# Power Ledger's Response: Open Energy Networks Consultation

## In Brief

This submission is intended to present Power Ledger's perspective on the Energy Networks Australia (ENA) and the Australian Energy Market Operator (AEMO) Open Energy Networks consultation on how best to transition to a two way grid, in a way which will benefit all customers.

This consultation comes at a time when over a quarter of Australian already households have rooftop solar. Energy systems in Australia are not designed to cope with the increasing deployment of distributed energy resources (DER) or the load dynamics imposed by the high penetration of DER and the increasing uptake of electric vehicles. Power Ledger fundamentally agrees that distributed energy resources (DER) need to be more effectively optimised at the distribution network level, in order to provide the most value for all customers, as well as for networks and utilities. We welcome the opportunity to contribute to the consultation, and look forward to participating in the discussion and trials throughout the next phases of the process.

## About Power Ledger

Power Ledger is a Western Australian company, formed in May 2016, that uses blockchain technology to provide an alternate model for the reconciliation and settlement of energy transactions. Our platform allows consumers with embedded renewable energy generating technology to sell excess energy to their neighbours. Our ecosystem of applications also extends to offer Virtual Power Plant (VPP) and distributed market optimisation mechanisms, aimed at empowering consumers and encouraging access to more reliable, renewable energy. The technology and business model were devised to support the transition of mature energy systems into dynamic, consumer-centric and renewable distributed energy markets.

## The Solution - "Managing the transition"

The consultation is seeking a model to manage the transition away from traditional, centralised generation, in a way which improves the reliability and security of Australia's energy system at lowest cost to consumers. It is Power Ledger's view that by managing the energy transition in a distributed way, optimisation of DER distributed market is not only possible, but can begin now, using existing and proven technologies.

The biggest mistake we could make in approaching this transition period, is to develop long-term frameworks that conform to the same centralised, traditional approaches of the past. The solution to optimise DER will not happen overnight, and the most important thing will be to adopt a staged approach, with immediate steps taken to embrace innovation, address structural issues and provide clear incentives for consumers to stay connected to the grid and participate in distributed markets.

We support and acknowledge the importance of deciding on a model for a Distribution System Operator (DSO), to allow AEMO to maintain a secure, reliable and low-cost network for consumers. However, we strongly believe any future model should avoid being too prescriptive, and should take into account the continued rate of technological innovation and the rapidly declining cost of DER.

# Response to the consultation questions

## Section 2. Pathways for DER to provide value

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

We agree that each of the use cases have a role to play within the distributed marketplace of the future. While the sources of value listed are fairly comprehensive, what they fail to highlight are the price signals and settlement processes that will be necessary to incentivise DER owners to participate in distribution level markets in the first place.

#### *Value Case for Blockchain*

The paper refers to blockchain as an option to help manage “bilateral agreements out of the market” and cites examples which include providing services to AEMO, network support and for peer-to-peer trading. In our view of a truly distributed market, agreements won’t just be bilateral, there will be multilateral agreements of a temporal nature, sometimes occurring simultaneously. For example, a residence with both solar PV and a battery could be trading their excess solar to their neighbour through a trading platform, whilst providing power quality management services to the network through an aggregator.

Blockchain can help manage this multiplicity of agreements, whether it be trading renewable energy, or providing voltage support for the network. Current settlement and payment systems used by AEMO are characterised by a latency that will likely act to discourage DER owners from participating in a Virtual Power Plant (VPP) or one of these emerging markets. To participate in the NEM and WEM, and in these multiple, usually temporary trading relationships, DER owners will need clear financial incentives, and a frictionless settlement process. Blockchain is the only technology we have found that is capable of facilitating such a complex transactive environment, in close to real-time.

Within a VPP scenario, the Power Ledger platform can act as the transactive layer between the various functions of the VPP, providing for settlement between generators, distribution network operators, retailers, the wholesale market (if required) and consumers. These multi-party agreements will normally cease to persist after a service is provided, or a trade is completed. Smart Contracts allow for the trustless, instantaneous settlement of these agreements. Participation in the wholesale and FCAS markets, or agreements outside of the NEM, can be therefore be facilitated using the same transactive platform for instantaneous, autonomous financial settlement, creating the most most value for all participants and maximising utilisation of network assets.

The value case for blockchain, and for the Power Ledger platform, is that they can be utilised to help manage the transition towards emerging distributed markets, in a relatively seamless way.

### *Blockchain and Visibility*

The Power Ledger platform functions through the provision of data from advanced metering infrastructure (AMI). If implemented correctly, the platform could contribute to the visibility of behind-the-meter DER installations. Using close-to-real-time data from smart meters, each transaction that occurs between the layers of services in a distributed market, can be immutably recorded on the blockchain, and the information relayed to AEMO or the DSO for system planning purposes.

### *Commercial and Industrial Customers*

The paper fails to highlight the clear value that could result from opening up distributed markets to commercial and industrial customers (C&I). Feed-in-tariff arrangements typically exclude C&I customers, and this has acted as a huge disincentive for investment in rooftop solar. Providing price signals for these types of customers could lead to significant uptake in DER, which could provide a range of benefits to the network.

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

While most of Power Ledger's more detailed modelling into these value streams remains commercially sensitive, we can provide a general value stack for our vision of an optimised distributed market.

Most models for a VPP will have the ability to aggregate distributed capacity and respond quickly to demand response signals to help manage peak demand and peak production. It is our view, that an optimised model for a VPP could integrate a range of additional services, providing further financial incentives for prosumers to participate. The dispatchable capacity function of a VPP could be therefore be considered just one feature within a broader approach of distributed market optimisation.

These dynamic additional services are highlighted in the paper, but can include:

- Resilience through self-healing networks managing faults
- Network control services
- Frequency control services
- Power quality management
- Capacity management (load shaping)
- Peer-to-Peer trading

To be able to access the value stack of an optimised VPP, there needs to be a platform which reflects the intermittent nature of the trading relationships involved. Power Ledger's model for "VPP2.0" creates a conduit for the transaction of value between the owners of distributed energy resources and multiple counterparties. Self-executing Smart Contracts integrate with system controls creating an autonomous, power market with secure value transfer between consumers, networks and energy markets. Blockchain is the technology which essentially pins the financial transaction to the physical transaction of energy, and ensures all participants are paid for the services they provide.

**Figure 2.1: Value stack for distributed market optimisation**

| | | |
|---|---|---|
| Prosumer | Fault Management (Self-healing Networks) | Network |
| | Network Control Services | Network |
| | Frequency Control Services | Market |
| | Power Quality Management | Network |
| | Capacity Management (Load Shaping) | Network / Market / Retailer |
| | Peer to peer Trading | Consumer |

# Section 3. Maximising passive DER potential

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

The increasingly high penetration of DER in Australia should not be viewed as a constraint, but as an opportunity. Any attempt to manage the challenges listed by imposing blanket limits on grid exports, or restricting applications for the installation of rooftop solar at certain locations should be resolutely discouraged by regulators and industry participants. We agree that unless the large number of passive DER in the NEM and WEM can be effectively be aggregated and coordinated, there will be resulting local network and security of supply challenges. However, dynamic strategies can be easily deployed using existing technologies, and without the need for significant network augmentation. Those who see the optimisation of DER as too difficult, are underestimating the capacity of energy systems and markets to innovate.

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

We agree with the suite of solutions listed by the paper as available to address some of the challenges of ‘passive DER’ and release their potential value. Implementing dynamic control would require new capabilities including network modelling and monitoring, advanced planning and operations, and the transition to ‘active DER.’

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

In Power Ledger's view, these capabilities and actions will not necessarily require material investment by the networks themselves. If appropriate regulatory changes do occur, and the market is gradually opened up to aggregators and technology providers, these third parties could help unlock these value streams for DER owners and the network. The increased value released from customers' DER has the potential to far outweigh any additional costs to stakeholders. In effect, passive DER will become active DER in response to clear market signals.

## Section 4. Maximising active DER potential

### 4.1 Are these the key challenges presented by active DER?

Power Ledger agrees that most of the key challenges listed would be a likely result if the potential of active DER is not realised. However, in our view, an escalating number of VPPs will not necessarily cause any serious security of supply issues, provided the transition towards distribution level optimisation is managed in a distributed way.

#### *Managing the impact of VPPs*

The impact of VPPs on security of supply will largely depend on the number and scale of the VPPs themselves. In an optimised distribution system, most of the VPPs will be formed from the aggregate nameplate capacity of a number of customer-owned DER. The Salisbury battery trial is a good indication of the challenges VPPs may cause if we were to treat them as large-scale power stations, located in a specific part of the network. If this were the case for all VPPs, we would not be managing a transition from a centralised system to a distributed system, but a transition from a centralised system to a slightly different centralised system based on renewable generation.

Currently, there are a large number of passive DER in the system which causes issue because they aren't visible to the system, and they have a fairly unpredictable output. We have an opportunity to transition these DER to become active within much smaller VPP scenarios, where their impact on the network is diminished. This presents an opportunity for the discrete management of more localised communities and networks. It is unlikely that a large number of 25 MW VPPs would be located close enough together to make it difficult to manage security of supply for the network.

In the future, it will be important to move away from large-scale government funded VPPs, like those in South Australia. Whilst these trials are valuable for indicative purposes, they do not provide an accurate depiction of the way customer-owned DER could be integrated into the power system. These types of DER will likely be more distributed and variable, and provide an opportunity to operate the wider system at a granular level. In the long-term, when the number of VPPs in the system does become significant, operating them as scheduled generation may provide the most value for the market. Until then, and as the technology continues to rapidly develop, the most effective course of action will be to trial and monitor the impact of different VPP models on different areas of the network.

Additionally, if you consider another aspect of security of supply as ensuring prosumers to stay connected to network, then VPPs can provide clear the type of clear financial incentives to help achieve this.

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

We agree that resolution of the key challenges listed will be essential to help unlock the additional value that active DER can provide for all types of customers. One additional point we will emphasise once again, is the fundamental need to manage distributed capacity in a distributed manner. There is an opportunity to manage this transition in a way which slowly breaks down a big, centralised energy system into its constituents parts.

## 4.3 What other action might need to be taken to maximise active DER potential?

We need to be agile, and plan for the transition of the system not for the outcome. Dynamic strategies can be deployed which manage demand and production in certain areas, ensuring the optimisation of power availability at any point in time.

### *Embracing New Technology*

To maximise the value of active DER, new technology offerings can be deployed alongside our transactive settlement layer to deliver the physical components of the range of network services within an optimised distributed market. Power Ledger has working relationships with world leaders in comprehensive energy control systems. These types of systems are already capable of remotely managing energy storage and responding to changing signals within the various layers of a virtual power plant, and will only continue to become cheaper and more widely available.

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

Under current market and regulatory structures we are increasingly facing a scenario of grid defection. To avoid this customers need to be provided with strong social and economic incentives, to motivate them to stay connected throughout the transition. We need to manage the transition in a way which addresses the structural issues causing grid defection, to avoid extra cost being placed on those who can least afford it.

Some additional key challenges in managing the new and emerging markets for DER will include:

- Integrating new technologies
- Providing the right market opportunities
- Consumer acceptance; and
- Achieving significant regulatory change.

**However, in our perspective the single biggest challenge will be to achieve the changes necessary to keep prosumers connected to the grid.**

These challenges may be resolved by developing structural incentives to monetise DER, and by encouraging or rewarding networks to provide the types of services which will shape consumer behaviour. Utilising a financial settlement system like Power Ledger's may help provide these incentives, and assist in the efficient allocation of capacity.

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

It is hard to predict at exactly what point the coordination of these markets will be required. The distributed energy transition will occur gradually over time, and the following three market levels will need to be coordinated to interface with the market:

1) At the local level P2P trading market which will act as the steady-state environment.
2) At the distribution network scale, consumers household DER can be aggregated and, where necessary, provide additional services to the network.
3) At the transmission network level each VPP will become a dynamic load centre.

Gradually implementing an optimised model for a VPP may help provide for the more efficient allocation of capacity, and support grid stability and management.

## Section 5. Frameworks for DER optimisation within distribution network limits

### 5.1 How do aggregators best see themselves interfacing with the market?

#### *Neo-retailers*

We agree that retailers will ultimately need to make these new value streams available to enable consumers to reach these markets through an aggregator. Currently, the only thing retailers offer consumers is a simple contract for the supply of energy. In the future, this could be just one aspect of the services retailers may offer. The aggregator model could present significant business opportunities for retailers, who could evolve to become an aggregator of the potential services prosumers can offer to the market.

#### *Financial Settlement*

While the technology underpinning VPP's has existed for some time, what has been missing is a tool to make such projects economically viable. The Power Ledger platform can provide aggregators with simple, low-cost and effective market trading and settlement mechanisms capable of interfacing with the NEM and the NEM. Without a transactive settlement layer, it would be difficult to provide the necessary incentives for both aggregators and consumers to participate. A battery may be able to provide FCAS support, but only if the owner is paid to provide it.

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

We agree with the overall advantages and disadvantages listed in the paper. Our more general view of the disadvantages of each of the models is that they try to explicitly define a future state, rather than the transition towards an unknowable distributed future, and the characteristics of a system that supports the integration of DER.

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

### *Distributed Energy Market*

Modelling the qualities of a DSO is equally as important as defining whether a DNSP or the AEMO will fill the role. In our view, a distributed energy market should be facilitated by a DSO which can both optimise DER at the distribution level and provide their services in way which is:

- Autonomous
- Fast
- Secure
- Visibile
- Trustless
- Transactive; and
- Low-cost.

In the short-term, the focus should not be on who will fill the role, but on the services the DSO will need to provide. This means that the DSO role could potentially be filled by an aggregator, a distribution network service provider (DNSP), a retailer or by a new branch of AEMO. The piloting and testing part of the consultation process may even result in a model for a DSO that is not any of the three "straw man" models outlined in the paper. Eventually, an optimised distribution network could see the emergence of the role of "neo-retailer" as an aggregator of prosumer opportunity.

**As this consultation draws to a close, ENA and the AEMO should be hesitant to recommend any final model which is overly prescriptive. The ideal model for a DSO needs to be responsive to change, and able to embrace emerging technologies and solutions in this rapidly changing space.**

# Section 6. Immediate actions to improve DER coordination

## 6.1 Are these the right actions for the AEMO and Energy Networks Australia to consider to improve the coordination of DER?

We generally support all of the steps that are outlined in the in the consultation paper as the immediate actions that will be necessary under any future model for a DSO. We will however make the following additional comments.

### *Standards for DER monitoring and management*

We agree that we working towards standards will be important to encourage interoperability between a range of smart DER installations. However, it is our view that it should the market should ultimately set the standards, not the regulators. If AEMO and ENA do choose to develop a technical standards, the focus should be on ensuring compatibility with the different bodies for international interoperability standards that are beginning to emerge. For example in the AMI space, institutions including IDIS, the Wi-Sun alliance, and the Zigbee alliance have been formed

### *Piloting and testing*

This stage of the consultation process will be extremely important. It should be flexible, with participants free to explore all types of roles. Additionally, participants need to be free to fail, and be given the opportunity to rapidly prototype and iterate their solutions and models.

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

*No Regret action 1:* *Advanced metering infrastructure*

### *Smart meter rollout*

Our business model and the benefits we provide consumers are dependent on access to close to real-time energy consumption data from digital smart meters (AMI).

It is Power Ledger's view that distribution-level settlement opportunities, including P2P trading, require access to accurate data from revenue grade smart meters. Our innovative new settlement model is reconcilable with existing wholesale market settlement processes, providing a number additional benefits for customers. It is our view that the more widespread the adoption of AMI, the more opportunity for consumers and prosumers to participate in the opportunities provided by a dynamic, distributed energy market.

More advanced smart meters can provide additional benefits to the network including:

- Visibility of DER capacity and output
- remote readings
- remote connection and disconnection
- remote fault detection
- power quality correction; and
- over-the-air software upgrades.

Beyond these obvious benefits, AMI can be viewed as an enabling technology that supports the managed deployment of DER in a manner that encourages all types of customers to stay connected to the grid. While the AEMC Power of Choice reforms have mandated all new and replacement meters to be smart meters, it is our strong view that they will need to be installed for all customers (most importantly DER owners) across the NEM and the WEM.

### *Third party access to metering data*

We support the proposal for the development of a "Consumer Data Right." Despite recent AEMC rule changes, under the current version of the National Electricity Rules (NER) the parties entitled to access or recieve energy data are limited to:

- Registered participants (retailer or DNSP);
- Metering coordinator;
- Metering provider and metering data provider;
- AEMO and its authorised agents
- the AER and jurisdictional regulators in certain circumstances
- A retail customer of a retailer or DNSP

By limiting consumer choice over who can access their data, we are limiting competition and innovation. We fundamentally believe in putting the decision back in the hands of consumers, to give them more control over who has access to their data, and what the data will be used for.

### *No regret action 2:* *Support AEMC rule change for consumer access to more than one service provider*

Under the current NER, consumers are only allowed access to one service provider. This is usually a retailer who will interact with the wholesale market on their behalf. In their recent set of rule change proposals published on 26 July 2018, the AEMC outlined the changes they think are necessary to support a grid with significantly more multi-directional energy flows. Of primary importance to us is the proposal to allow energy users to participate directly in the wholesale electricity market. This has the potential to promote wider uptake of technology platforms like Power Ledger's, and allow for smoother entry to market for third party service providers and aggregators. This type of competition will drive innovation and ultimate result in lower costs for consumers, and we strongly believe ENA and the AEMO should support the rule change request when it is submitted.

### *No regret action 3: Peer-to-peer trading market*

Within a managed transition to distributed market optimisation, it is Power Ledger's view that the evolution of a local P2P is the essential first step. A local P2P trading market should be implemented to act as the steady state environment of a VPP environment. From there, consumers can be incentivised to provide additional services to the network in response to changing signals. Coordination of this may begin in an off-market scenario before it interfaces with the market. The core value of P2P trading is that creation of the fundamental incentive needed to avoid an irreversible scenario of grid defection. After the establishment of P2P trading platforms, DER owners could then be more easily incentivised to provide the additional services to the network we have outlined above. For Power Ledger the solution is a trading platform, blockchain simply happens to be the only technology we have found which provides the desired outcomes.

### *No regret action 4: Wide-ranging tariff reform*

If distribution level optimization is to become a reality, comprehensive tariff reform will be required to provide the necessary price signals for both DER owners and consumers to become active participants in distributed markets. Tariffs will need to be adjusted to become more value reflective, to more accurately reflect the network services the customer is utilising. Power Ledger, alongside some of our partners, is working towards trialling a number of tariff reform approaches both here in Australia and overseas.

#### *Smart Cities - RENeW Nexus Project*

Power Ledger is currently participating in RENeW Nexus, a federally funded Smart Cities project in the City of Fremantle. In an Australia first, we will be trialling P2P trading across the regulated network, with the support of Synergy as the retailer, and Western Power who is both the DNSP and the TNSP. The project involves a number of consumers, prosumers with existing solar PV arrays, and a 600 kW community battery.

For the duration of the trial, both Synergy and Western Power are developing non-reference tariffs, which they have agreed to offer participating households. Negotiations are currently underway for the terms of the network tariff which will be offered to participants starting from the second phase of the project. The current model is centered around a fixed daily supply charge. The aim of this fixed charge is to help ensure the financial viability of the trial for both Western Power and the participants. Without it, customers would be paying a network fee each time they drew power from the battery, or each time they carried out a trade.

#### *Dynamic grid pricing*

Power Ledger is also working towards a model of dynamic grid pricing, to support the realisation of the value of grid capacity, which we believe creates greater value opportunities for Distribution Network Service Providers (DNSPs) in the longer term. Current network revenue models incentivise DNSPs to invest in expanding their asset base. This has historically meant that the greater the value of network assets, the greater the revenue for the networks. Moving towards a tariff model which drives network utilisation, not capacity, would create better outcomes for all participants in a distributed marketplace, including DNSPs.

Dynamic pricing would mean:

- Consumers are charged for the part of the network they actually use;
- The efficient deployment of DER will be further incentivised
- There will be reduced investment in non-renewable assets; and
- Network service providers will be incentivised to encourage P2P trading and utilisation of their distribution network.

Where new generation is required, this model could incentivise the strategic installation of renewable generation on the parts of the grid which would benefit the most. As new local markets begin to emerge, networks will need to begin adjusting their pricing mechanisms to compete with emerging platforms.

Dynamic pricing is more commonly employed in the supply of energy, but extending the concept to network pricing is becoming more common, and is currently being trialled in some European countries.

A tariff model that reflects the value of network connection to consumers could provide a price for distributing energy between locations, or, through voltages across the network.  For example, in a manner akin to energy wheeling on the transmission network, energy traded between neighbours across LV distribution networks could incur a cost that reflects the value of that tranche of the network.

**Figure 6.2: Dynamic grid pricing model** - the table demonstrates a possible cost breakdown of a 14 cent offered by a DNSP.

***Please note that the data is illustrative and for example purposes only***

| **Voltage Level** | **Contribution to tariff (cents)** |
|---|---|
| L1 - 330/500 KV | 1c |
| L2 - 220 KV | 1c |
| L3 - 132 KV | 1c |
| L4 - 66 KV | 1c |
| L5 - 33 KV | 2c |

| | |
|---|---|
| L6 - 22 KV | 2c |
| L7 - 240V/115V | 6c |

Under the above example for a dynamic tariff, if generation is traded between a generator connected at 22 kV and a customer on an interconnected LV network, the network charge would reflect the use of those two trances of the distribution network.

A generator connected to a LV circuit trading energy to an adjacent LV circuit connected via a 22 kVA transformer, would pay for the use of those elements of the distribution network.

**Note:** Existing data outlining the costs of both connecting and maintaining a connection to the distribution network is not currently public, though it is likely that DNSPs would have the information readily available to them.

### *No Regret action 5:* *Educating consumers*

One of the challenges of transitioning to a multi-directional grid, will be to convince prosumers and consumers both of the need and the benefits for a timely and efficient transition. In our view, this education process does not need to be challenging. Current market structures fail to provide clear incentives to DER owners, and as battery storage becomes cheaper a scenario of grid defection becomes more and more likely.

Innovative trading platforms like blockchain provide clear incentives and are enthusiastically received by customers with DER and the wider community. Without these added incentives we risk further and irreversible load defection. By way of example, one of the households participating in the RENeW Nexus project has a solar PV array and battery with enough capacity to defect from the grid entirely. However, when presented with the prospect of sharing renewable energy with neighbours or people in the Fremantle community, it provided the consumer with the social and financial incentives to stay connected.

## *Conclusion*

Power Ledger supports the consultation on how best to integrate DER for the benefit of all customers. We look forward to participating in any opportunities that present themselves during the piloting and testing phase, and will continue to provide ongoing feedback as the process continues.