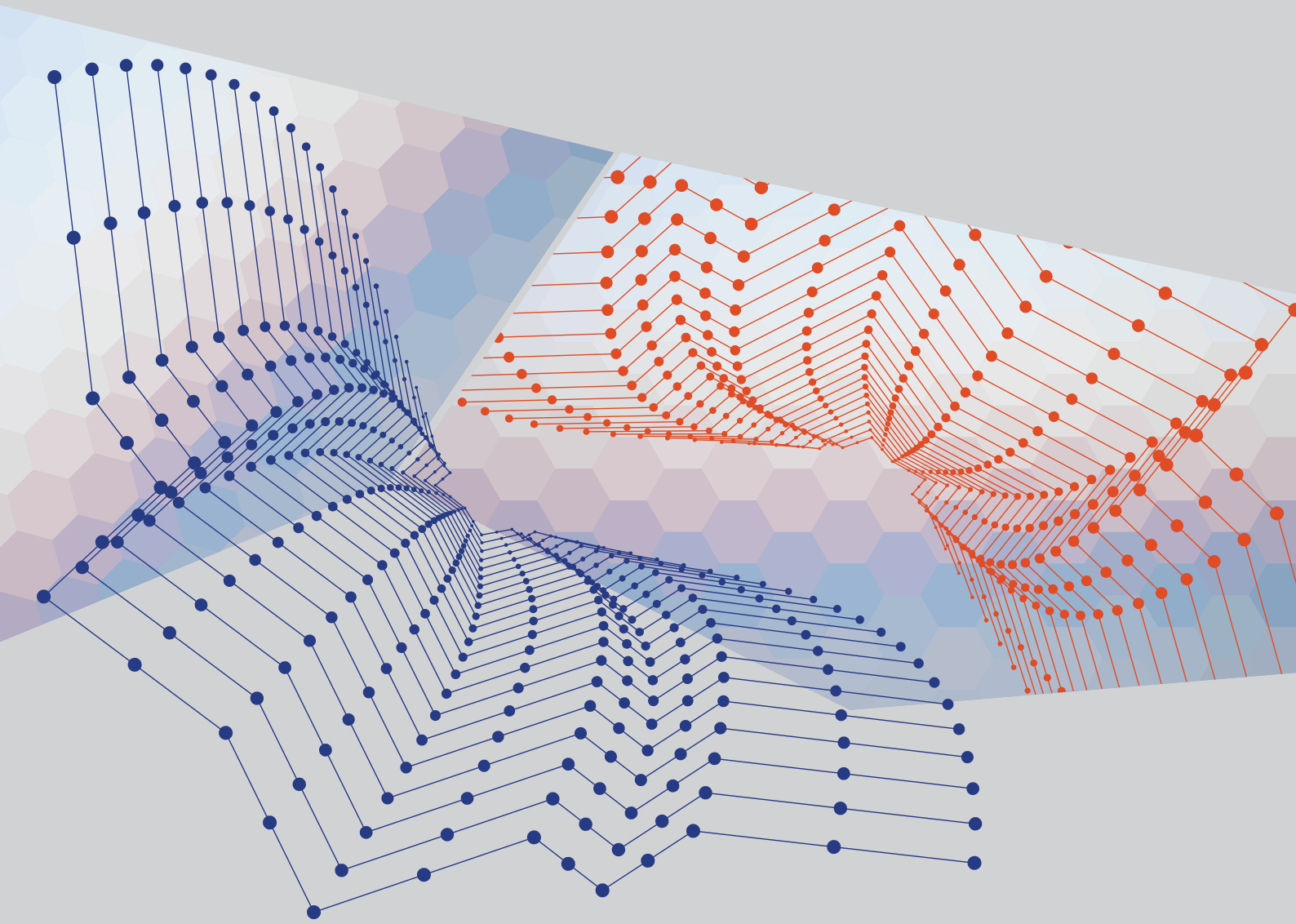
AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

Energy Networks Australia

OPEN ENERGY NETWORKS

Consultation Response

December 2018



Contents

Citation

AEMO and Energy Networks Australia 2018, Open Energy Networks, consultation paper.

Acknowledgements

Chris Cormack, Australian Energy Market Operator (AEMO)
Violette Mouchaileh, Australian Energy Market Operator (AEMO)
Steve Humphries, Australian Energy Market Operator (AEMO)
Dr Stuart Johnston, Energy Networks Australia

Introduction

In June 2018, Energy Networks Australia and the Australian Energy Market Operator (AEMO) opened a consultation on the "Open Energy Networks" project. The consultation aimed to identify how to best transition to a two-way grid that allows better integration of Distributed Energy Resources (DER), leading to better outcomes for all customers.

We asked stakeholders a series of questions focused on key areas of the project:

- Pathways for DER to provide value
- Maximising passive DER potential
- Maximising active DER potential
- Frameworks for DER optimisation within distribution network limits
- Immediate actions to improve DER coordination

The responses we received were encouraging. Our thanks goes to all respondents who provided feedback, whether directly, via the workshops or by other means.

Feedback is important to us; it has informed and adapted the Open Energy Networks Project, which was designed to be responsive, collaborative and dynamic. The project's future stages are set out in this document.

Context

In the years since Australia's National Electricity Market (NEM) and Western Electricity Market (WEM) were designed, the system has evolved from one that was dominated by central large scale, synchronous power plants, and passive consumption, to one that includes a multitude of resources and technologies of various sizes. At the same time, customers are engaging with their electricity services in new ways. We are seeing a significant proportion of energy being generated at the customer premises – facilitating a move from a centralised to a decentralised system.

Figure 1: The context

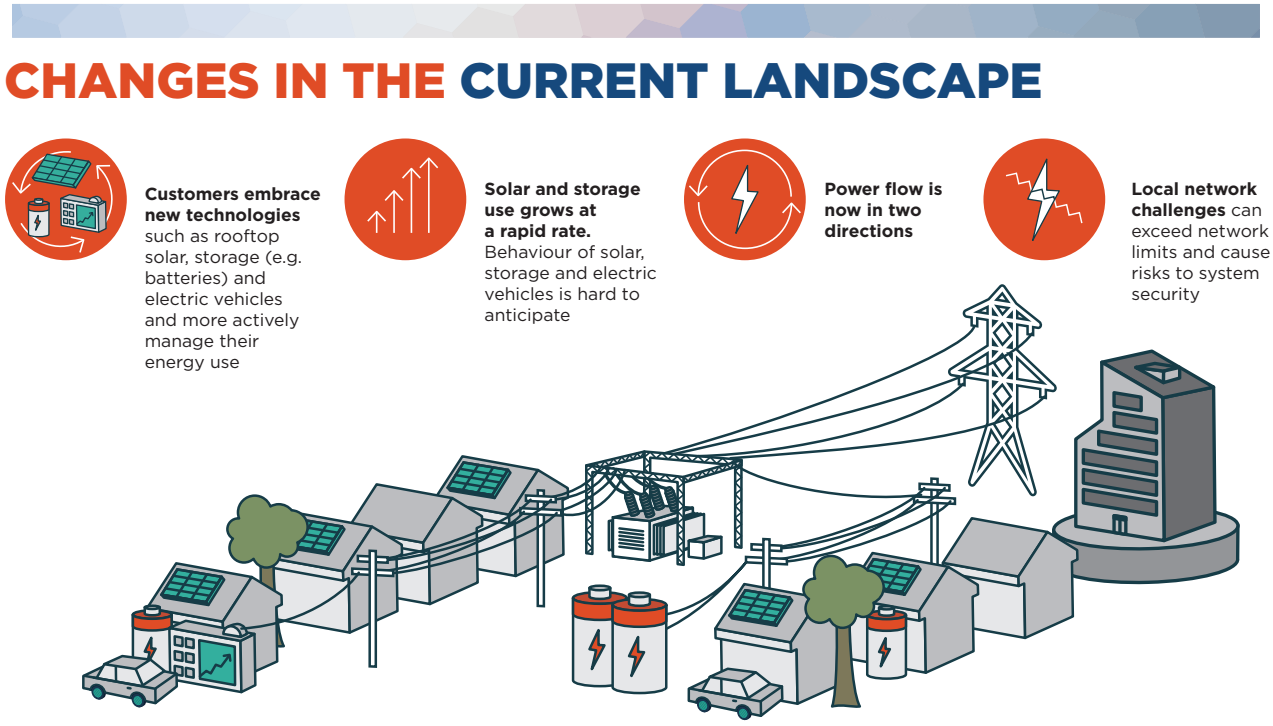


Table 1: Technical integration challenges of DER integration

Examples of DER Technical Integration Challenges		
	Steady State Operations	**Contingency Events**
System-level	Over-generation and increasing variability in generation resulting in: » Curtailment of other renewable generation » Inability to manage transmission network limits - more reserves required as there are no mechanisms to curtail DER » Frequency regulation and ramping challenges for central generation	Behavior of aggregate DER fleet may exacerbate grid instability during emergencies: » Need grid-supportive frequency, voltage trip and ride through settings » Need accurate dynamic models that capture DER behaviour during disturbances
Network-level	Over-generation resulting in: » Approaching or exceeding distribution system equipment capacity limitations	Behavior of DER systems during circuit-level contingencies may result in: » Unintentional islanding » Temporary load rejection overvoltage

These changes are expected to present operational challenges for AEMO and network businesses

Engagement on Open Energy Networks

The paper was launched with a webinar with more than 350 registered participants.

Four workshops were held during the consultation period, with more than 500 attendees from 100 different organisations, representing the entire spectrum of the energy sector.

In addition, more than 20 briefing sessions were held for individual organisations and stakeholder groups in major capital cities.

62 submissions were received by the completion of the consultation.

Submissions received

- Queensland University of Technology
- Greater Western Sydney Energy Alliance
- Paul Caston
- EnerNOC
- City of Sydney
- Open Cities
- Ausgrid
- Public Interest Advocacy Centre (PIAC)
- St Vincent de Paul Society
- Reposit Power Pty Ltd
- Australian Gas Infrastructure Group
- Climate Works Australia
- Tasmanian Renewable Energy Alliance
- Essential Energy
- Horizon Power
- Renewable Newstead
- Marchment Hill Consulting
- AGL
- AER Consumer Challenge Panel CCP14
- Clean Energy Council
- Lachlan Blackhall (ANU)
- Centre for Energy and Environmental Markets
- Reinhausen Australia
- CitiPower, Powercor & United Energy
- Consort
- CSR Limited
- EMH Trade
- Simply Energy
- Samuel Steinberg
- GHD
- Western Power
- Frank Reale
- Energy Queensland
- Evoenergy
- Greensync
- Jemena
- Monash Energy Materials and Systems Institute
- SAS Institute
- Endeavour Energy
- Jan McNicol
- AusNet Services
- EnerNOC
- AMP
- Wattwatchers Digital Energy
- Mark Majzoub
- Origin
- Planet Ark Power
- Powerledger
- Powerlink
- Red Lumo
- Korteck Industries
- University of Melbourne
- SA Power Networks
- S & C Electric Company
- Schneider Electric
- Hydro Tas
- The Customer Advocate
- Tas Networks
- Tesla
- Total Environment Centre

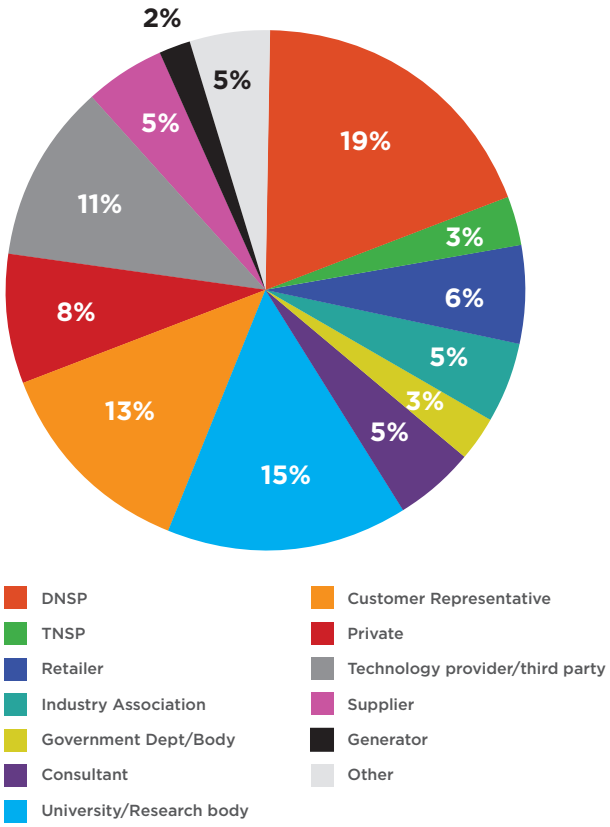
Assessment of submissions

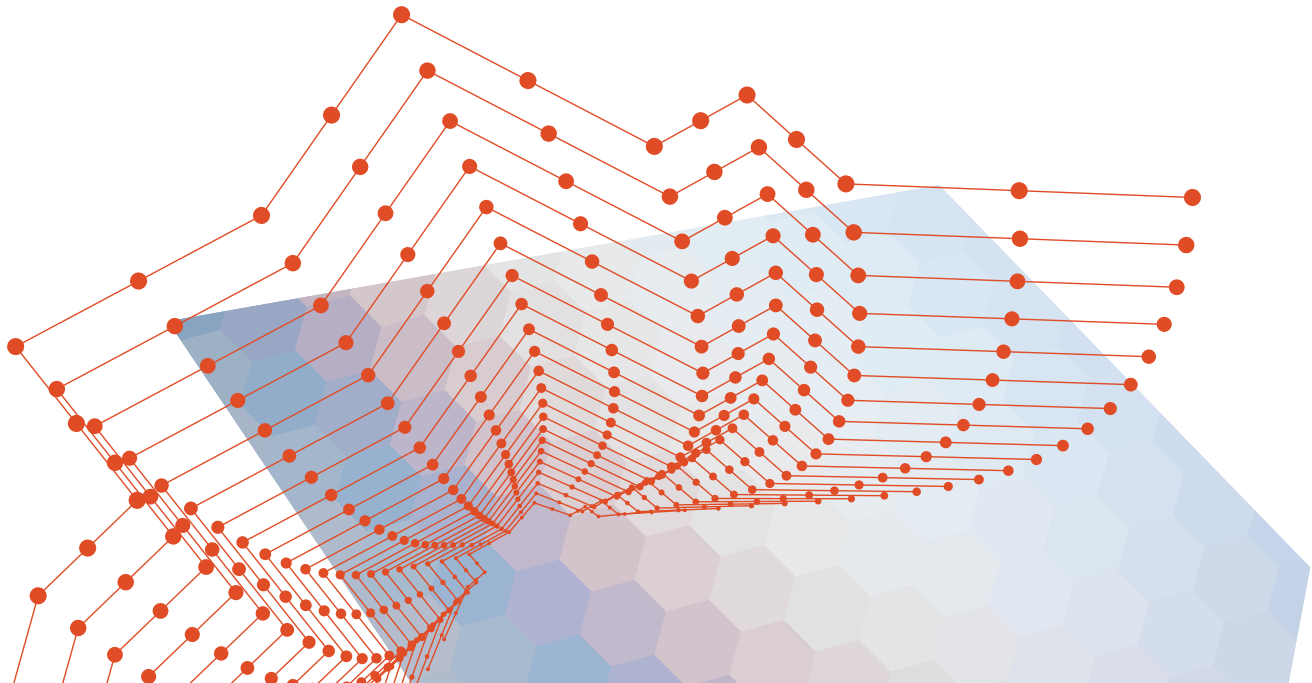
Participation from a diverse range of organisations representing the wide spectrum of industry was achieved.

The 62 submissions were received from:

- All distribution members
- transmission members
- retailers, suppliers
- technology providers and aggregators
- industry associations/peak bodies
- consultancies
- public bodies/government
- investment firms
- information/data system specialists
- researchers, customer groups and private citizens

Figure 2: Breakdown of respondents





High level themes identified from submissions

- Market reforms and regulations are struggling to adapt to the pace of change
- Rates of change will vary
- Reforms that correctly allocate risks to the relevant party (or parties) best placed to manage emerging challenges are required
- Reforms must provide holistic solutions for the system (National Electricity Market, Wholesale Electricity Market, etc.) with a focus on outcomes for all consumers
- Reforms must be proactive; reactionary decision making leads to inefficient outcomes
- Minimum architecture; what is required and when?
- Greater consideration of Electric Vehicles (EVs)
- Customer-centric consideration

Figure 3: Potential areas of benefit

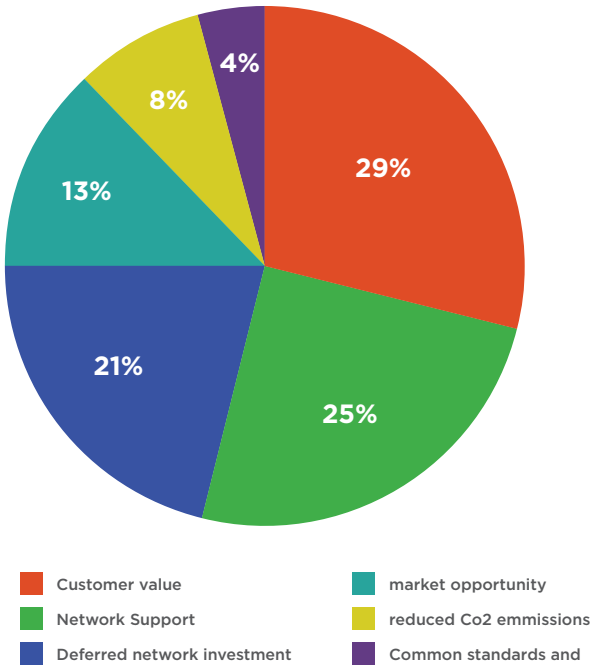
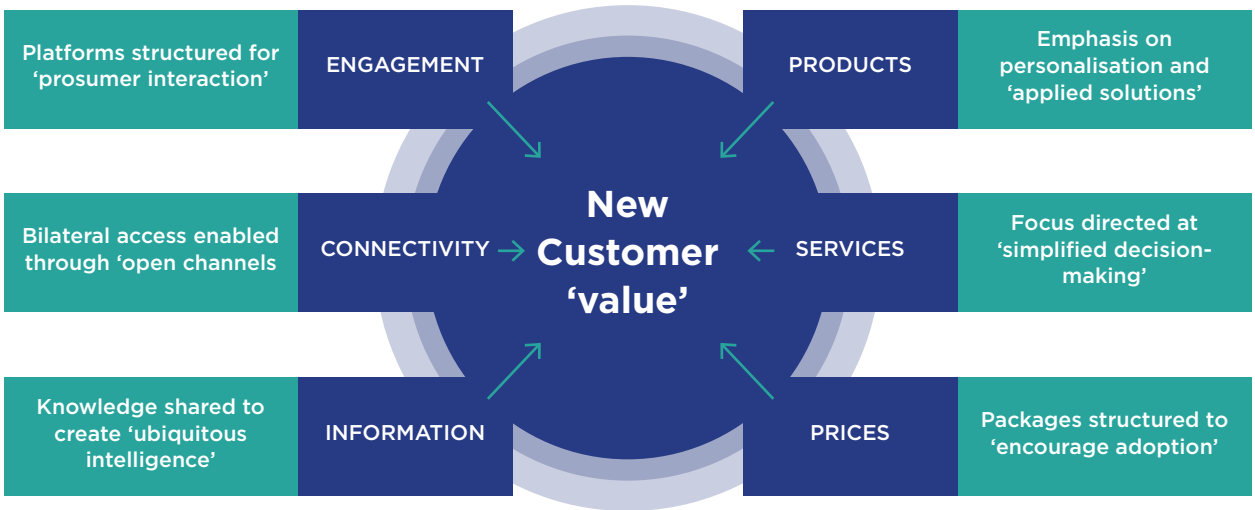


Figure 4: An evolving value proposition for customers



Distribution level optimisation frameworks

The OpEN project, investigating the transition to DSOs, has developed three distribution level frameworks to better integrate DER within the distribution system.

The frameworks broadly cover:

» How the DSO accesses DER

» How the DSO facilitates services and markets

» How the DSO provides own services to network customers

» The extent of its relationship with AEMO

» The associated market arrangements

Stakeholder consideration of model market frameworks

Scores represented in this graph reflect only explicit feedback for model preferences. Some submissions did not identify a framework preference.

The preferences generally reflect the industry segment of the submission respondent. For example, the majority of DNSPs prefer the two step tiered platform, while many non-traditional energy market players prefer the independent DSO.

Figure 5: Model framework preferences

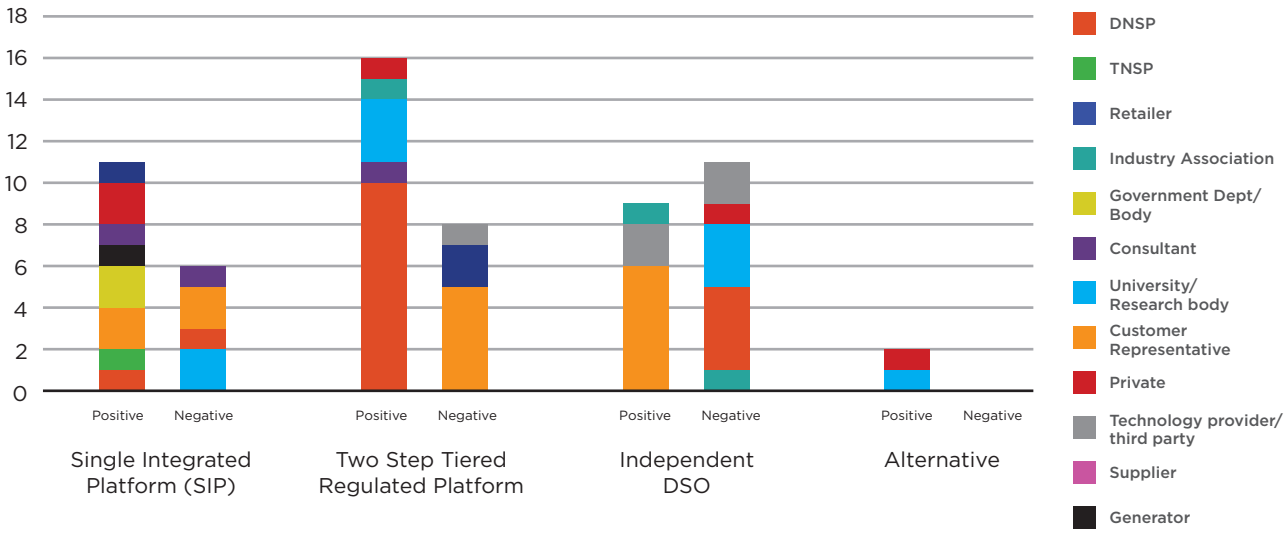


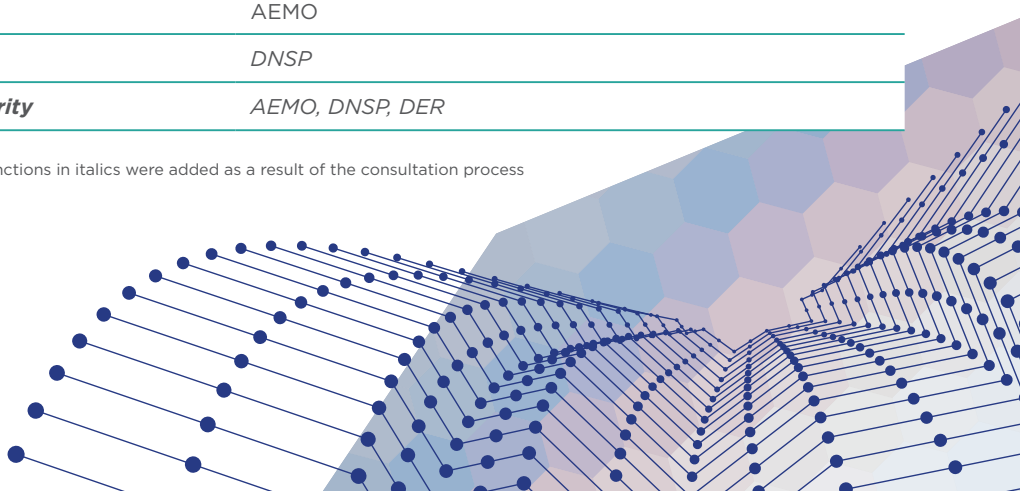
Table 2: Stakeholder consideration of model market frameworks

Model	For	Against
Single Integrated Platform	» Centralised approach can generate efficiencies through single/existing procurer/platform » Independent party	» Concerns that local opportunities might be missed » Significant capability development required » Perceived lack of innovation in this model
Two Step Tiered Regulated Platform	» DNSPs better placed to coordinate DER utilisation and benefit local issues » Optimisation may include network as well as DER optimisation	» Perceived potential negative commercial impact on DER as could lack transparency » Complexity – DNSP-AEMO interface » Perceived conflict of interest in Network owner managing market mechanism
Independent DSO	» Benefits of independent party able to operate dispatch platform	» New bodies would need to be established requiring significant technology/capability development » Risk of market fragmentation » Extra layer of significant complexity - many AEMO-DSO-DNSP interfaces to manage

Table 3: Functions in DER optimisation

No.	Function	Owner
1	Distribution system monitoring and planning	DNSP
2	Distribution constraints development	DNSP
3	Forecasting systems	DNSP, AEMO, or new third-party
4	Aggregator DER bid and dispatch	Third-party: New participant category
5	Retailer DER bid and dispatch	Retailer
6	**DER optimisation at the Distribution level**	DNSP, AEMO, or new third-party
7	Wholesale - distributed optimisation	AEMO
8	Distribution network services	DNSP
9	**Data and settlement (network services)**	DNSP, Aggregator/ Retailer, AEMO or new third-party (facilitates)
10	Data and settlement (wholesale and FCAS)	AEMO
11	DER register	AEMO
12	***Connecting DER***	*DNSP*
13	***Network & system security***	*AEMO, DNSP, DER*

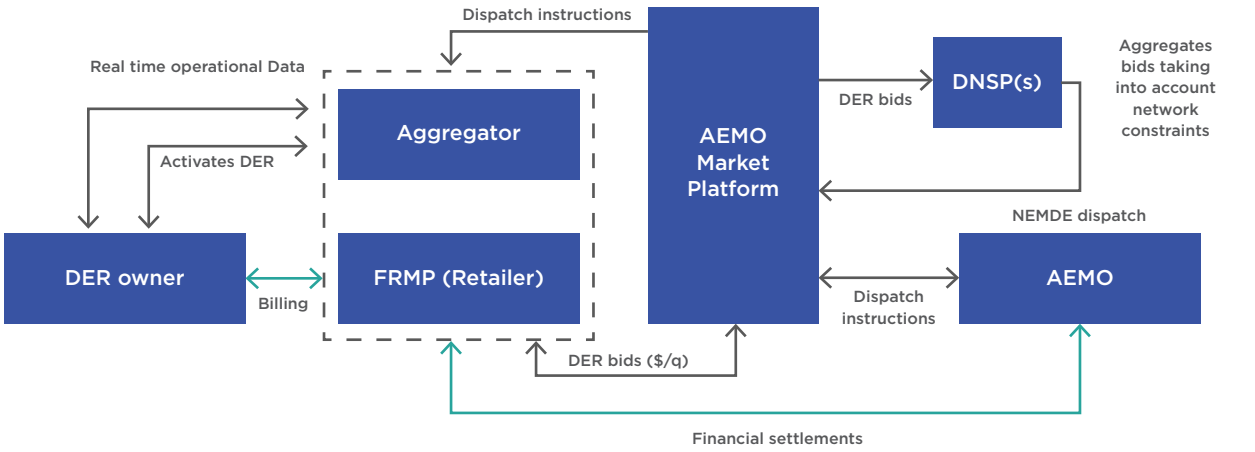
Note: Functions in bold were modified. Functions in italics were added as a result of the consultation process



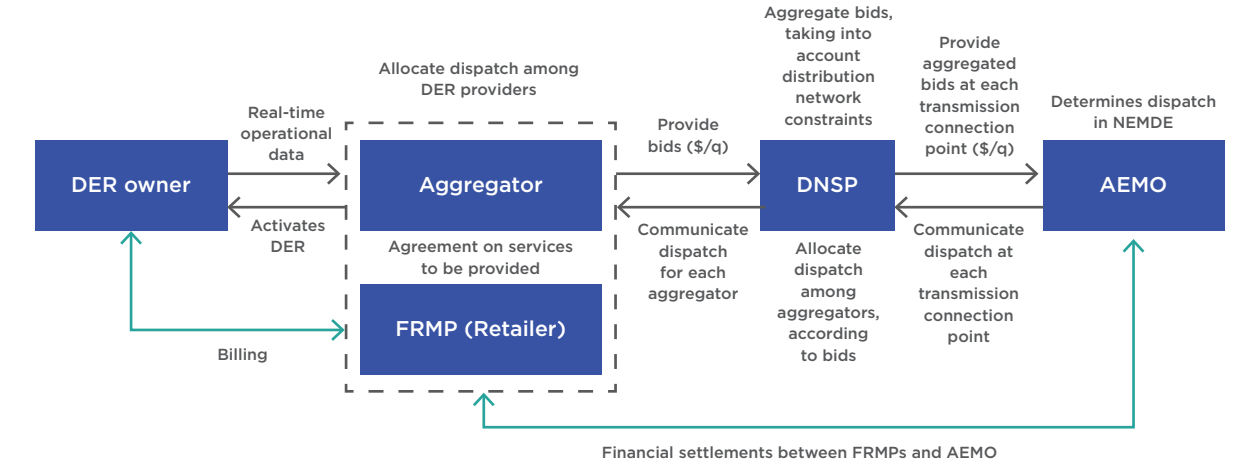
Strawman model options

Key change to all models: DNSP provides each connected DER with a dynamic 'operating envelope'

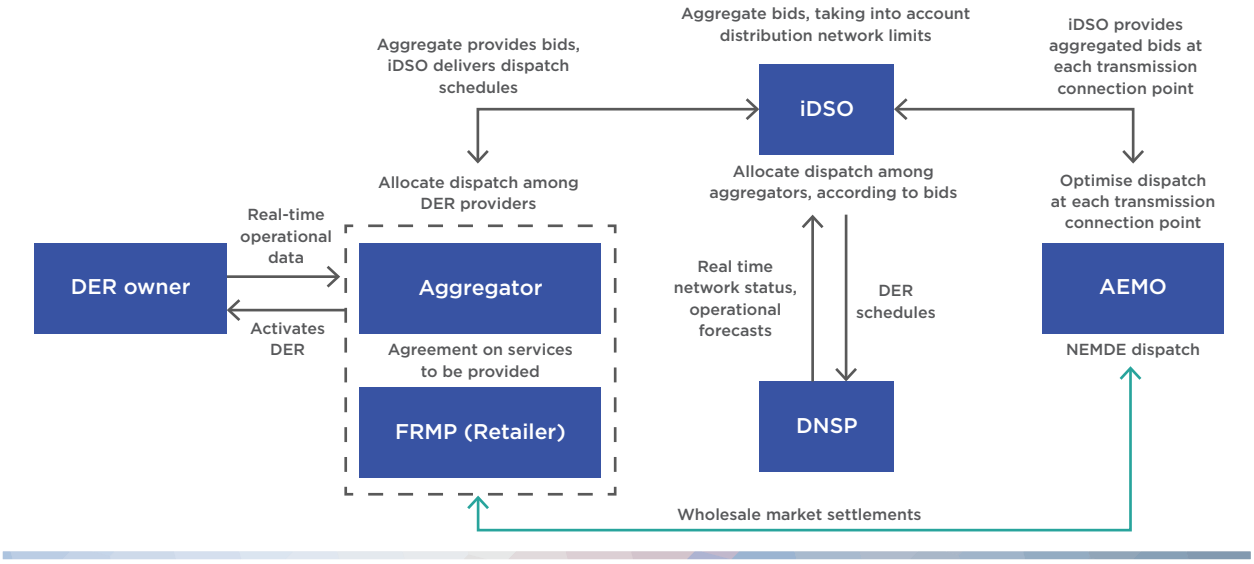
Option 1 Single Integrated Platform: AEMO central platform



Option 2 Two Step Tiered Platform: DNSPs optimising distribution level dispatch



Option 3 iDSO optimises distribution level dispatch



Key changes to models

- Introduction of the DER operating envelope – a dynamic value range (positive or negative) provided at the NMI level that defines the DER generation or load limits
- This enables all DER bids entering the Wholesale/FCAS markets to be dispatched without further consideration of distribution constraints
- Introduction of two new functions connecting DER and network and system security in high DER
- DNSPs and AEMO need to gather real time data to calculate the operating envelopes and create operational forecast

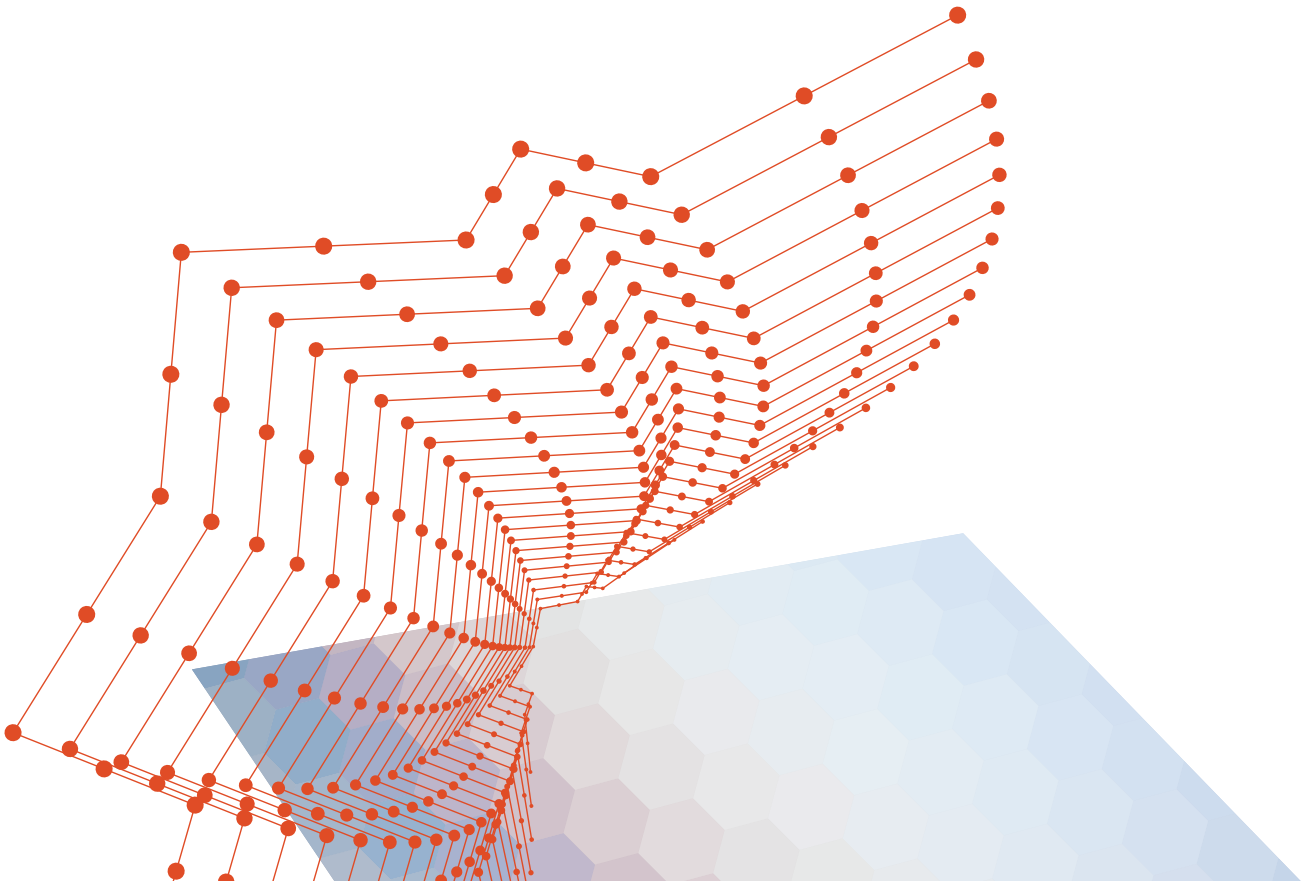
Planned actions in response to consultation feedback

- In response to the high level of interest among stakeholders, there will be increased reporting and frequent updates on the project
- Further stakeholder engagement opportunities from February 2019 through briefings, webinars and subject specific workshops
- As requested, the scope of the consultation on DSO market models will include input on DSO definition and functions
- In addition to stakeholder input to the cost benefit analysis (CBA), we will add a consultation on the CBA outcomes, giving stakeholders the opportunity to review and comment
- Issues raised in workshops outside of the consultation's scope may be pursued through other channels, such as ARENA'S Distributed Energy Integration Program (DEIP)

Detailed responses to feedback

Question 2

Q 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?	
Stakeholders said:	**What the Open Energy Networks project will do:**
Customers should be the focus of value creation.	The OpEN team acknowledges that customers must be the focus of this project. This will be made more explicit in both the 'least regrets' actions report and the final report. Other key areas of value will also be explored in phase two (i.e. EVs) This will feature in future consultation.
Customers must not be disadvantaged by any of the work undertaken by AEMO and Energy Networks Australia. They must retain choice in respect of the services they want.	Choice is a key consideration in any value proposition. This will feature in future consultation.
The report fails to highlight what will be necessary to incentivise DER owners to participate in distribution level markets in the first place.	We acknowledge that incentivisation of customers will need to be addressed and may require further exploration in a parallel piece of work driven by the Australian Energy Market Commission (AEMC).
Stakeholders identified a number of projects and studies that could be drawn upon to test value release mechanisms.	The OpEN team will investigate and report back on these activities when producing the 'least regret' actions paper and/or the final report, depending on relevance.

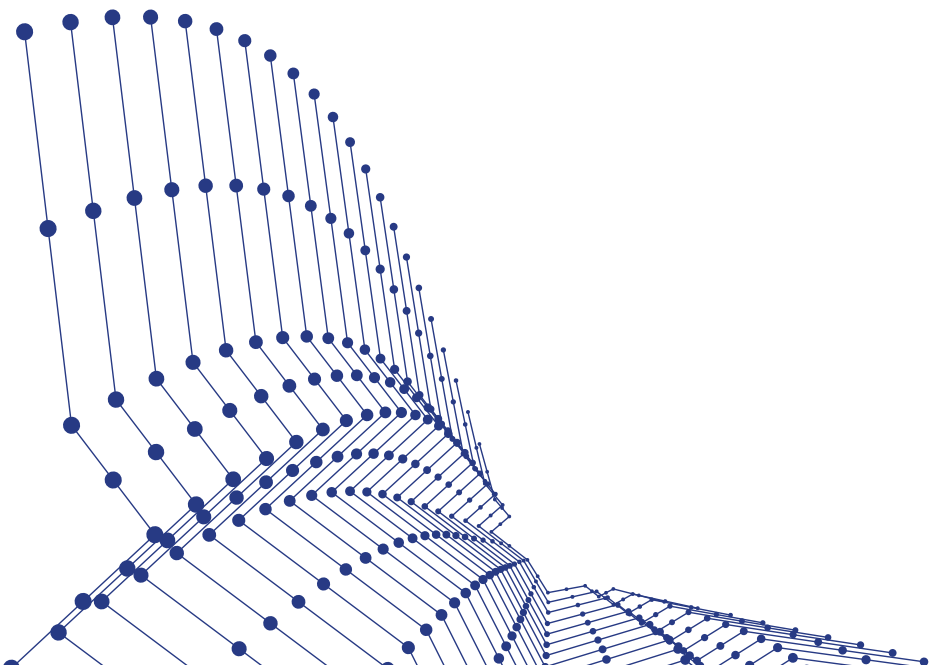


Question 3

Q 3.1 Are there additional key challenges presented by passive DER beyond those identified here?	
Stakeholders said:	**What the Open Energy Networks project will do:**
Urgent action is required to address the lack of policies within governments and regulators.	The OpEN project is a critical piece of work that has been flagged with the Distributed Energy Integration Program (including bodies such as the AMEC, AER, CER, CEFC, ECA). The OpEN team is conducting dedicated briefing sessions with the AER and the AEMC to explore these policies and other matters which are out of scope of the this piece of work but nevertheless critical to positive outcomes for all customers.
There are concerns about the spatial and temporal elements of issues created by high DER penetrations.	It is noted that these issues are occurring and will also occur at different times and locations in the networks. This matter was explored in the first piece of work surrounding the counterfactual analysis to be conducted by the CSIRO. Work such as the ARENA CSIRO taxonomy of the networks will also be key to this OpEN work.
There are technical challenges from additional local distribution on the network and the system's security.	Further assessments of network security issues with high DER uptake have uncovered additional challenges, including low voltage/neutral voltage rise. Additionally, there are challenges associated with current protections schemes and practises resulting in non-detection (blind-spots) for anti-islanding, earth faults and degradation of sensitivity of backup protection on the MV. OpEN will examine these assessments and ensure that the least regret actions include pathways to manage security risks to both system and network.
The voltage limits of the LV are the primary limiting factor of new passive DER installations. The secondary issue is thermal limits of the distribution network.	The OpEN team acknowledges that the LV voltage limits are a new and rapidly evolving issue in the networks (noting it is a temporal and spatial issue). Primary focus in the past has been thermal limits due to increase in demand, however voltage limits have a smaller window to rectify the issue; thermal limits can be expressed in terms of minutes and hours whilst voltage limits have much shorter timeframes.
Customer protections and safe-guards are another key challenge.	The OpEN team is of the view that this issue was not given sufficient focus in the consultation paper. Customer protections and safe-guards are critical policy and customer engagement pieces. Both of these issues are out of scope of this piece of work, however OpEN could include these as a recommendation to the AER, AEMC and other relevant bodies to ensure that these issue is on the radar of governing and ruling bodies.
Cross-subsidies highlighted the 'first-in-best-serviced' aspects of the currently policies and connection arrangements of the networks.	The AER and AEMC are critical cross-subsidy parties. The OpEN team is not a rule maker, but will inform the governing and rule making bodies. Any framework must work for the benefit of all customers, including vulnerable customers. There is a view that a preferential system exists whereby some residential customers can connect without extreme limitation on DER export capacity compared with commercial (business) customers, who cannot. This highlights the need for equal customer protections.

Q 3.2 Is this an appropriate list of new capabilities and actions required to maximise network hosting potential for passive DER?	
Stakeholders said:	**What the Open Energy Networks project will do:**
It is a matter of urgency to gain a better understanding of the hosting capacity and visibility of the dynamic state of the LV networks through better monitoring and modelling.	The OpEN project will leverage the work that CSIRO conducts on the taxonomy of networks and further ARENA trials. Hosting capacity and visibility are key items which must be understood in both spatial and temporal aspects. The OpEN team has included the idea of 'operating envelopes' as a way to better communicate and calculate the hosting capacity of the networks. These envelopes will need to be derived from the modelling and monitoring of networks state.
Distribution Management System (DMS) is anticipated to play a greater role in managing the integration of DER into the network.	The OpEN project considers DMS is a key enabler for greater integration of DER into the networks and therefore, the system. A DMS will provide the static and real-time data, and a network model to enable advanced planning so that operations can be understood and communicated.
Distributed Intelligence and Algorithms or Decentralised Optimisation are required for an optimal use of DER assets rather than central dispatch.	The OpEN team received feedback from a number of respondents that decentralised optimisation solutions should be considered, however none came forward with a framework for how this would operate. It is understood that there is doubt on how this can occur for the case of LV networks, whose complexity and nodal quality may dictate the need of a distributed solution for the automation. However, there may be a need in the transition to signal operating envelopes for DER aggregators and operators.
Distributed Intelligence and Algorithms or Decentralised Optimisation are required for an optimal use of these DER assets rather than central dispatch. (continued)	The OpEN team is aware of current trials of activate automatic local voltage control and some response to frequency variations as part of a strategy for distributed system control. The stabilisation of the local voltage and a response to deviations and rate of change of system frequency on a distributed basis would make the network more stable. This would not require complex orchestration as synchronous generator excitation and governor control have provided distributed control at a more aggregated level. These trials will be observed and any findings will inform the final paper.
Do we need any additional changes to the current energy market to maximise network hosting potential?	The OpEN team acknowledges the potential to maximise network hosting. The current pure energy market design produces scarcity pricing, promoting maximum self-consumption. This does not rule out the need for other measures to improve system and network security (e.g. the use of directions for system strength). The OpEN team will note the market's evolution and continue to gain insight from market operators and regulators.
There is a new requirement to understand the nature of the customer's connection (i.e. where they are physically connected) and educate customers on how they can contribute to system solutions.	The OpEN team will include this as a recommendation to the DEIP and other relevant bodies to ensure an engagement program is developed for customers who are or want to connect to the system. The OpEN project has engaged and consulted with consumer advocate groups representing the full spectrum of Australian consumers. The OpEN team will also ensure that customers are the key focus of any future framework. Frameworks must be designed with customers at their heart.

Q 3.3 What other actions might need to be taken to maximise passive DER potential?	
Stakeholders said:	**What the Open Energy Networks project will do:**
There is growing need for voltage management on the LV grid.	If the value of active DER to networks can be identified and made available to owners of active DER, this will increase the incentive for DER installations to be 'active'. There is also a view that passive DER does not cause local network challenges due to current network connection agreements. The OpEN team will explore the cost benefits analysis conducted by CSIRO and will ensure that timings of this or any required changes are understood as part of the least regrets action recommendations.
There is a suggestion that the network benefits associated with DER can be maximised through the transition to active DER.	If the value of active DER to networks can be identified and made available to owners of active DER, this will increase the incentive for DER installations to be 'active'. There is also a view that passive DER does not cause local network challenges due to current network connection agreements. The OpEN team will explore the cost benefits analysis conducted by CSIRO and will ensure that timings of this or any required changes are understood as part of the least regrets action recommendations.
Reliable data streams from technologies being installed behind the meter or through Advanced Metering Infrastructure (AMI) are a significant enabler to increase the reliability of the planning and forecasting required by the DNSPs and market participants. This information is critical for any transition. There were suggestions of a fee for voltage management on the LV grid and supply of data for visibility of voltage and related information beyond the substation.	OpEN modelling by EA Technology will focus on the types of information (rather than the data itself) and the types of communication required. Parties may require different information and types of communication in the three different possible futures outlined in the consultation. The OpEN team will continue to explore this matter and at the conclusion of this work, articulate and quantify the information and communication required in the possible future models.



Question 4

Q 4.1 Are these the key challenges presented by active DER?	
Stakeholders said:	**What the Open Energy Networks project will do:**
We need understanding of the key technical and network challenges for all parties.	The OpEN team will bring all identified technical challenges to-date, in addition to new challenges, to the next stage of the OpEN work.
The economics of the changing market haven't been considered.	The economics of the evolving market were explored in the Electricity Network Transformation Roadmap (2017) as part of the cost Benefit Analysis conducted by the CSIRO. The OpEN team has taken note of the concerns raised and these will be considered in stage two for all models.
There should be a greater consideration of the owner of challenges including which party is best placed to manage them.	The OpEN team will apply output from the EA Technology 'actor-agent' roles and will also consider the feedback from the deep-dive workshops to help highlight which party is best placed to manage individual risks and challenges. This will feature in future consultation.
There is a lack of understanding of network constraints and visibility of the LV network.	The OpEN team has included the idea of 'operating envelopes' as a way to better communicate and calculate the hosting capacity of the networks. These envelopes will have to be derived from modelling and monitoring of networks' state. Operating envelopes are linked to the constraints of the networks.
There is a need for a decision making framework to determine whether DER are likely to breach local network or system constraints.	The OpEN team is conducting briefing sessions with the AER and the AEMC to explore these policies and frameworks which are out of scope of this piece of work. We have taken note of the comments raised and have included the idea of 'operating envelopes' as a way to better communicate and calculate the hosting capacity of the networks.

Q 4.2 Would resolution of the key impediments listed be sufficient to release the additional value available from active DER?	
Stakeholders said:	**What the Open Energy Networks project will do:**
Technical issues in the system or networks caused by DER are not ubiquitous and the need to address these issues in different networks is not uniform.	It is noted that technical issues such as voltage or thermal constraints are occurring and will also occur at different times and locations in the networks. This will be explored in the first piece of work concerning the cost benefit approach to investment being conducted on behalf of OpEN by the CSIRO, as well as a separate LV Taxonomy study also being conducted by CSIRO. These will be key inputs into further OpEN work. All frameworks presented will be modelled using the Smart Grid Architecture Model (SGAM) which will completed by EA Technology. SGAM models will then be coupled with the cost benefit analysis work with CSIRO to provide a quantitative comparison.
As centralised frameworks and regulatory environments mature, it is critical that consideration be given to appropriately incentivise market participants as these reforms will likely be the way that customers ultimately access DER value.	The OpEN team acknowledges retailers are the current market participant responsible for opening the value stream available for DER. If DER value is not achieved then the market will look to new ways for DER owners to trade peer to peer and in other services through an aggregator, which will need to be legislated and facilitated for consumer protections. The OpEN team will work with the AER and the AEMC to ensure that this issue is on the radar of governing and ruling bodies.

Q 4.3 What other actions might need to be taken to maximise active DER potential?	
Stakeholders said:	**What the Open Energy Networks project will do:**
The priority is to enable DER export into the grid which will require each value stream to be coordinated and prioritised across the local constraints and system wide needs.	The OpEN project will highlight the need for a coordinated and phased approach with the development of: » Appropriate standards and protocols for data, communication and interoperability » Smart applications and integration platforms which promote competition and locking customer value » Further understanding the customer's behaviour and motivations These aspects will feature within the least regrets paper and the final paper. The OpEN team will consult with the AER and the AEMC to ensure that customer protections such as contracts for services, defined fees and issues regarding relationships with parties are on the radar of governing and ruling bodies.
Policy development of DER monitoring and control should be a priority before retro-fitting becomes too expensive.	The OpEN team is aware that technology is available to monitor DER inverter voltages and power and it is proposed that this data be made available to networks and other market participants for the mapping and visibility of the LV network. This highlights the requirement to encourage or perhaps mandate the uptake of smart devices which change passive DER to active DER. An example of this is home appliances and rating standards. The OpEN team will ensure these matters are addressed within the least regrets paper.
Tariff and demand management are effective price signals to support the integration of DER into emerging electricity markets	The OpEN team will consult with the AER and the AEMC to ensure that tariffs and demand management frameworks are on the radar of governing and ruling bodies. The OpEN team understands that a prerequisite for fully integrated pricing is the digital meter rollout into the NEM, implementation of the five minute settlement rule, changes to network tariff signals and retail prices reflecting the wholesale market. Improved data quality and access could be as important as technological developments.

Q 4.4 What are the challenges in managing the new and emerging markets for DER?	
Stakeholders said:	**What the Open Energy Networks project will do:**
The next greatest challenge is related to the pace of the transition from centralised to distributed generation and the rapid emergence of new energy products and services.	The OpEN team understands from stakeholders that this transition creates perceived conflict of interest between networks, retailers and potentially new market participant such as aggregators. In addition, this rate of change poses challenges for regulators and rule makers in adapting the complex regulatory framework to keep up whilst not stifling competition and ensuring consumer protections. The OpEN team will consult with the AER and the AEMC to ensure that these issues are on the radar of governing and ruling bodies.
The frameworks under review and in development must keep the focus on customer outcomes for all customers on a fair and competitive basis.	The OpEN team considers that this issue was not enough of a focus in the consultation paper. All customer protections and safe-guards are a critical policy and customer engagement piece which are out of scope of this work, however the OpEN team will work with the AER and the AEMC to ensure that this issue is on the radar of governing and ruling bodies

Q 4.5 At what point is coordination of the Wholesale, FCAS and new markets for DER required?	
Stakeholders said:	**What the Open Energy Networks project will do:**
There is a concern that the distributed energy transition will likely occur gradually over time.	It is noted that the distributed energy transition will occur at different times and locations in the networks. This will be explored in the first piece of work surrounding the counterfactual analysis to be conducted by CSIRO and other work, such as the ARENA CSIRO taxonomy of the networks. These studies will be key inputs into OpEN reports. The OpEN team believes that the following three market levels will need to be coordinated to interface as the market matures: 1) At the local level P2P trading market which will act as the steady-state environment 2) At the distribution network scale, consumer household DER can be aggregated and, where necessary, provide additional services to the network 3) At the transmission network level each DER will become part of a dynamic load centre.
All potential DER resources can be coordinated to provide necessary services to network and electricity markets.	The OpEN team is working to develop the models on how this could be achieved in alternative futures. The vision considers optimisers between network support services, FCAS and electricity. This will become critical to operation and reliability of the network at the point at which networks plan for this DER capacity in their forecasting processes.

Question 5

Q 5.1 How do aggregators best see themselves interfacing with the market?	
Stakeholders said:	**What the Open Energy Networks project will do:**
Aggregators would like to be agents of control behind meter assets on behalf of owners. However, if the aggregator is merely an unregulated entity, they may not be able to capture the full value of DER.	As part of the least regret actions report, the OpEN project proposes a review of the current market participant categories for VPP and other DER.
Whichever model or framework is chosen, a standard interface or communications protocol between the market and aggregators is preferred.	The OpEN team considers the role of device standards, data protocol standards and communications protocol standards vital to the way DER integrates with the market. We agree that a standard interface between DER and the market will be a key consideration for any framework design.
Regarding aggregator interface design, the customer experience must remain central to the decision making process to ensure optimal outcomes are achieved.	The OpEN team considers a key role of the aggregator or the retailer to be effective management the customer experience. Part of this is dynamic pricing and other incentives to encourage the customer to participate in the DER market. Any framework will need to ensure that the design of common protocols and interfaces result in positive customer experiences. The OpEN team will collaborate with the DEIP and other customer representative bodies to ensure that DER integration is approached with the customer at the heart of its design.

Q 5.2 Have the advantages and disadvantages of each model been appropriately described?	
Stakeholders said:	**What the Open Energy Networks project will do:**
There is some scepticism that a central optimisation or 'one size fits all' model of distribution optimisation is warranted.	The OpEN team acknowledges the requirement to make a case for DER optimisation. To that end, we will deliver a cost-benefit analysis with the assistance of CSIRO. This will build on the benefits identified in previous analysis completed for the Energy Transformation Roadmap. Also considered will be the cost of a 'do nothing' approach in light of increasing DER penetration. In addition, we consider that the frameworks are likely to be implemented with a greater level of complexity in the places in the Distribution Network where DER uptake is the highest - or where the Distribution Network is under strain. This will be considered in work being undertaken by CSIRO in its LV topology study and this will be examined in our least regrets report.
Discussion around distributed optimisation frameworks is premature and should be undertaken exclusively by the AEMC.	The OpEN team acknowledges that the AEMC as the rule making body of the NEM will need to put any changes we recommended through a formal rule change process. We are working with the AEMC and the AER to ensure that views from each respective organisation are being addressed and that this work helps to move forward any decisions regarding frameworks or regulatory changes.

Q 5.2 Have the advantages and disadvantages of each model been appropriately described?	
Stakeholders said:	**What the Open Energy Networks project will do:**
The discussion regarding DER optimisation is premature. Central dispatch is difficult and may not be warranted.	The OpEN project seeks to comprehensively understand the challenges associated with setting up a DER optimisation framework before any changes are recommended. We acknowledge that a framework for DER optimisation is unlikely to be implemented in the immediate future. However, a thorough examination of the options available is prudent. In order to implement changes that are incremental in nature, a future framework is helpful to ensure that the changes we make are not piecemeal, rendering the industry incapacitated at a future point in time when redesign will be difficult.
DNSPs will need to build capability to monitor and communicate LV network constraints no matter which model is finally chosen. Given the technical challenges and the large volume of DER, some suggest the natural extension of the DNSP role will be to filter and screen aggregated distribution bids. Bids may be classified as optimisation, or a part of an interim model.	The OpEN team considers that LV network monitoring and constraint management is likely to be required for any future framework. This will be a key action recommended in the least regrets report. Optimisation of the bids and offers from DER differ from the role of the DNSP in providing constraint information. This will be an area of focus in upcoming stakeholder workshops.

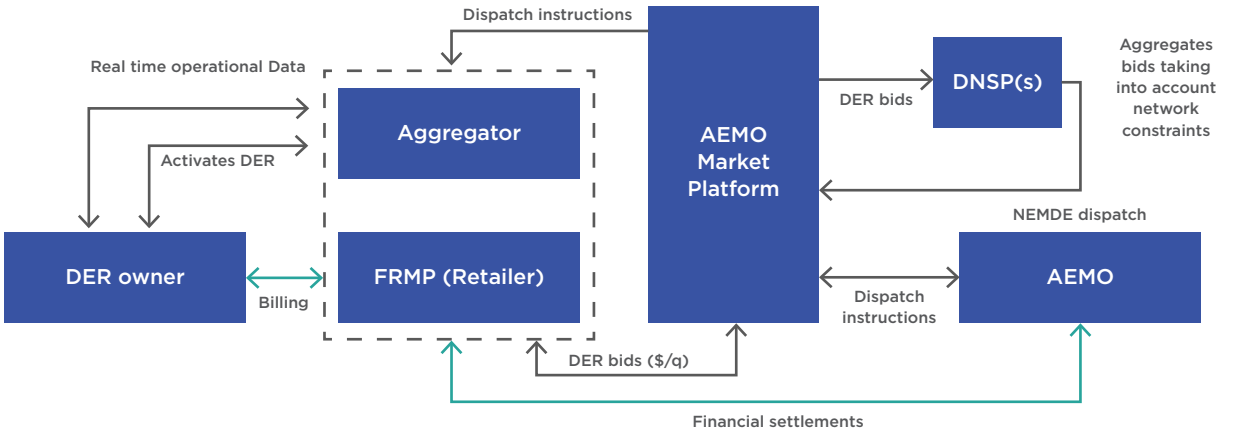
Q 5.3 Are there other reasons why any of these (or alternative) models should be preferred?	
Stakeholders said:	**What the Open Energy Networks project will do:**
Some stakeholders prefer the iDSO framework. This is usually as a result of two factors; perceived conflict of interest for the DNSP and the level of complexity for AEMO to manage both the transmission and distribution networks.	Some stakeholders prefer the iDSO framework. This is usually as a result of two factors; perceived conflict of interest for the DNSP in the role of the DSO, and the level of complexity for AEMO to manage and operate both the transmission and distribution networks.
Some prefer local level dispatch or a completely decentralised model.	The OpEN team is keen to hear from stakeholders who may support a model not identified in the Open Energy Networks consultation paper. To-date, proposals that support local level dispatch or a completely decentralised model have been unable to articulate how this might work in practice. An idea that the OpEN team has incorporated into all frameworks is the use of 'operating envelopes'. These are positive and negative values that would define the ability of DER to operate in a static or potentially real time environment once calculated. This would allow a DER optimisation framework to be applied while determining the best economic output on top of the technical constraints embedded in the operating envelopes. Without optimisation, individual DER may be able to technically operate, but potentially not be in a way that increases market efficiency for consumers – a key element of optimisation's purpose.

Q 5.4 At what point is coordination of the Wholesale, FCAS and new markets for DER required?	
Stakeholders said:	**What the Open Energy Networks project will do:**
This will be required when the system runs the risk of breaching operational or physical limits of the grid infrastructure through DER integration, operation or participation in energy, ancillary and network services markets.	The forthcoming least regrets report will focus on LV network monitoring in order to determine where in the distribution network the focus for real time network monitoring and DER optimisation frameworks should be.
More work is needed to determine the exact timing, coordination and the new markets – but this is likely to be targeted at areas of the network where penetration of DER is the highest.	The OpEN team agrees that work should be targeted in areas where DER penetration in the network is highest. However, an overall framework that addresses all distribution networks is necessary for consistent integration and for connected devices standards. An overarching communication protocol is superior to piecemeal solutions that separately address each network or problem.
Little or no information is presented regarding the extent of risks. Alternative mitigating factors, timings, and certainty of the benefits are unclear. The impact on energy costs to customers is unknown, and whether the benefits to customers of a proposed framework will exceed the costs required to implement it.	The OpEN team prioritises an evidence based approach for DER optimisation. To that end we are undertaking a cost-benefit analysis with the assistance of CSIRO. This work, in addition to LV network topology studies, will inform the blueprint for the DER optimisation frameworks. Higher complexities and their associated costs will be identified in places within the network where these considerations are required.

Actors and relationships for proposed models

Option 1

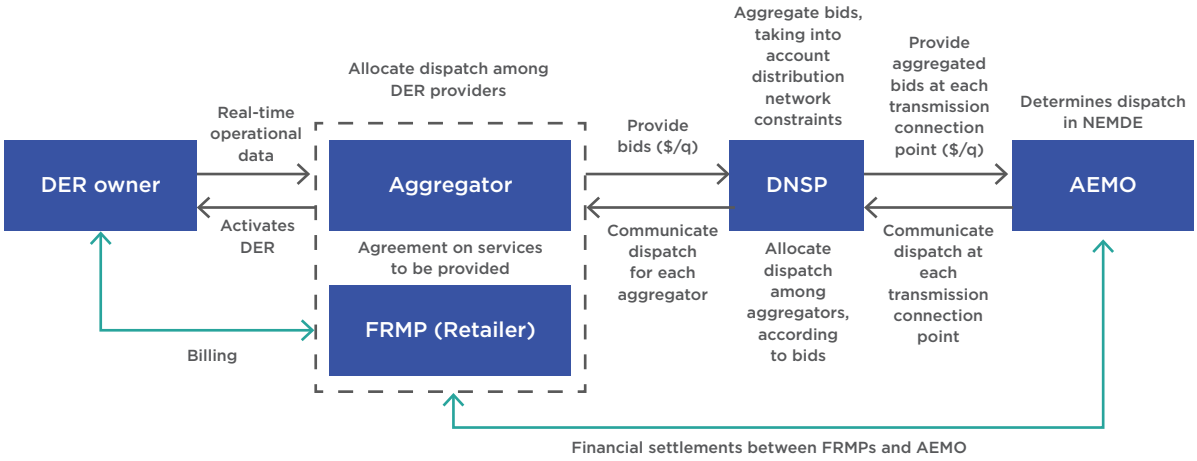
Single Integrated Platform: AEMO central platform



Key characteristics	
Market arrangements	» There is a single central market comprised of wholesale and ancillary services markets (i.e. FCAS, NSCAS and SRAS) that is operated via a central market platform » Market participants, including DER via aggregators/retailers, submit bids and offers for system services to the central market platform which in turn makes them available to AEMO for whole system optimisation
AEMO	» AEMO organises and operates the central market and is responsible for balancing the whole electricity transmission system » AEMO assesses all bids and offers and optimises the dispatch of energy resources considering T-network and D-network constraints » AEMO sends out dispatch instructions to energy resources, including DER via their respective Aggregator/Retailer
DSO	» DNSP receives DER bids from the central market, prequalifies them into aggregated bids and passes them to AEMO for whole system optimisation » The DNSP prequalifies, procures and settles the DER from aggregators/retailers for D-network constraint management via central market platform
Retailer / Aggregator	» Aggregator/retailer combines different DER and offer their aggregated output as flexibility services to the central market platform

Option 2

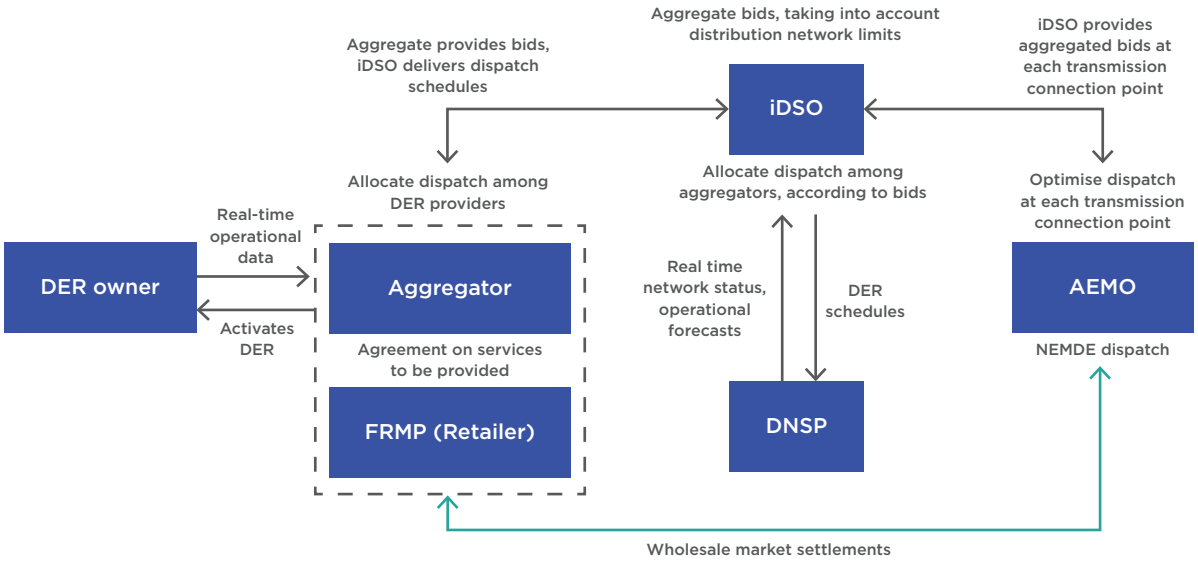
Two Step Tiered Platform: DNSPs optimising distribution level dispatch



Key characteristics	
Market arrangements	» There is a central market comprised of wholesale and ancillary services markets that is operated via a central market platform » There is a local market(s) for regional and national system service provision from DER that is operated via a local market platform
AEMO	» AEMO organises and operates the central market and is responsible for balancing the whole electricity transmission system » AEMO assesses all bids and offers and optimises the dispatch of energy resources considering T-network and D-network constraints » AEMO sends out dispatch instructions to energy resources, including DER via the DNSP and then the respective aggregator/retailer
DSO	» DNSP(s) organises and operates the local market(s) » DNSP receives DER bids and offers from the local market, prequalifiying them into an aggregated bids stack per transmission connection point and passes them to AEMO » The DNSP allocates the dispatch to individual DER based on the power exchange schedule across the T- and D-network boundary optimised by AEMO » The DNSP prequalifies, procures, dispatches and settles the DER from aggregators/retailers for D-network constraint management via the local platform

Option 3

iDSO optimises distribution level dispatch

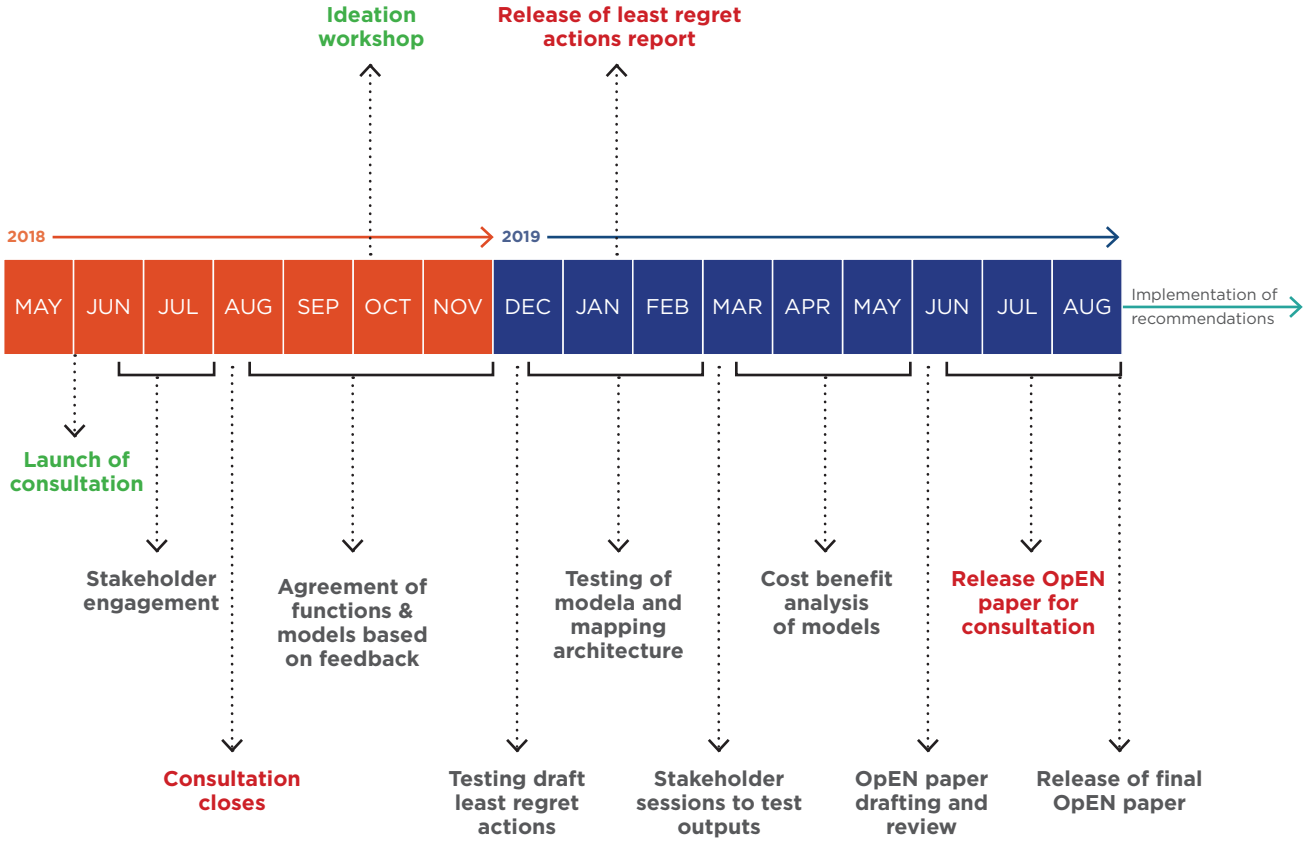


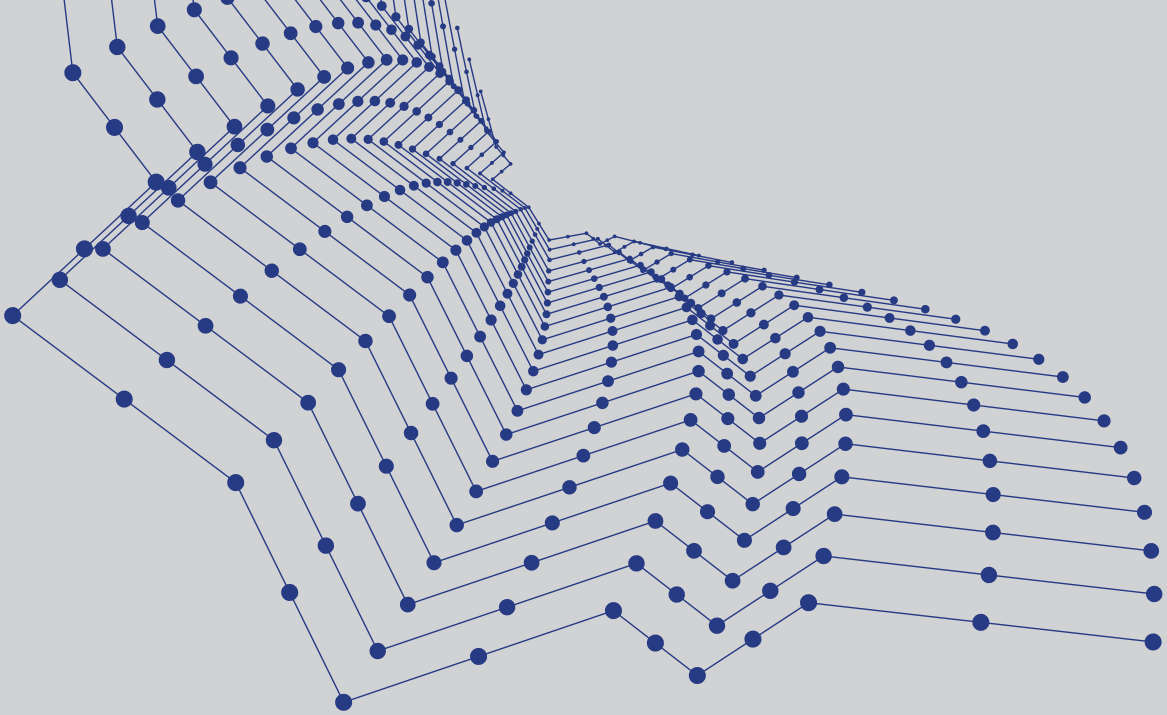
Key characteristics	
Market arrangements	» There is a central market comprised of wholesale and ancillary services markets that is operated via a central market platform » There is a local market(s) for regional and national system service provision from DER that is operated via a local market platform
AEMO	» AEMO organises and operates the central market for balancing the whole electricity transmission system » AEMO assesses all bids and offers and optimises the dispatch of energy resources considering T-network and D-network constraints » AEMO sends out dispatch instructions to energy resources, including DER via the iDSO and then the respective aggregator/retailer
iDSO	» iDSO(s) organises and operates the local market(s) » iDSO(s) receives DER bids and offers from the local market; prequalifies them into an aggregated bids and passes them to AEMO for whole system optimisation » iDSO(s) allocates the dispatch to individual DER based on the power exchange schedule across the T- and D-network boundary optimised by AEMO
DNSP	» The DNSP actively exchanges relevant network information with the iDSO(s) to account for D-network constraints in AEMO's dispatch process » The DNSP procures and settles the DER from aggregators/retailers for D-network constraint management via the local market platform

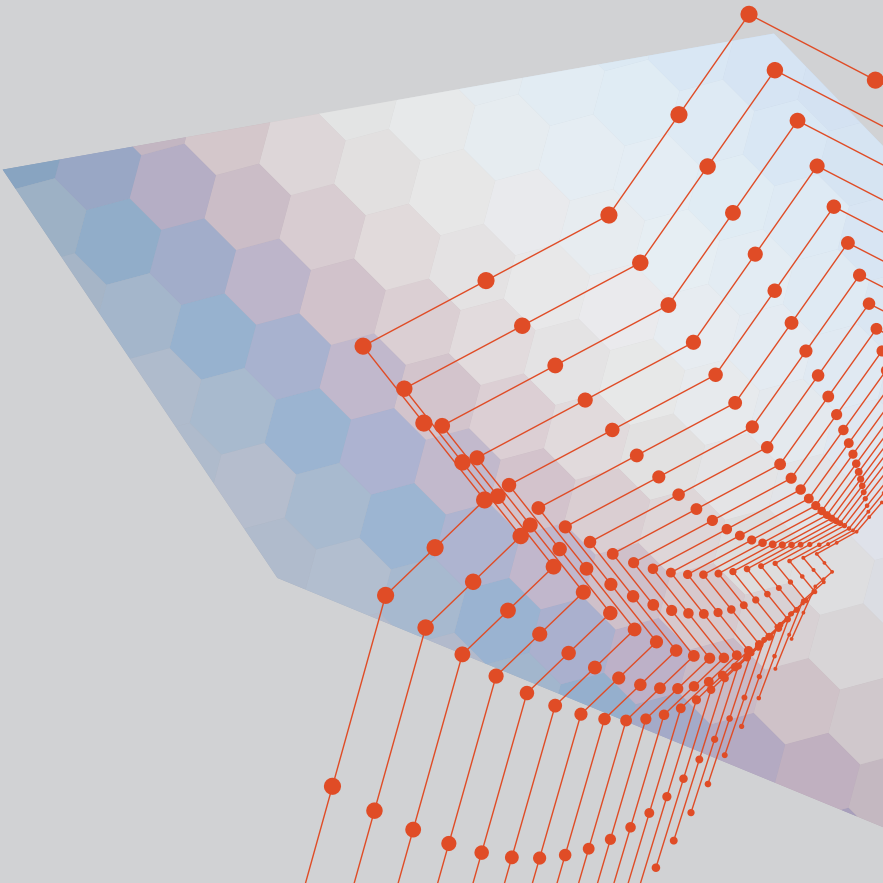
Least regret actions identified by stakeholders

Function	Key areas of least regret
System coordination	» Establish better coordination across the system (i.e. planning and forecasting) » Review current regulatory framework for flexible service provision » Establishment of 'operating envelopes'
Network operation	» Establish real time network monitoring for thermal and voltage excursions » Activation of flexibilities and smart grid solutions
Investment planning	» Traditional investment planning
Connections and connection rights	» Development of a DER Register » Development of standard connection agreements (flexible) » Regulatory review of connection rights
System security and restoration	Establish trials and systems that allow DER to be used for issues such as: » Black Start » Islanding » Voltage reduction
Services and market facilitation	» Assess requirements for flexibility services including procurement, activation, conflict mitigation and resolution
Service optimisation	» Review regulatory frameworks for market failure and last resort measures » Development of standards (interoperability, communications, data, cyber)
Charging	» Establish requirements for exchange of information to determine market charges and flexibility resources. » Establish trials in regard to tariff/pricing reform
Customer engagement	» Develop key messaging and engagement strategies on optimisation (I.e. benefits/value)

Full project timeline







AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

Energy Networks Australia