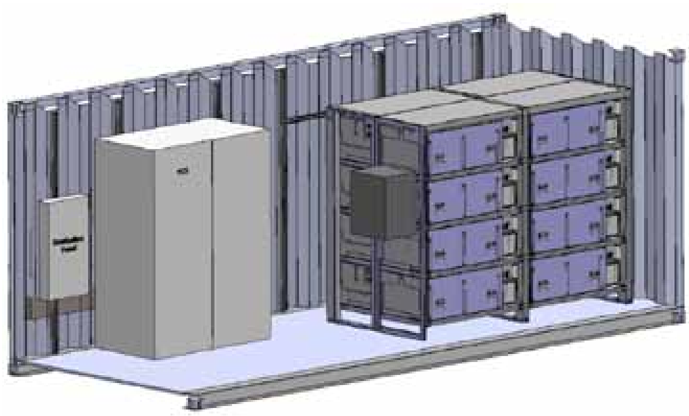
ZEN POWER SYSTEMS

ENERGY		
Energy storage capacity	100, 400, 800, 1200 kWh	
Round trip efficiency	→ 85%	At rated power
House keeping power	← 100 W	At idle
Standby energy loss rate	← 35% per year	Grid is available

ENERGY		
Type	Lithium iron phosphate	
Capacity	400 Ah @ 3.2V nominal cell voltage	
Cycle life	→ 3,000	80% DOD
	→ 5,000	70% DOD

THERMAL MANAGEMENT	
Operating temperature	-20 to +50°C
System idle temperature	-30 to +70°C
Cooling	Forced air (internal to container) and heat exchange or refrigeration assist depending on application
Cooling power	Customised to intended application to minimise parasitic losses
Fire suppression system	Optional on request (clean agent discharge, very early detection, remote alerts and trips)

COMMUNICATION & CONTROL	
Connection types	Ethernet, 3G Wireless Broadband, RS232, RS485
Protocols	TCP, UDP, Modbus, HTTP, Web Services
Data formats	Binary encoded values, XML
Network security	SSL with X509 certificate optional
System response time	← 1 second (excluding comms delays)



Maintenance and Reliability

Standard 16 cell / 20kWh tray modules for easy replacement and storage maintenance to maximise shelf life.

Protection at cell, tray and system levels.

Redundant communication and control paths.

Remote, non - interruptive firmware update.

DESS Portal Integration

The Grid Support PowerBank GS100 and GS400 are a joint development with ZEN sister company, Greensmith Energy Management Systems in the USA.

Web browser-based graphical interface for operation, real-time monitoring and reporting. System-to-system integration for unit control and utility integration.

Central database archives all historical data for analysis.

Supported Solutions

- Peak Shaving
- Renewable Integration
- Load Following
- Backup Power
- Voltage & Frequency Regulation
- Reactive Support around a set target voltage
- PV smoothing / ramp rate control
- Offset diesel generation for remote stand-alone microgrids.

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ZEN POWER SYSTEMS

Clean Energy Council MEMBER

BSI Quality ISO 9001 Certified System