



Open Energy Networks Project:

How best to transition to a two-way grid that allows better integration of DER to deliver better outcomes for all customers

Energy Networks Australia & the Australian Energy Market Operator (AEMO)

July 2018



Workshop Ground Rules

Logistics & Safety



Emergency procedure...



Morning / Afternoon Tea –outside the conference room



Lunch – on site



Toilets – outside the conference room to your left/right



Workshop materials can be emailed

Workshop Ground Rules



Full Agenda

Stick to schedule yet flex as necessary



Outcome Focused

Focus on clear outcomes and seek clear insights from the group



Open Engagement

Inquire by asking questions
Building by using AND instead of BUT
Challenging by using 'What if'
Creating by using 'How might we'



Formal Response

Everyone has the opportunity to respond formally

Important Notices

- These slides are solely for workshop purposes only. The contents have been designed to foster a diversity of thinking about future possibilities in Australia. They do not represent the official position of either the Energy Networks Australia or AEMO.
- ‘Chatham house’ rules apply
- Competition and Consumer Act provisions apply
- Participants to make their own call on sharing commercially sensitive material

'Open Energy Networks' Project - Workshop Agenda

10:00 – 10:15

Welcome & Introduction to the Workshop

10:15 – 11:00

Session 1: Context

- Grid Purpose, Characteristics & Challenges
- Pathways for DER to Provide Value

11:00 – 12:00

Session 2: Maximising DER Potential

- Passive DER
- Active DER

12:00 – 12:30

Session 3: Functionality Required & Actions

- Explore functionality required to deliver future frameworks
- Explore Actions required to deliver functions

12:30 – 1:15

Lunch

1:15 – 1:45

Session 3: continued

1:45 – 3:00

Session 4: Frameworks for DER Optimisation

- Exploring possible framework options for DER optimisation

3:00 – 3:10

Afternoon Tea

3:10 – 3:50

Session 5: Immediate Actions Required

- Revisit actions to identify possible “no regrets” actions

3:50 – 4:00

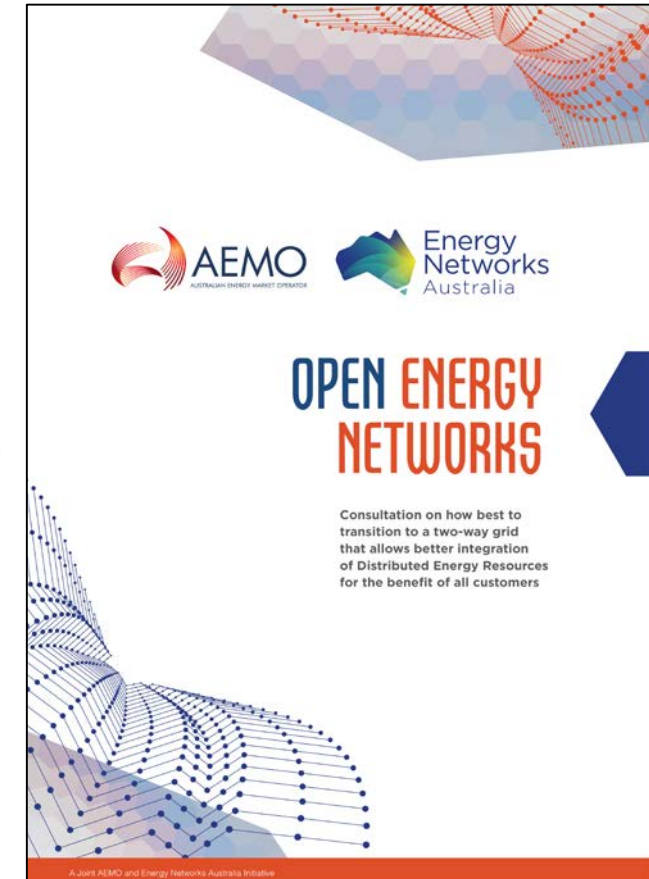
Workshop Wrap up & Close

- Summarise day and next steps



Consultation Purpose – Why are we doing this?

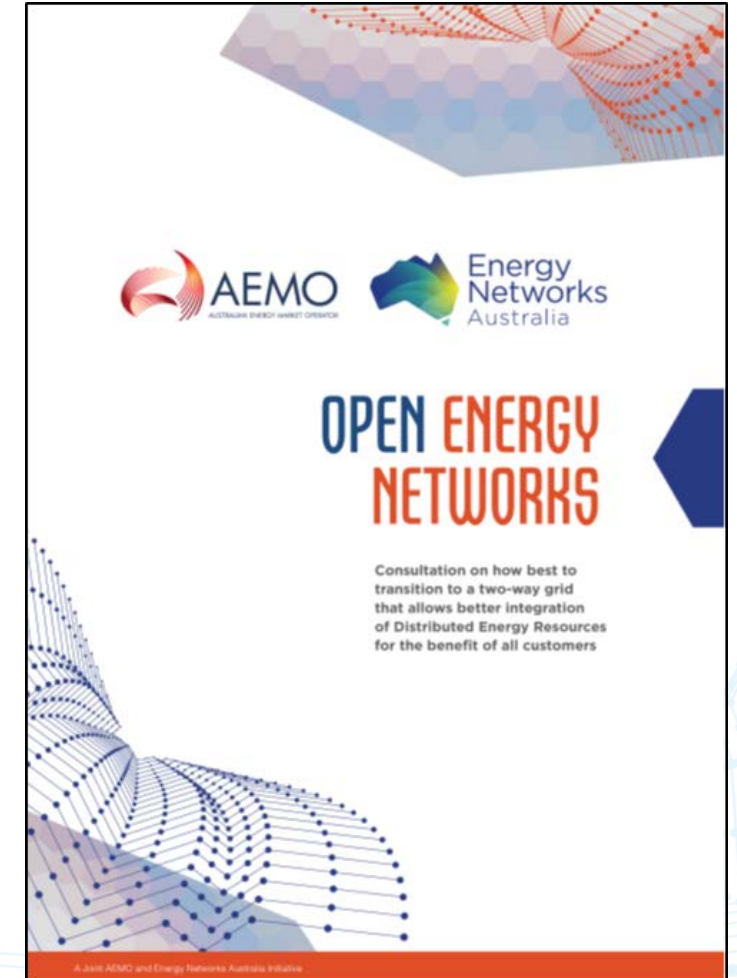
Evolution



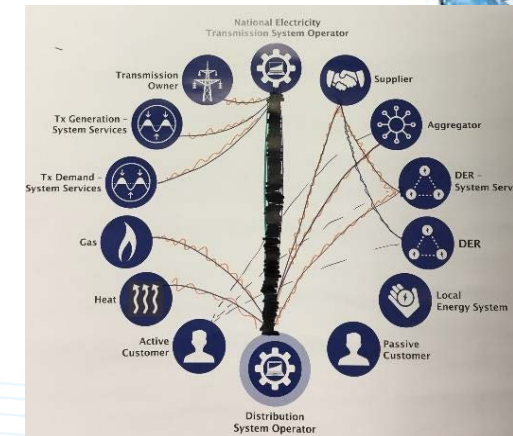
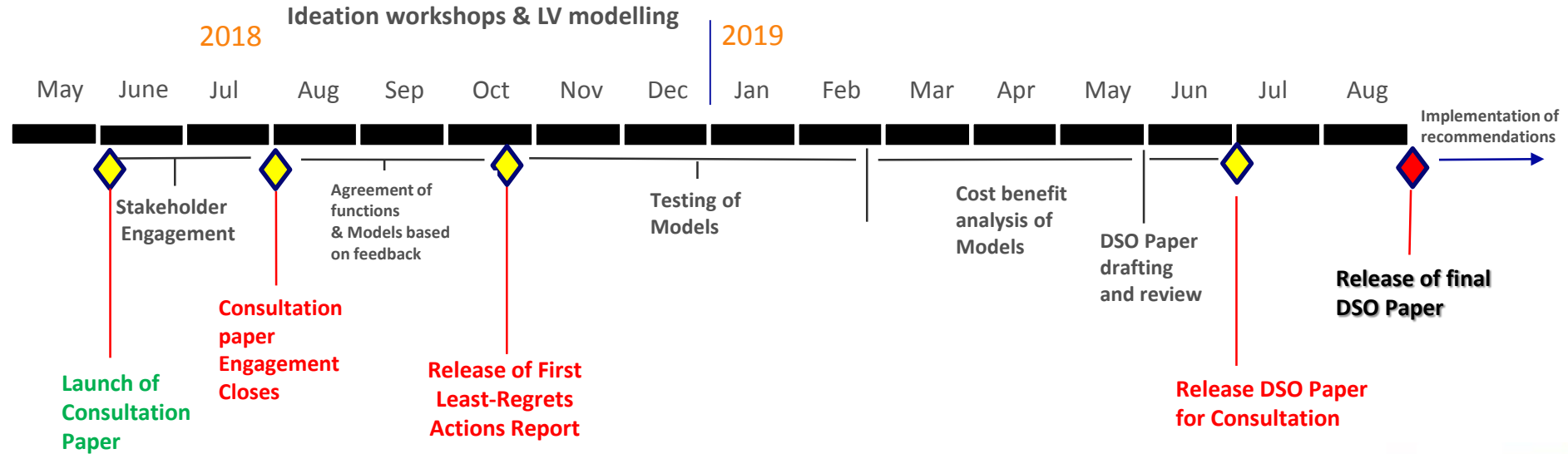
The Roadmap identified that if DER could be optimised and coordinated properly across the system, significant value could be released for all stakeholders

“Open Energy Networks” - Purpose

- The purpose of this paper is to explore with all stakeholders on how to best facilitate the entry of DER into the market.
- Our objective is to identify both the system requirements that must be addressed in the optimisation of DER connected to the distribution system, and to obtain a better understanding from traditional and new market participants how from a network and market operator perspective, we can reduce barriers to entry into the system and best facilitate innovation and competition at the grid edge.
- Consultation extended to the 10 August 2018



Development Plan for the DSO Paper

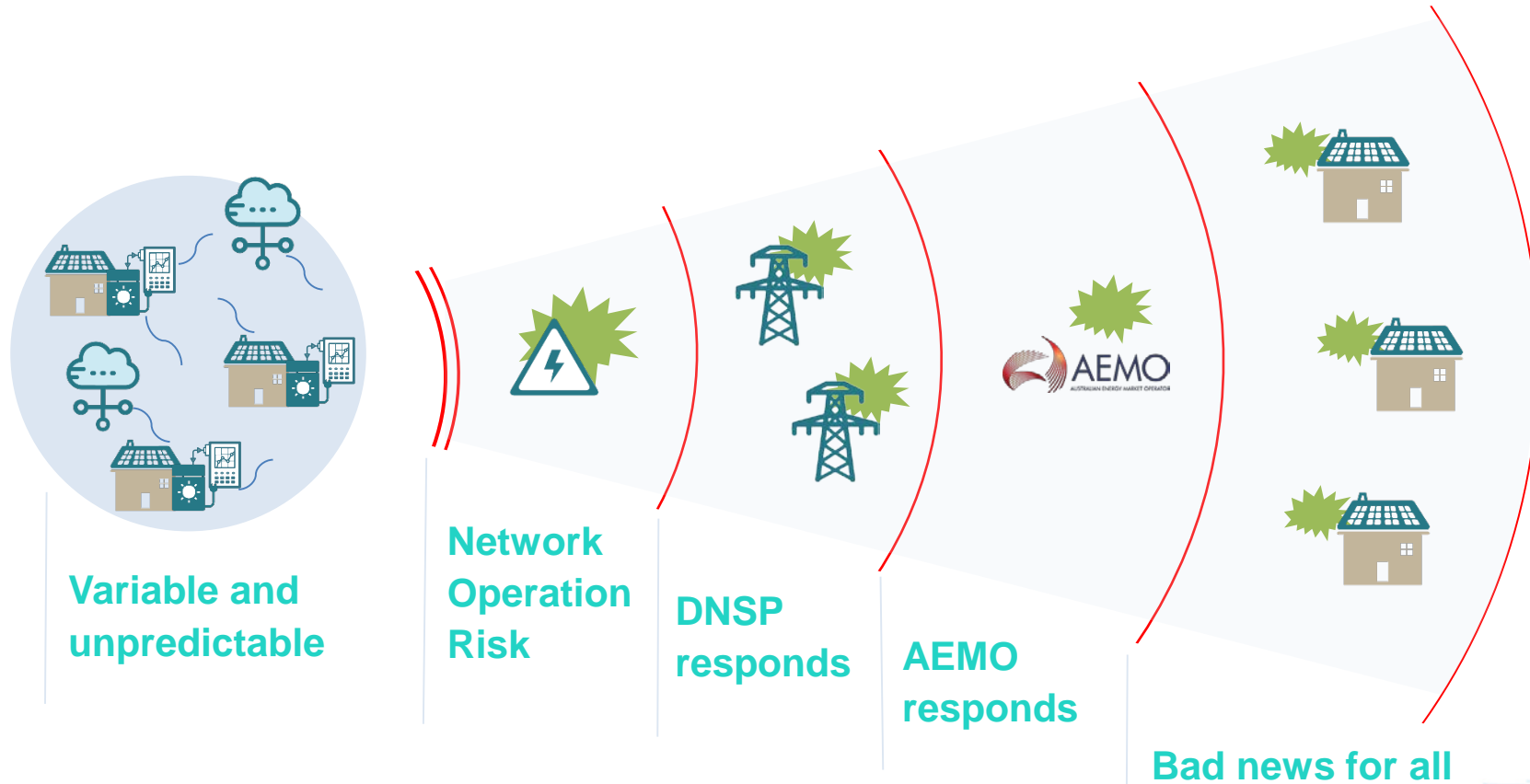


OpEN Project Engagement Principles

General Principles

- Stakeholders will be provided with opportunities to reflect upon, contribute to and provide feedback on all stages of the project.
- A summary of the stakeholder feedback received will be made available.
- A diversity of legitimate perspectives will be considered on all topic areas to inform the projects key outcomes and deliverables.
- As a process involving a wide range of stakeholders, all participants are expected to engage respectfully, proportionately and in good faith
- While placing a high priority on the principle of co-design and the pursuit of consensus, Energy Networks Australia and AEMO also recognise that not all stakeholders will agree with all decisions made or content developed.

Get Acceptance on why Distributed Energy Resources (DER) have to be optimised



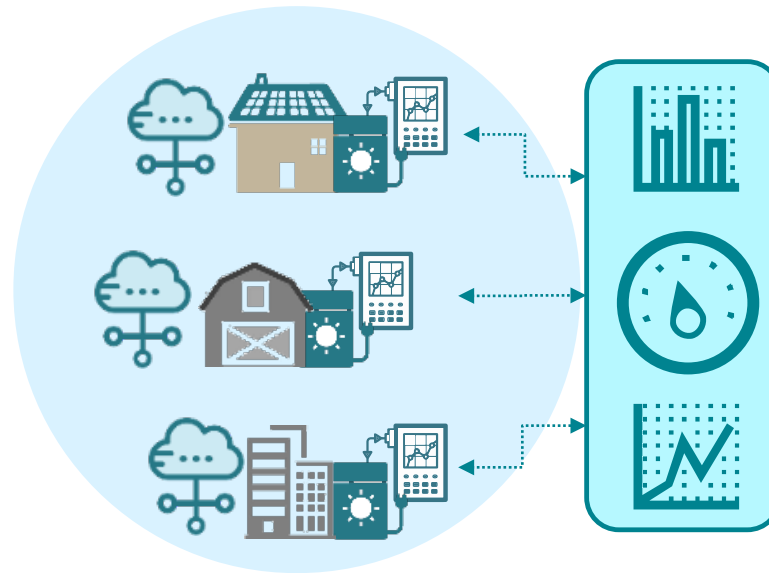
Exploration of how we could Realise the Greatest Positive Outcomes for Customers if we Optimise DER

WHAT IF



We had better network state information

THEN WE COULD



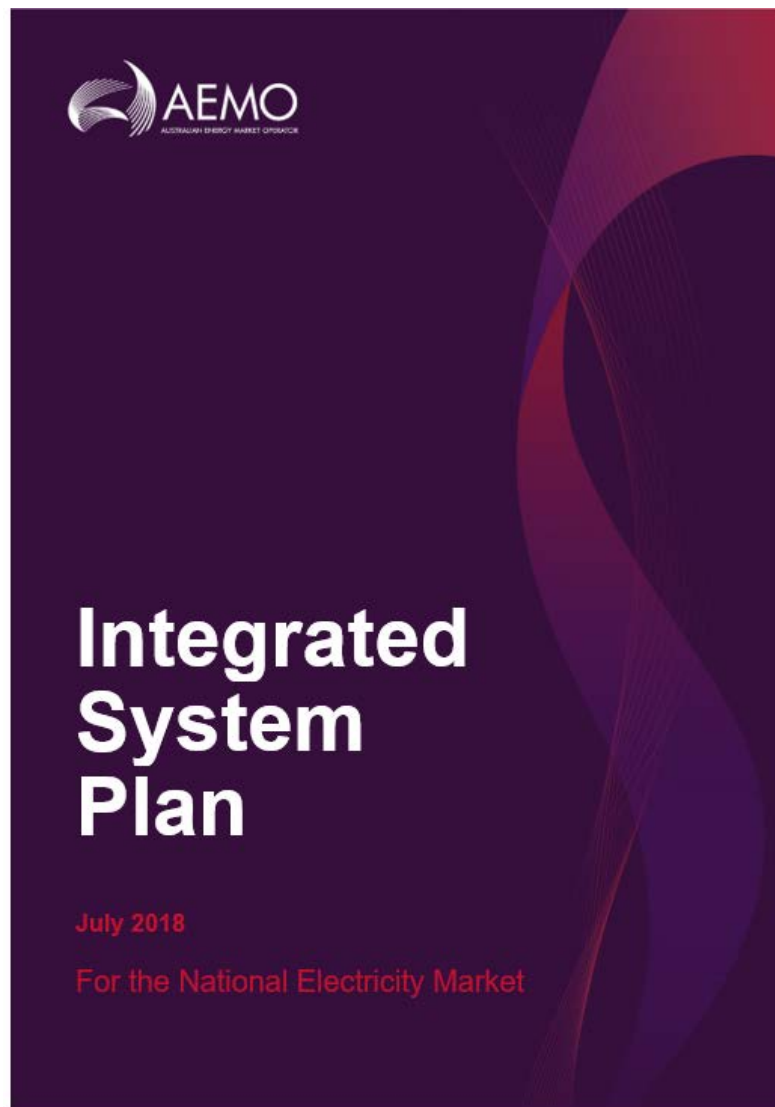
Optimise DER & increase benefits and value

LEADING TO



Better outcomes for all stakeholders and Customers

Passive to Active DER – Integrated System Plan



- AEMO has published the inaugural Integrated System Plan (ISP)
- The ISP includes scenario planning including a High DER scenario which provides system wide benefits
- There are system challenges in high DER environment including forecasting, system operations and planning
- The challenge is to channel the investment customers are making in DER to create system wide benefits
- Customer incentives to activate DER are key

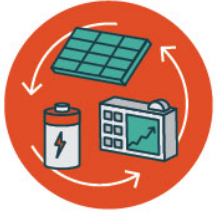


Session 1: Context

Session Objectives

- Set the context
- Articulate the challenges of integrating DER
- Articulate the potential benefits of DER
- Discuss why effective coordination of DER is important

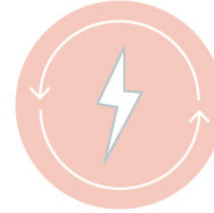
CHANGES IN THE CURRENT LANDSCAPE



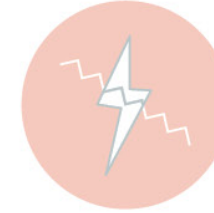
Customers embrace new technologies such as rooftop solar, storage (e.g. batteries) and electric vehicles and more actively manage their energy use



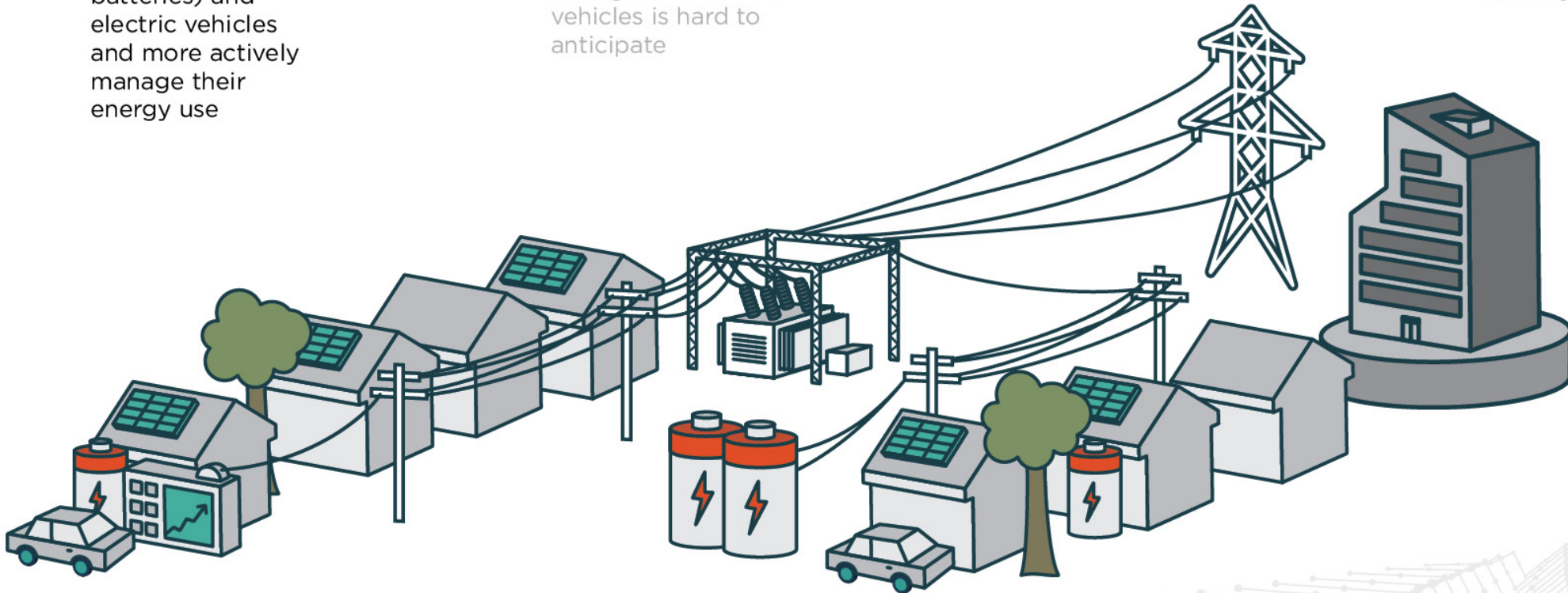
Solar and storage use grows at a rapid rate. Behaviour of solar, storage and electric vehicles is hard to anticipate



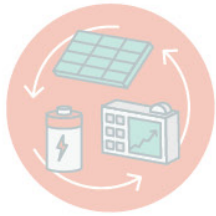
Power flow is now in two directions



Local network challenges can exceed network limits and cause risks to system security



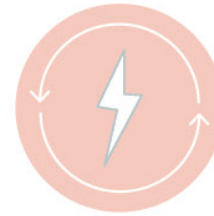
CHANGES IN THE CURRENT LANDSCAPE



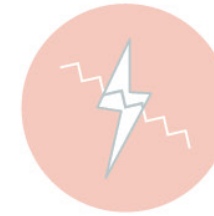
Customers embrace new technologies such as rooftop solar, storage (e.g. batteries) and electric vehicles and more actively manage their energy use



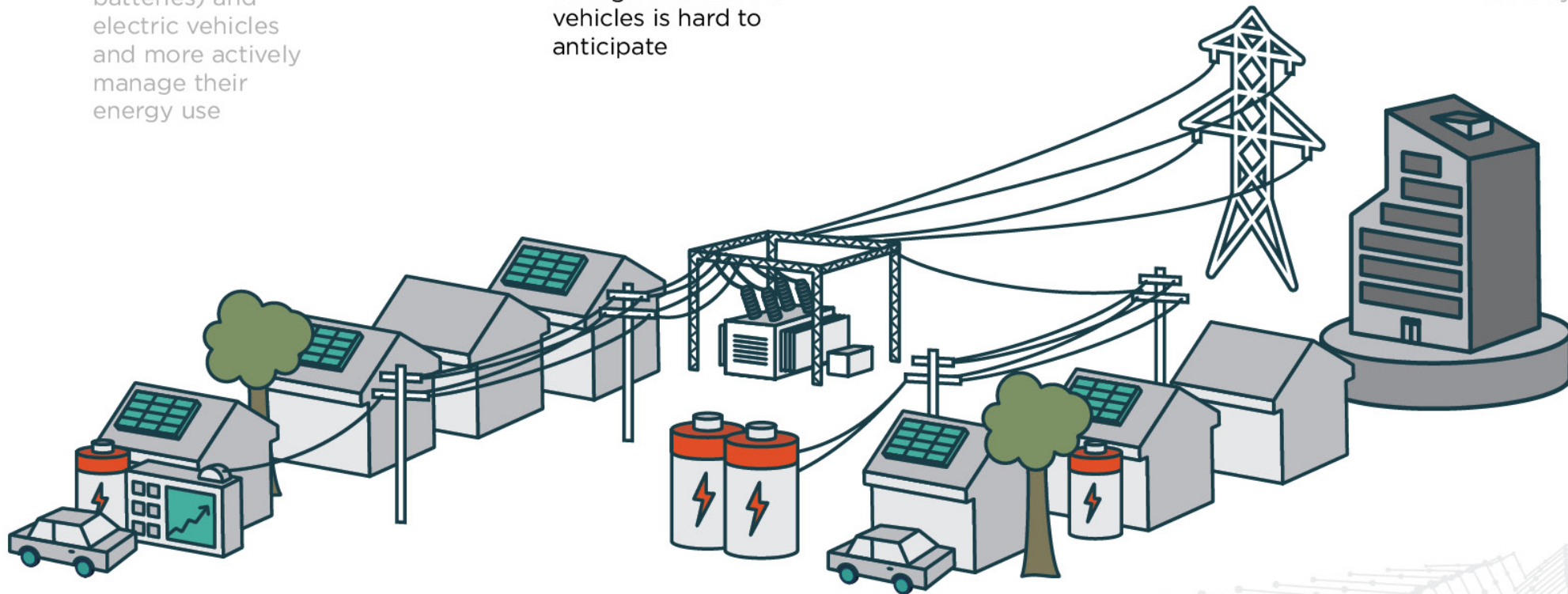
Solar and storage use grows at a rapid rate. Behaviour of solar, storage and electric vehicles is hard to anticipate



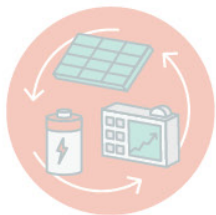
Power flow is now in two directions



Local network challenges can exceed network limits and cause risks to system security



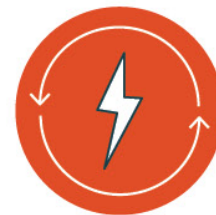
CHANGES IN THE CURRENT LANDSCAPE



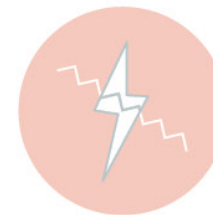
Customers embrace new technologies such as rooftop solar, storage (e.g. batteries) and electric vehicles and more actively manage their energy use



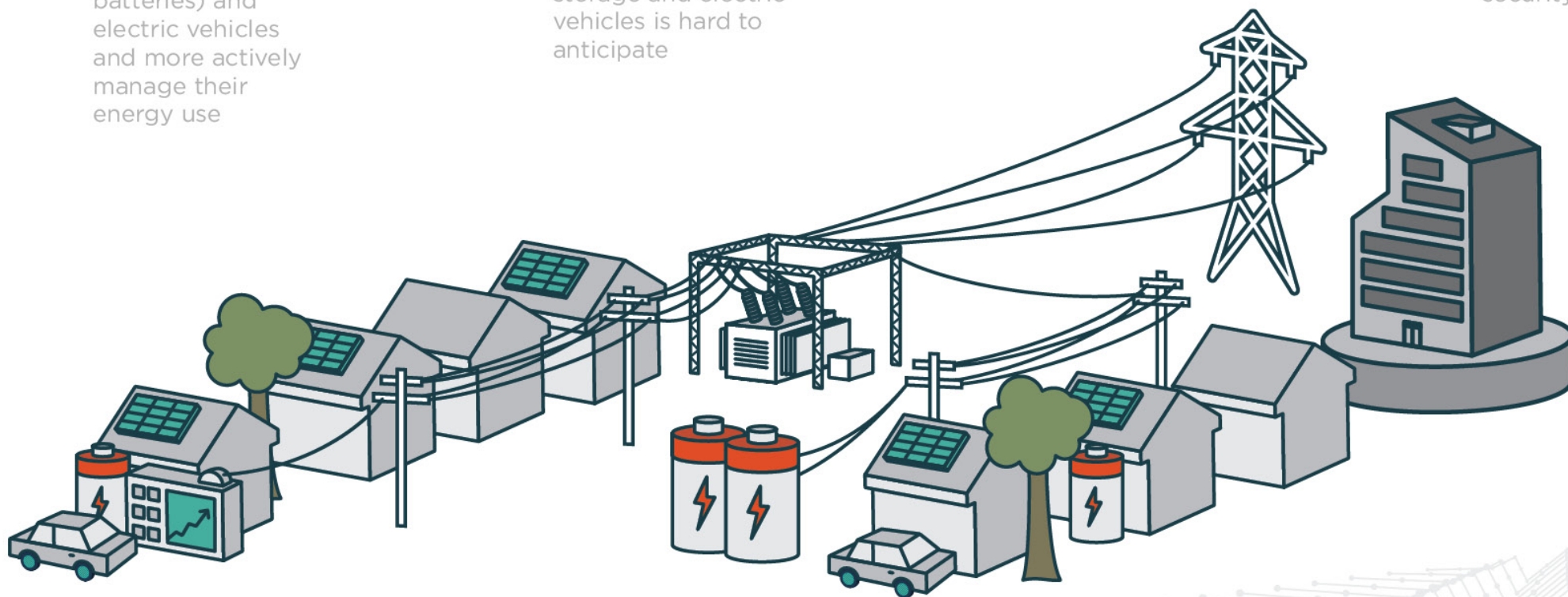
Solar and storage use grows at a rapid rate. Behaviour of solar, storage and electric vehicles is hard to anticipate



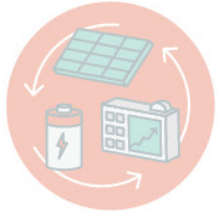
Power flow is now in two directions



Local network challenges can exceed network limits and cause risks to system security



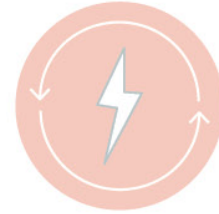
CHANGES IN THE CURRENT LANDSCAPE



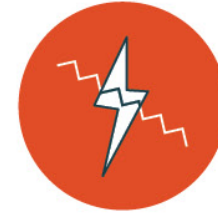
Customers embrace new technologies such as rooftop solar, storage (e.g. batteries) and electric vehicles and more actively manage their energy use



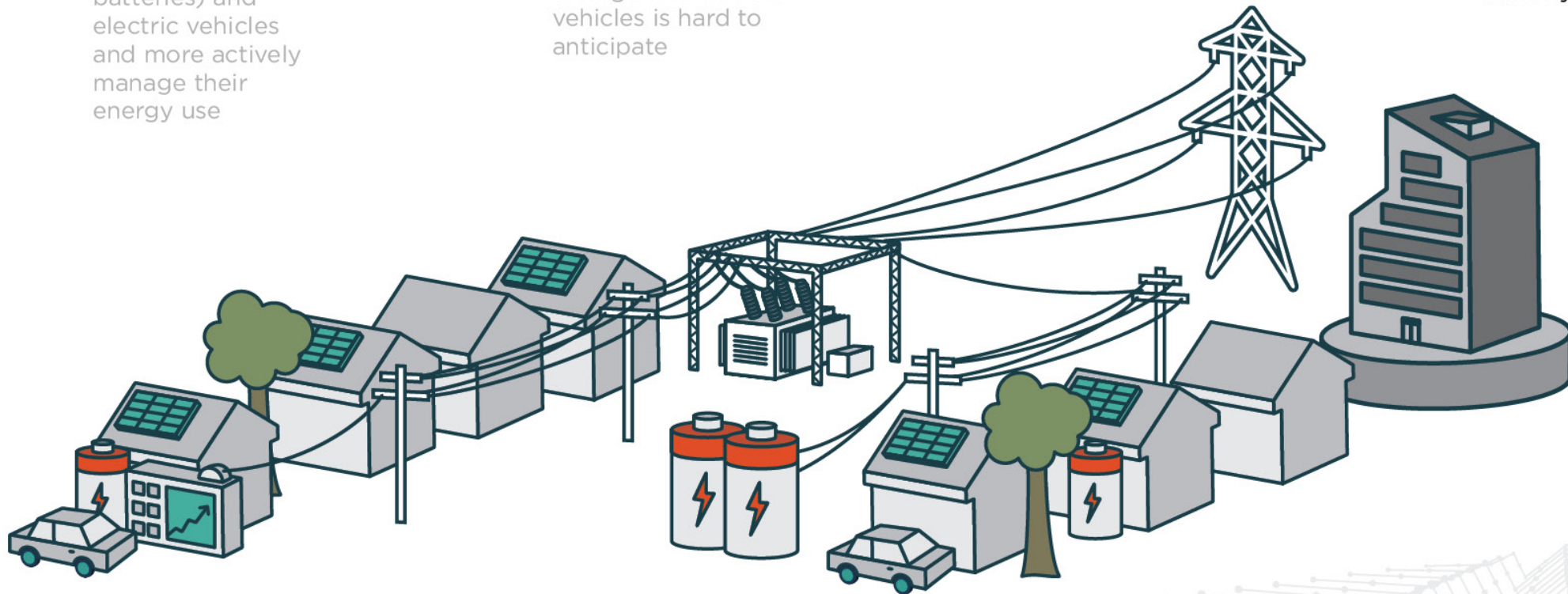
Solar and storage use grows at a rapid rate. Behaviour of solar, storage and electric vehicles is hard to anticipate



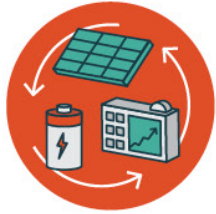
Power flow is now in two directions



Local network challenges can exceed network limits and cause risks to system security



CHANGES IN THE CURRENT LANDSCAPE



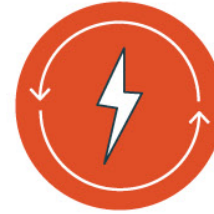
Customers embrace new technologies

such as rooftop solar, storage (e.g. batteries) and electric vehicles and more actively manage their energy use

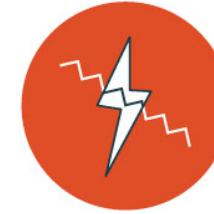


Solar and storage use grows at a rapid rate.

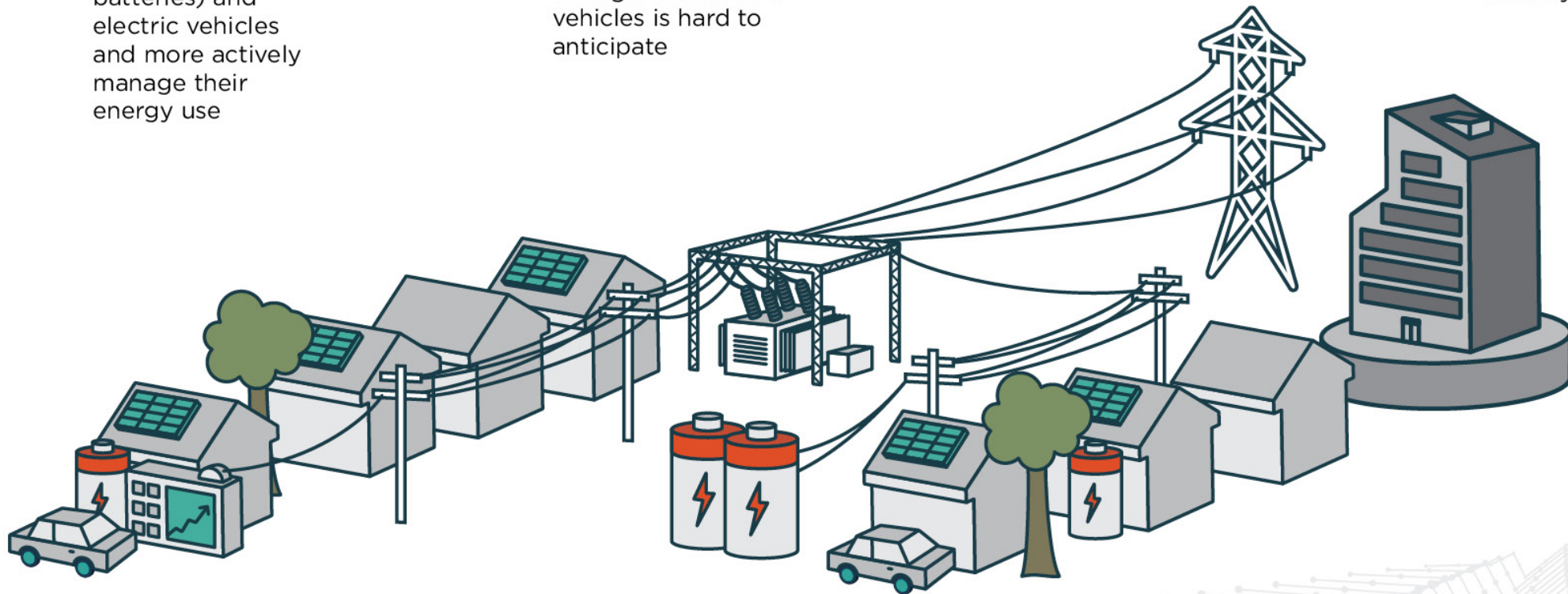
Behaviour of solar, storage and electric vehicles is hard to anticipate



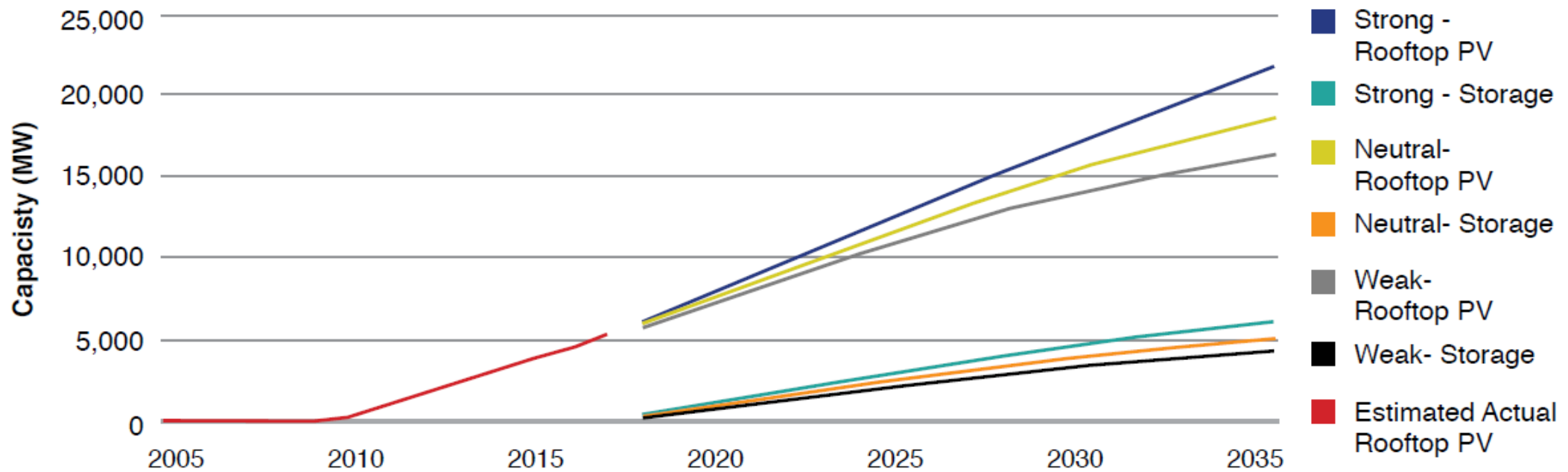
Power flow is now in two directions



Local network challenges can exceed network limits and cause risks to system security

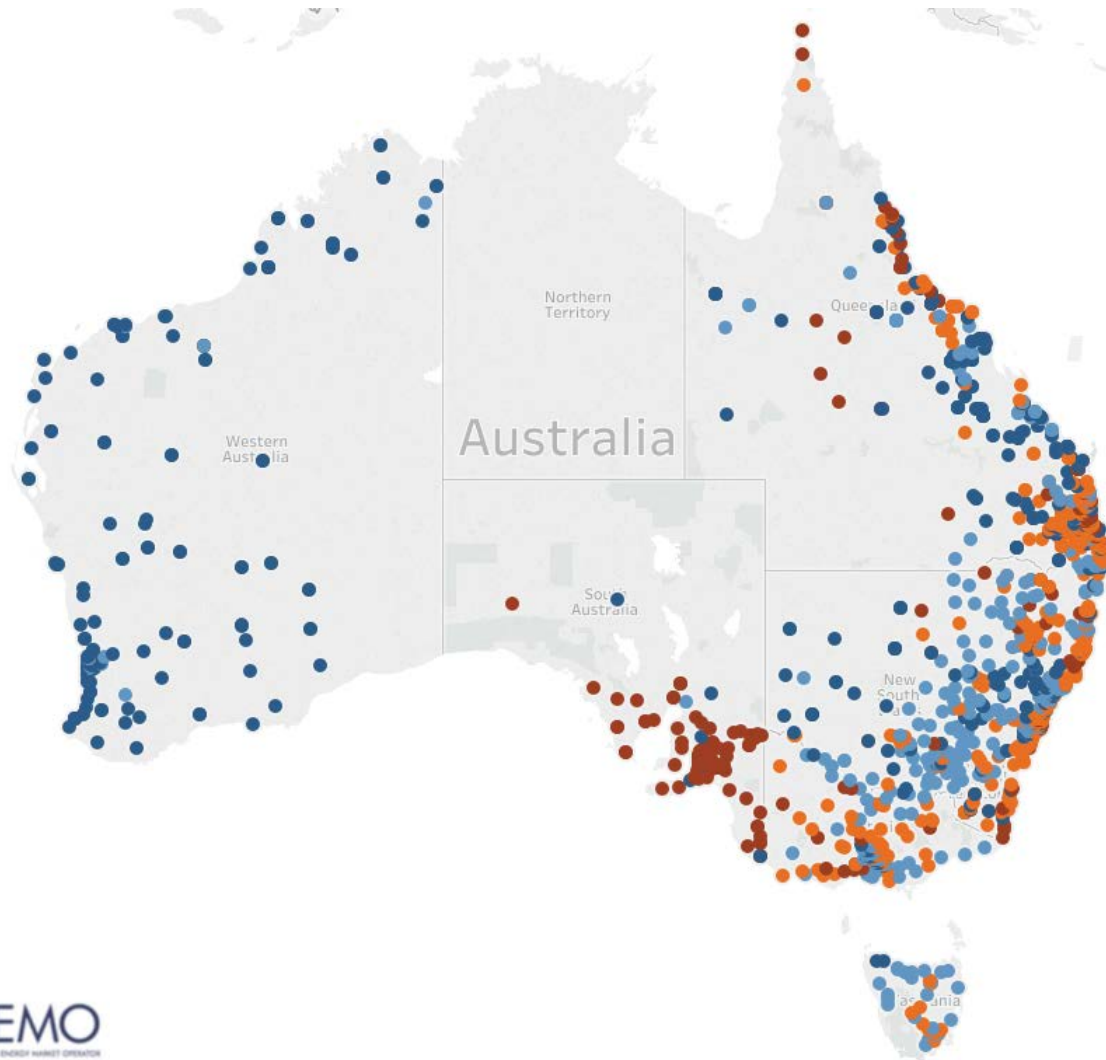


Consumer preferences – growth of DER in the NEM

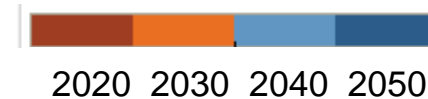


Regional Modelling: Distributed energy resources adoption

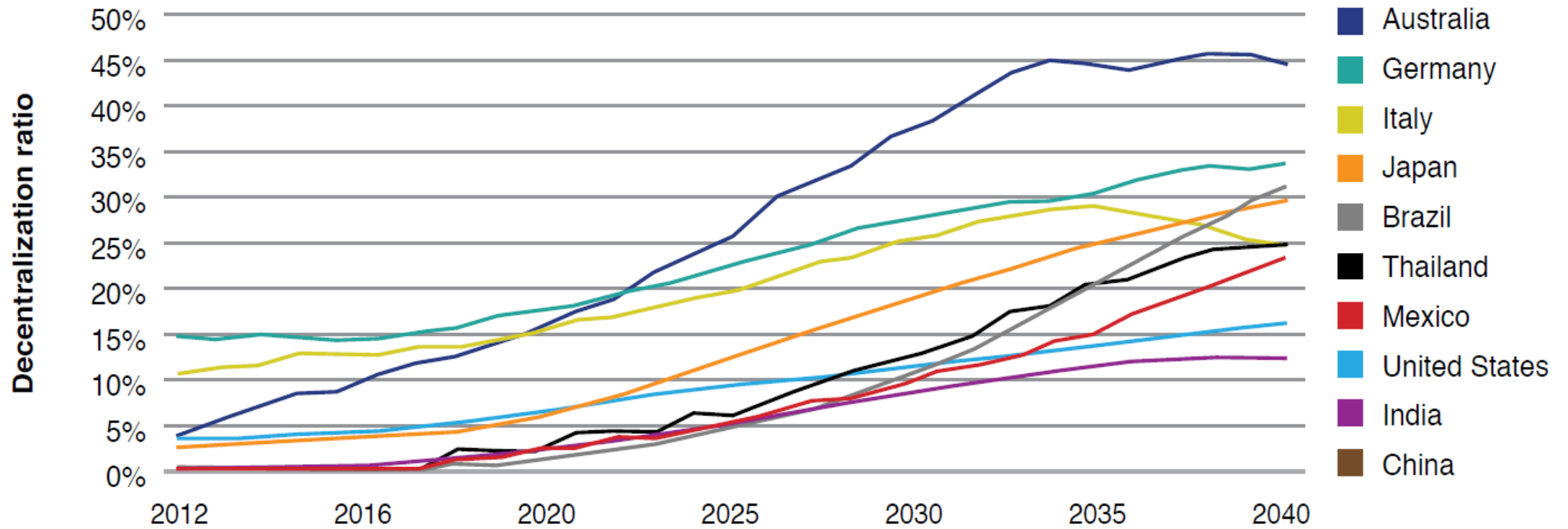
While South Australia is most at risk of reverse power flow associated with high rooftop solar adoption, other states, or particular substations within a state, are expected to follow over time, making it a growing national issue.



Projected decade in which each zone substation will reach a threshold penetration of rooftop solar adoption (40%) indicative of reverse power flow



A Changing World



High-DER network management challenges

Initial analysis has identified the following challenges:

System/operational challenges:

- managing a changing and passive demand profile,
- DER generational levels exceeding secure system limits,
- response to disturbances,
- emergency frequency control mechanisms, and
- DER visibility for operational and planning purposes.

Distribution network challenges:

- Maintaining power quality and network voltages.
- DER will increasingly exceed the limits of network components - reverse power flows

Need for integration of DER – Benefits

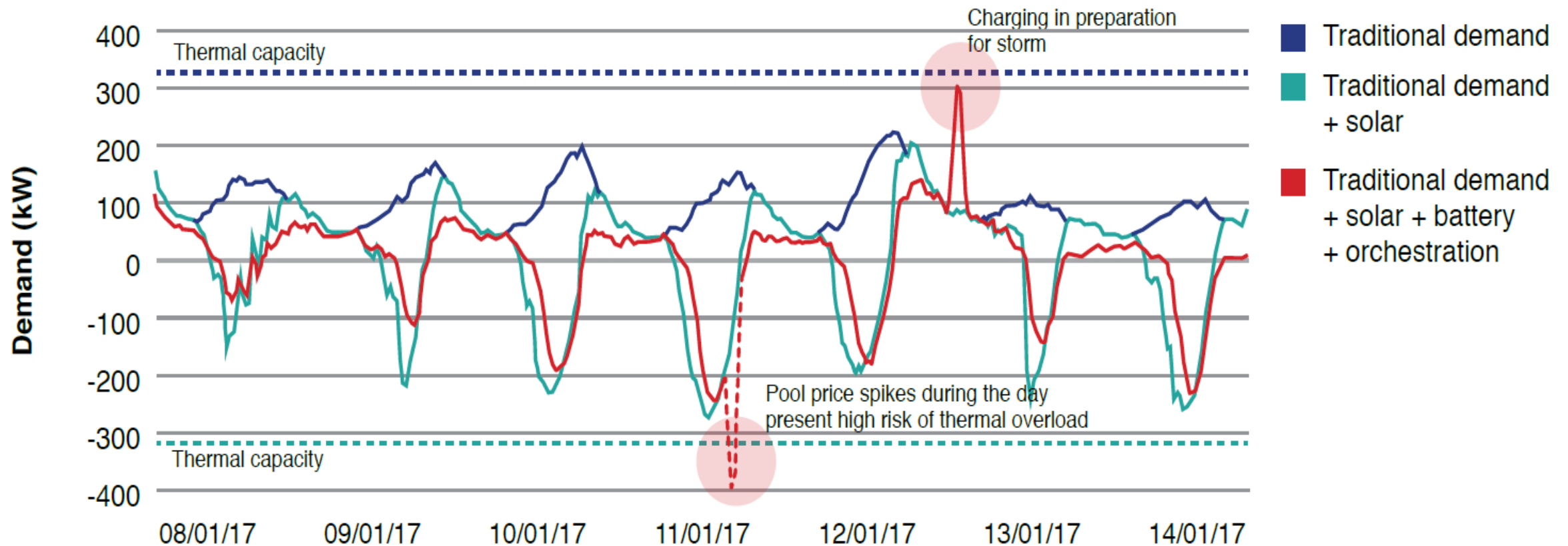
The optimisation and coordination of DER at the distribution level could provide a number of benefits. These include:

- Efficiencies to the system,
- Improved system utilisation, and
- Customers being able to exchange value with the grid.

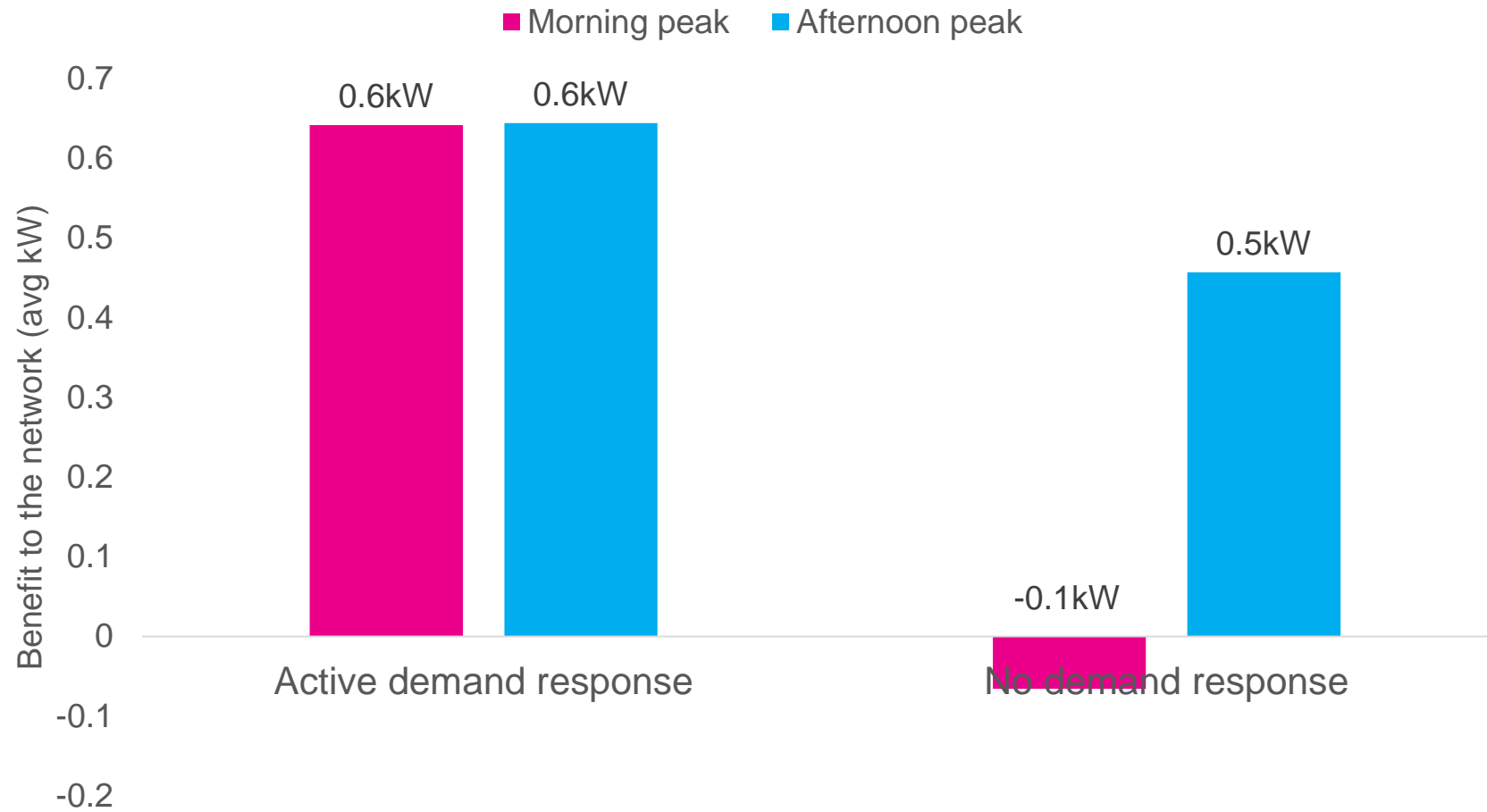
This value would be provided, through:

- Reduced requirements to build additional generation capacity
- Network solutions to deal with changes in demand, and
- providing customers with better value for the DER investments through access to new markets (i.e. Wholesale market, access of demand management services, and potential to establish local markets)

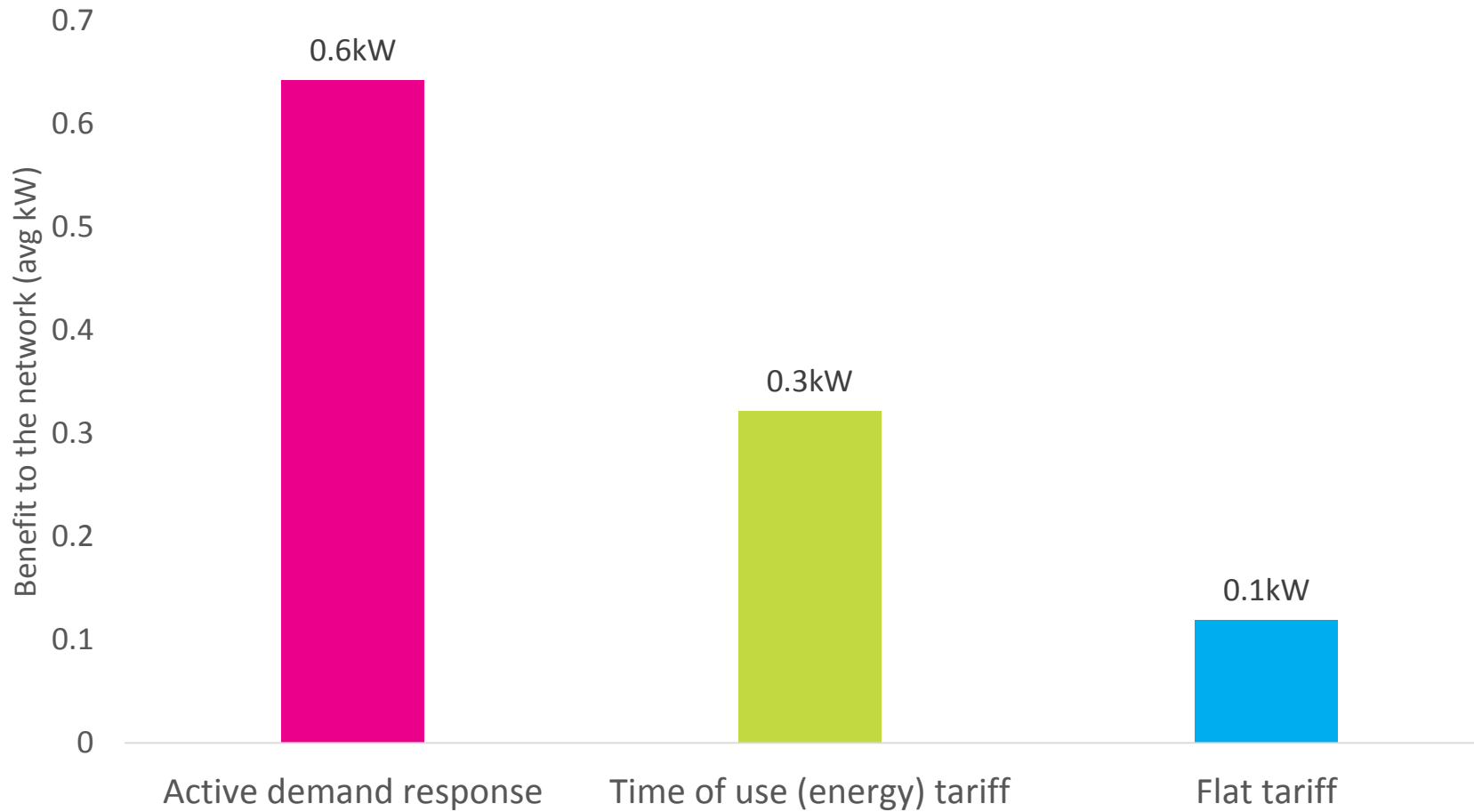
VPP impacts on Network Flows: SAPN Salisbury battery trial



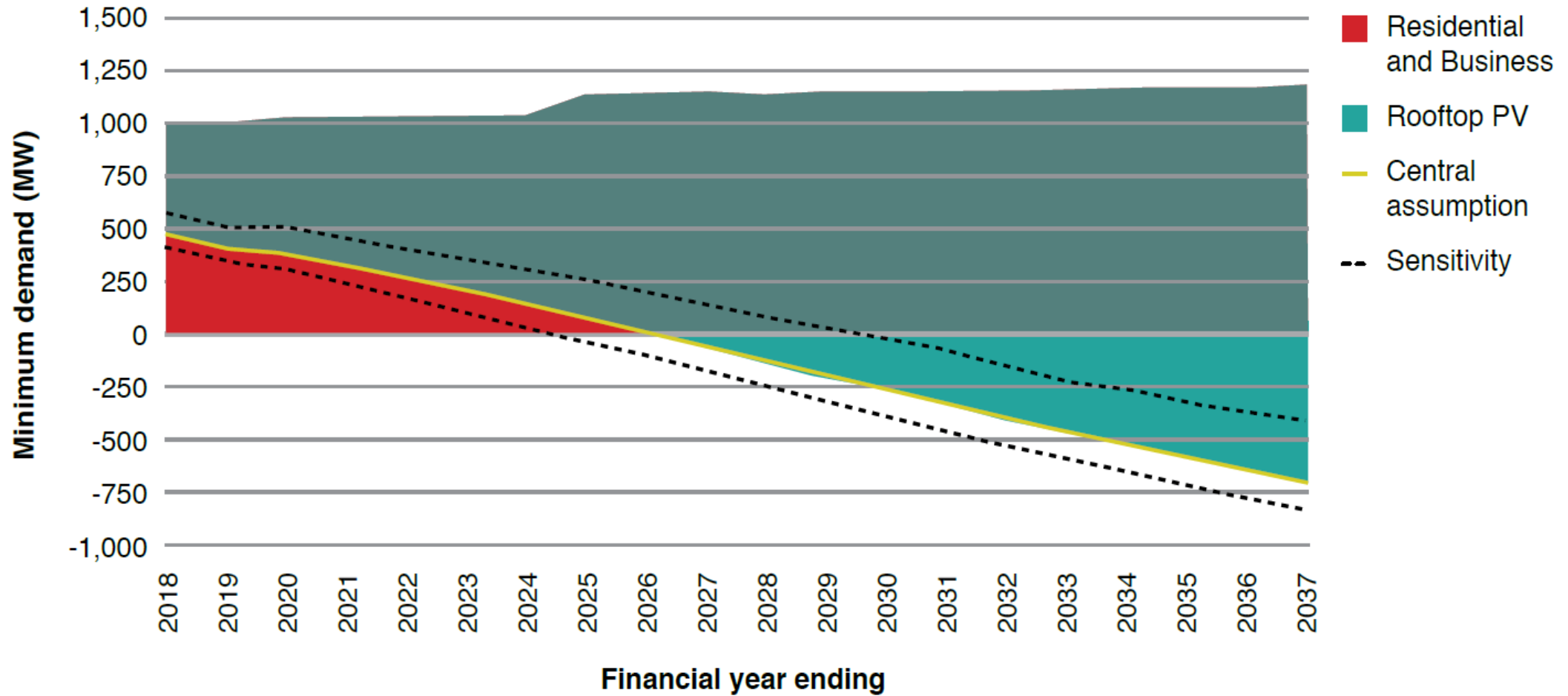
Time of day is important... - Bruny Island



Why do we need control? – Bruny Island



Security of Supply Issues



Key Definitions

DSO - Distribution System Operator

Distribution System Operator; this term has been used to refer to the functions of Distribution Level coordination and optimisation of multiple DER aggregators in multiple markets operating at distribution level.

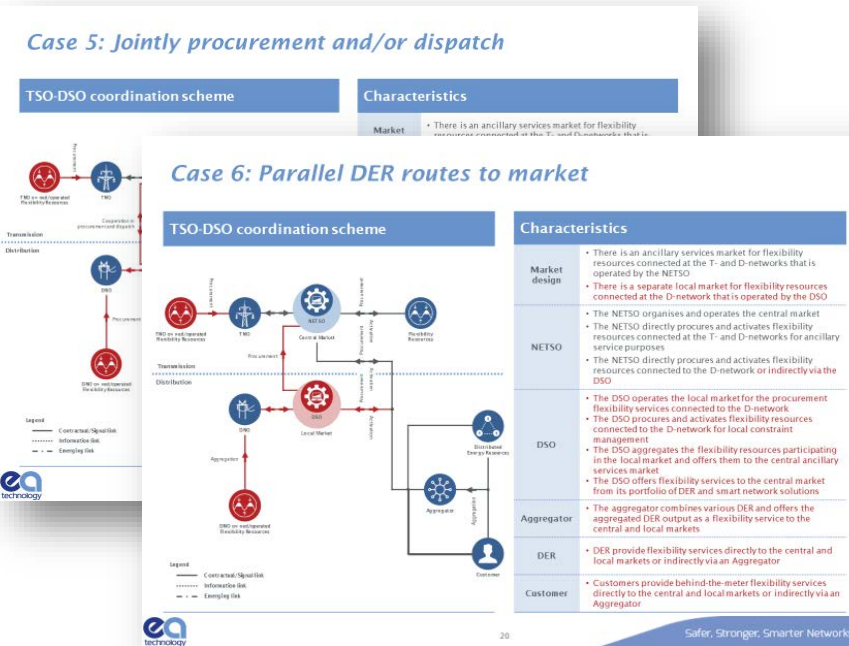
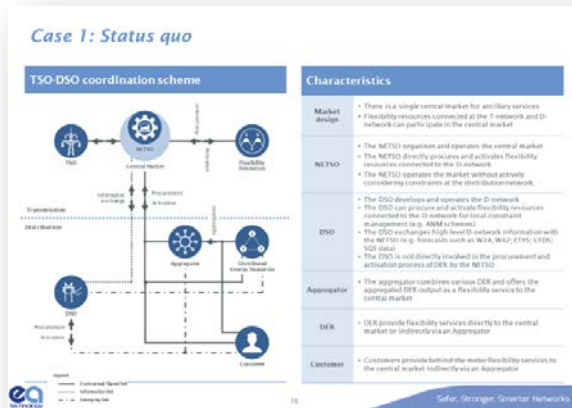
Optimisation

Aggregation and prioritization of distribution level bids and offers; in other global markets also known as “orchestration”.



Potential Future 'Worlds'

- It is critical to define what the potential future worlds might look like
- There are many variants of this



- Any of these futures could be made to work, but they require differing levels of change in terms of:

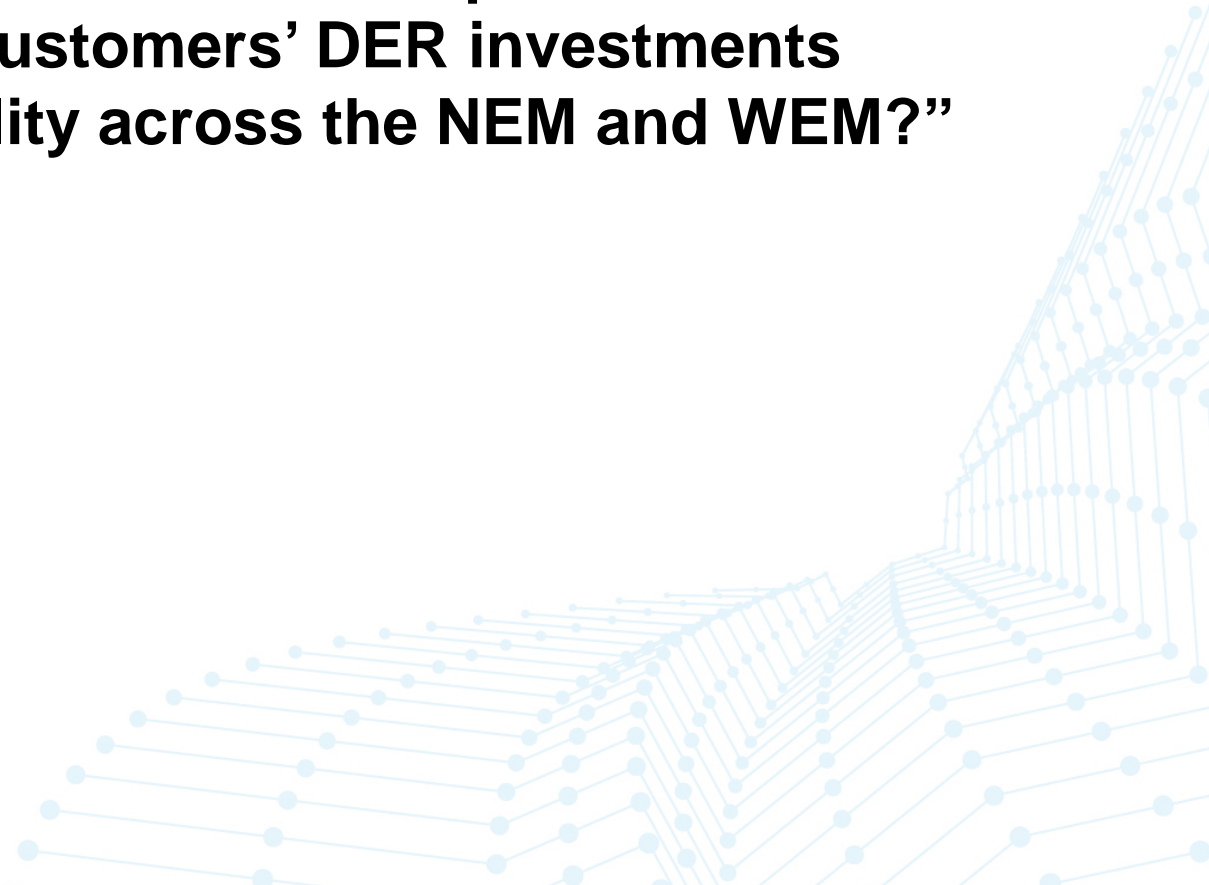
Technical

Commercial

Regulatory

The key question we would like all stakeholders to consider

“What new capabilities, functions and roles will be required to coordinate and optimise the value of customers’ DER investments whilst maintaining security and reliability across the NEM and WEM?”



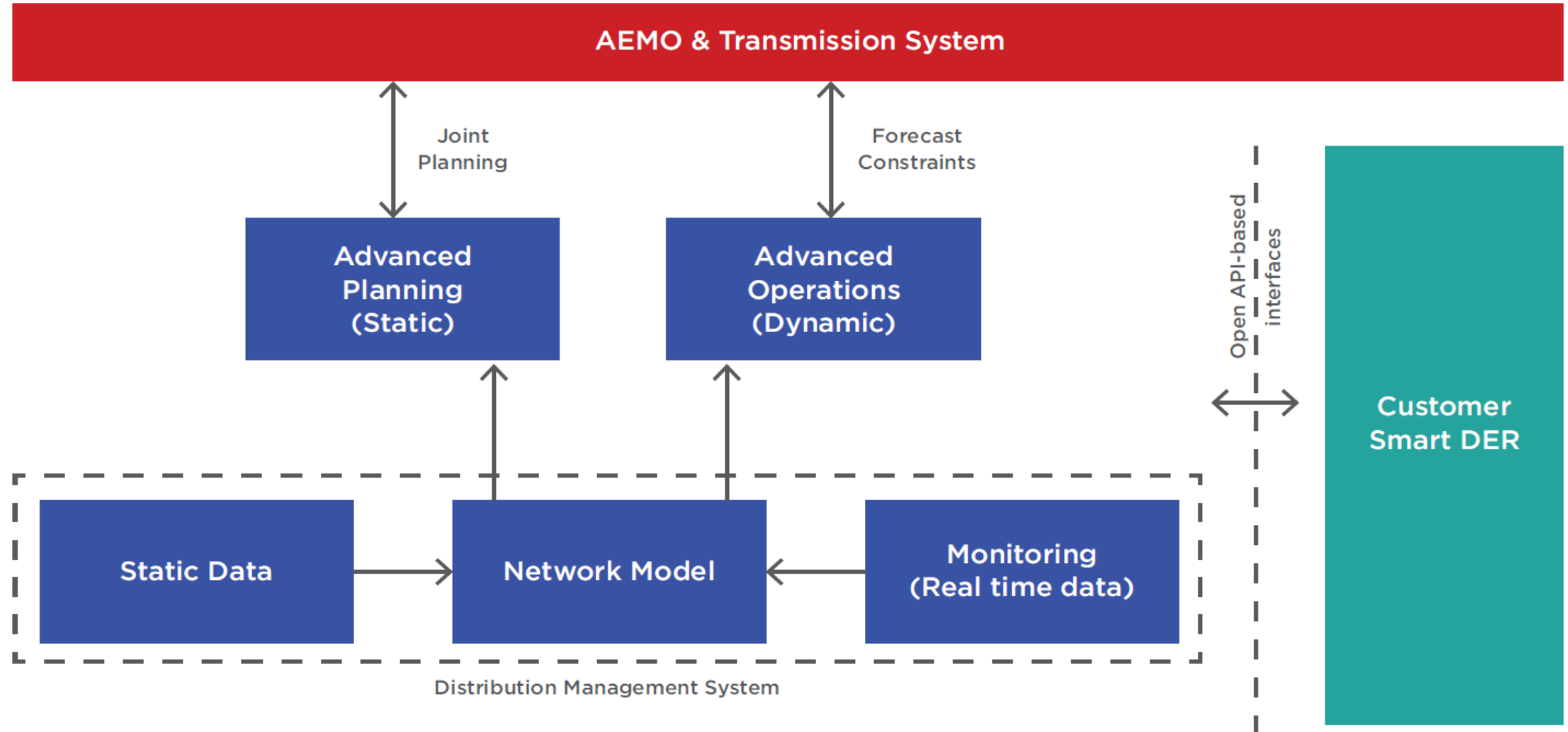


Session 2: Maximising DER Potential

Session Objectives

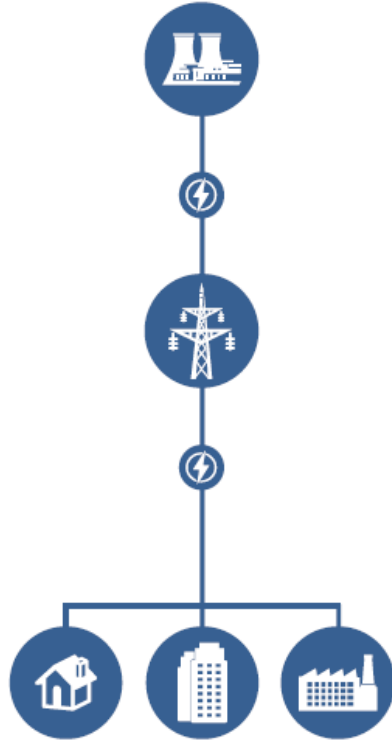
- Outline how we could maximise the value of DER
- What are the limitations with the current framework
- Identification of path-ways for DER to be released to provide that value
- How do we transition Passive DER to Active DER

The Current Framework



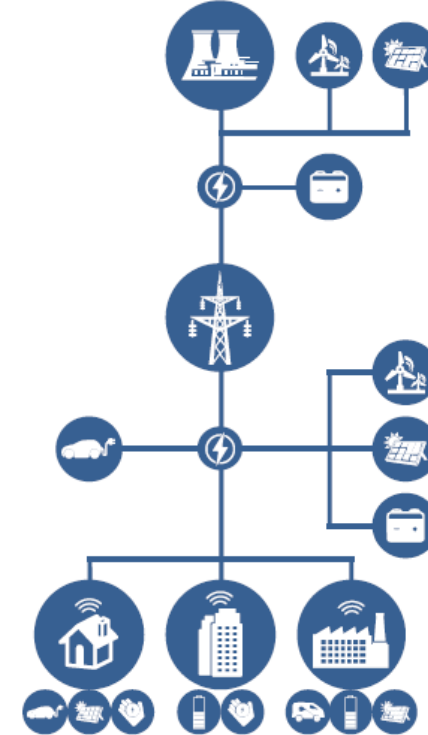
Transitioning System to a DSO

Distribution Network Service Provider (traditional)



Passive Network

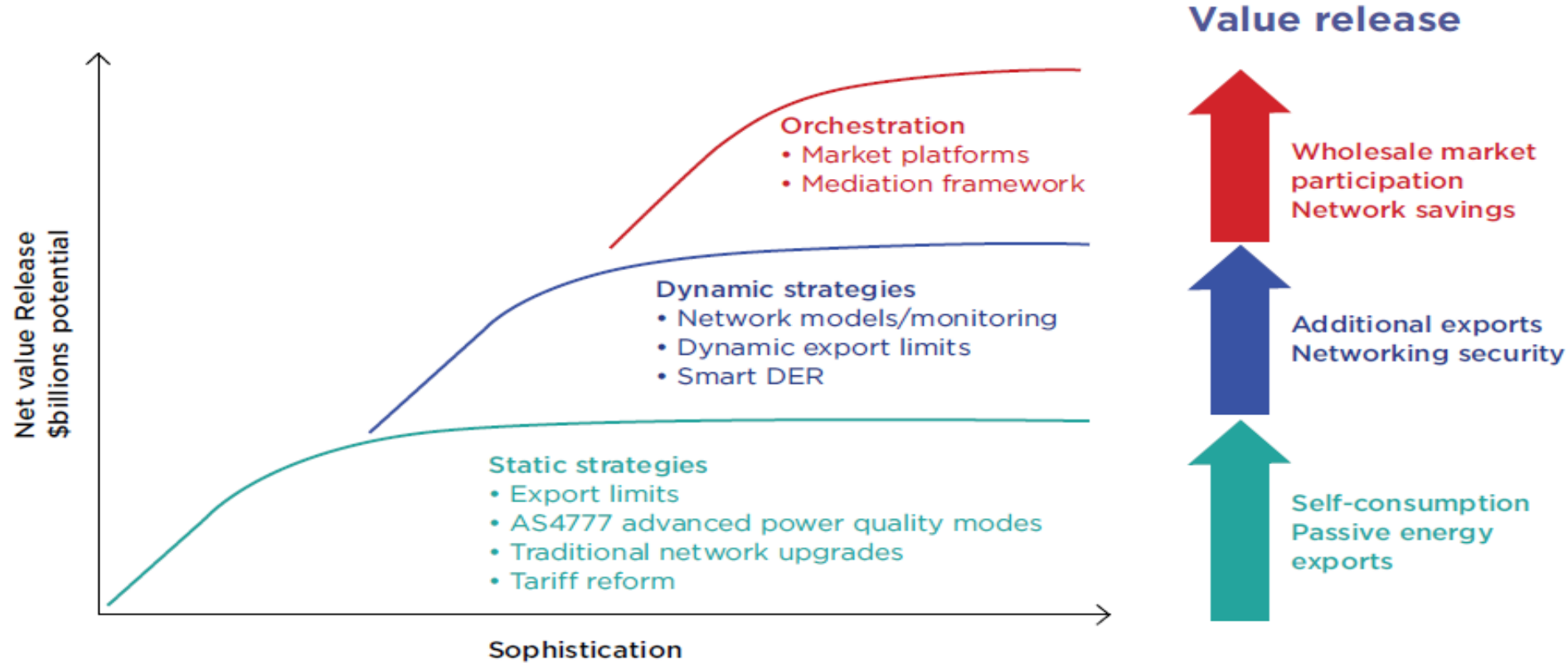
Distribution System Operator (Future)



Active Network

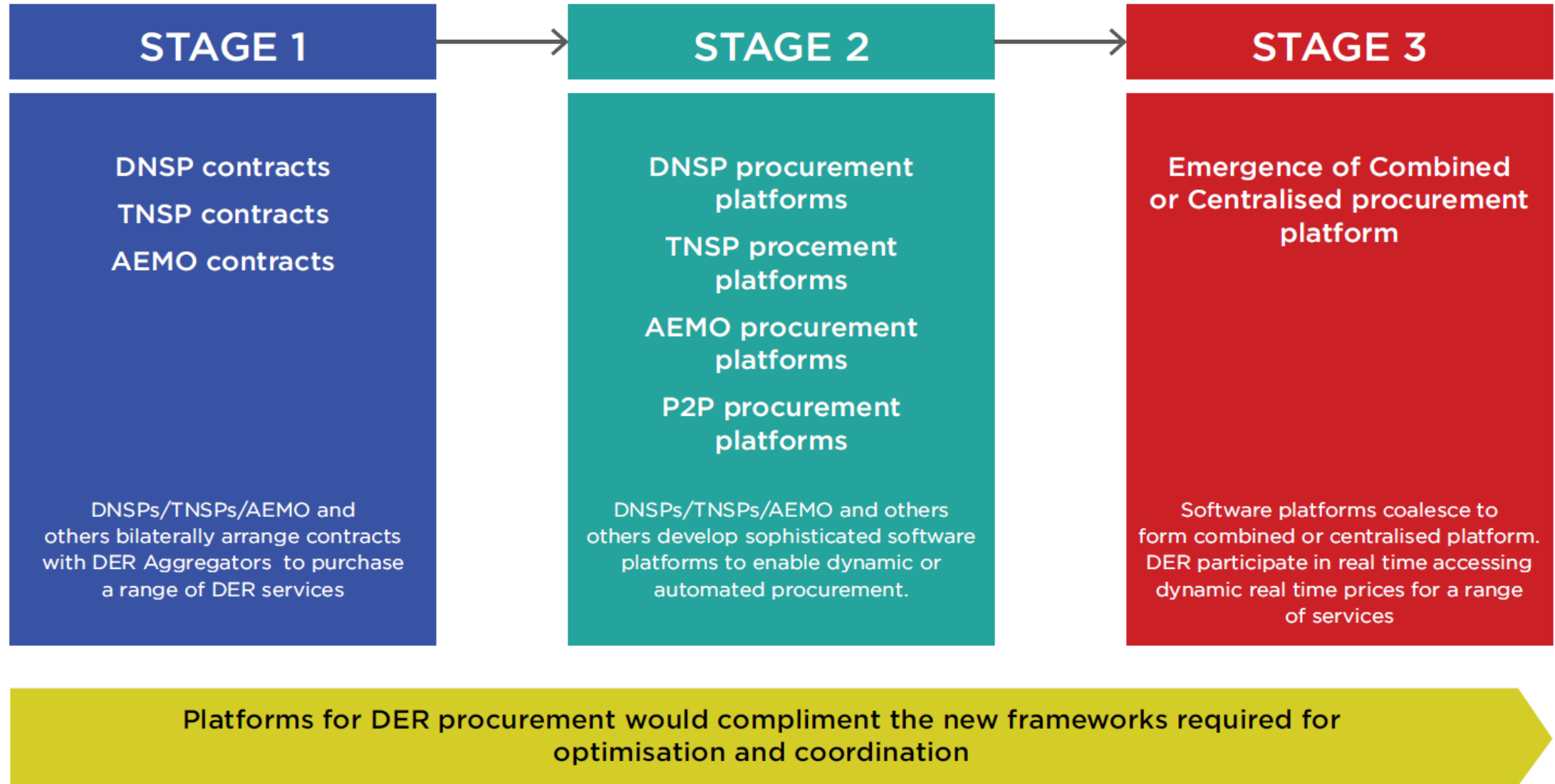
Reactive Network

Value release



ENA-CSIRO Network Transformation Roadmap estimate that by 2050, DER optimisation could lower network charges by 30% compared to 2016, deliver annual savings of \$414 in average household electricity bills, (compared to with a business as usual pathway), and avoid over \$1.4 billion in network investment by 2027 and \$101 billion by 2050

New Markets for DER

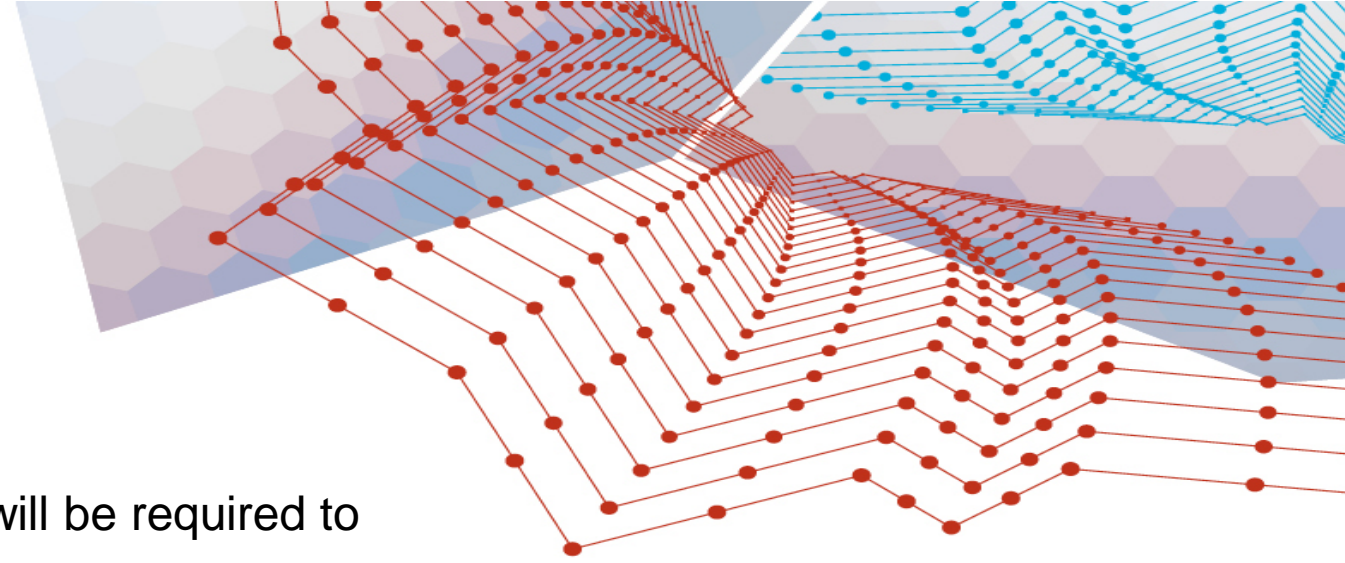




Session 3: Functionality Required & Actions

Session Objectives

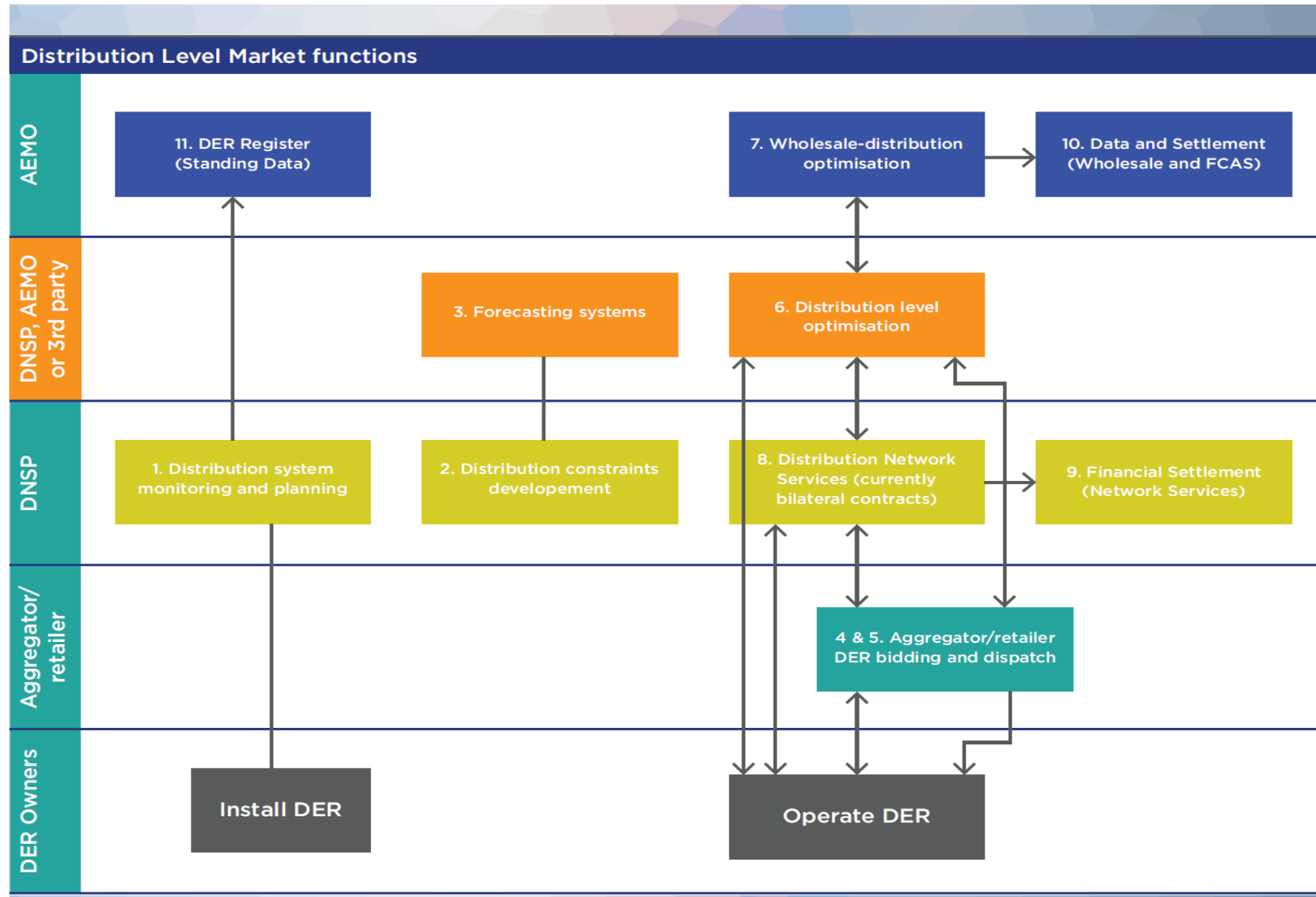
- Review the proposed high level functionality will be required to enable distribution level optimisation.
- Identify any other functionality that may be required.
- Identify possible ways that functionality could be delivered.
- Identify when the functionality needs to be available



Potential Functions Required for DER Optimisation

Function	Description	Owner ?
1. Distribution system monitoring and planning	Enhanced function: Distribution network monitoring to inform distribution network constraint development	DNSP
2. Distribution constraints development	New function: To develop distribution network constraints that will be a key input into the distribution level optimisation.	DNSP
3. Forecasting systems	New function: Provide key forecasting information to allow for distribution level optimisation – may be available to market participants	DNSP, AEMO, or new third-Party
4. Aggregator DER bid and dispatch	New function: Aggregates local DER installations to provide bids into the energy, FCAS and Network Markets (through distributed level optimisation)	Third-Party: New Participant category
5. Retailer DER bid and dispatch	Enhanced function: Retailer aggregates customer DER installations to provide bids into the Wholesale Market for scheduled generation, scheduled load, FCAS and Network Markets	Retailer
6. Distribution level optimisation	New function: Optimise distributed level resource dispatch within distribution network constraints, to establish an aggregated bid stack for DER per area that can feed into wholesale optimisation. Dispatch DER once aggregated dispatch signal received	DNSP, AEMO, or new third-Party
7. Wholesale - distributed optimisation	Existing Function: Integrate distributed level optimisation results into existing wholesale market optimisation.	AEMO
8. Distribution Network Services	Enhanced function: Distribution network services, such as power quality/voltage control, which can be provided by aggregated DER, either through bilateral contracts or potential through an optimization	DNSP
9. Financial Settlements (Network Services)	Enhanced function: Financial settlement of distributed network services dispatched Network Market	DNSP, aggregator/ retailer
10. Data & Settlement (Wholesale and FCAS)	Enhanced function: AEMO settles wholesale and distributed level transaction. AEMO already settles the existing market to the NMI	AEMO
11. DER Register	New function: AEMO to provide DER register based on AEMC rule requirements.	AEMO

High level functions required for future frameworks

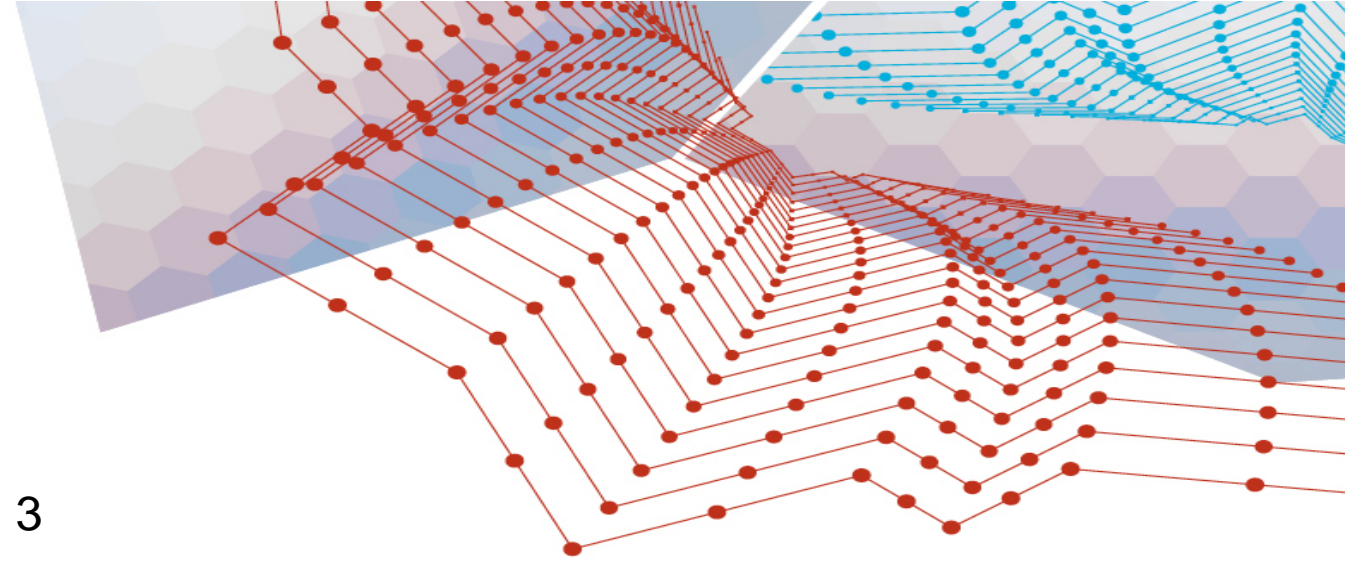




Session 4: Frameworks for DER Optimisation

Session Objectives

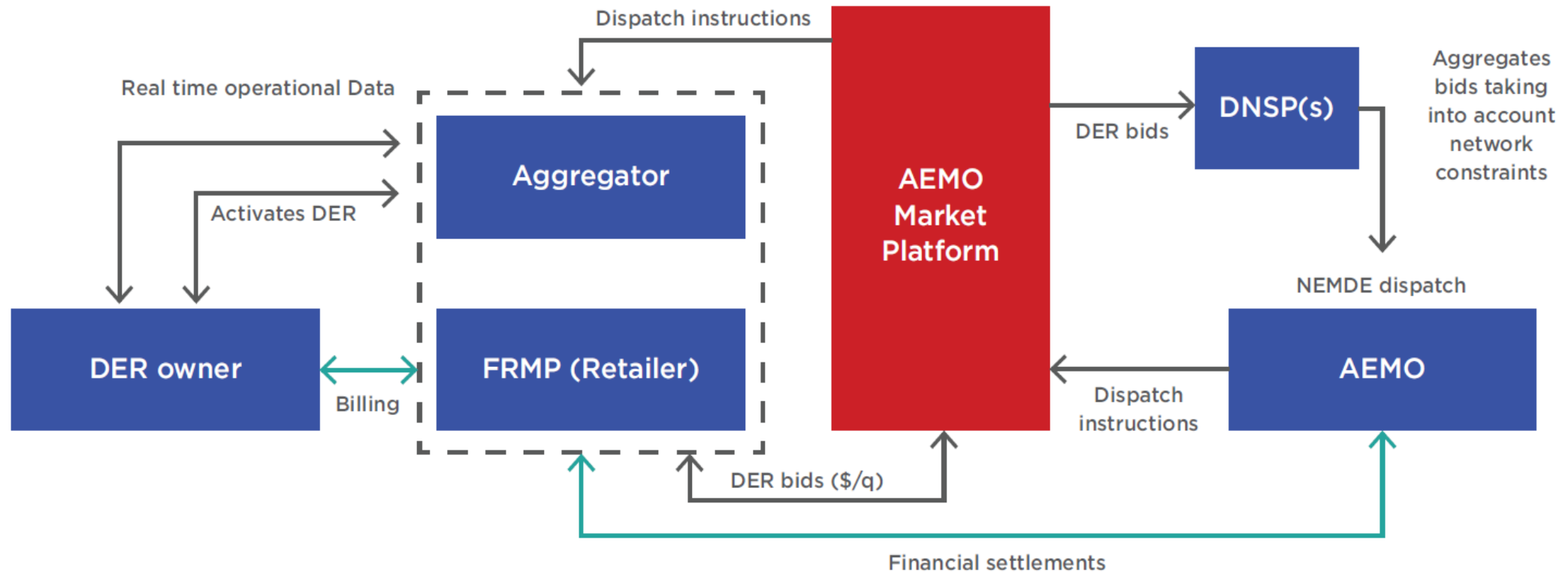
- Based on the outcomes discussed in Session 3
 - Test functionality against the proposed models – do they work
 - Explore if the framework options need modification
 - Identify if there are other potential options that we should consider



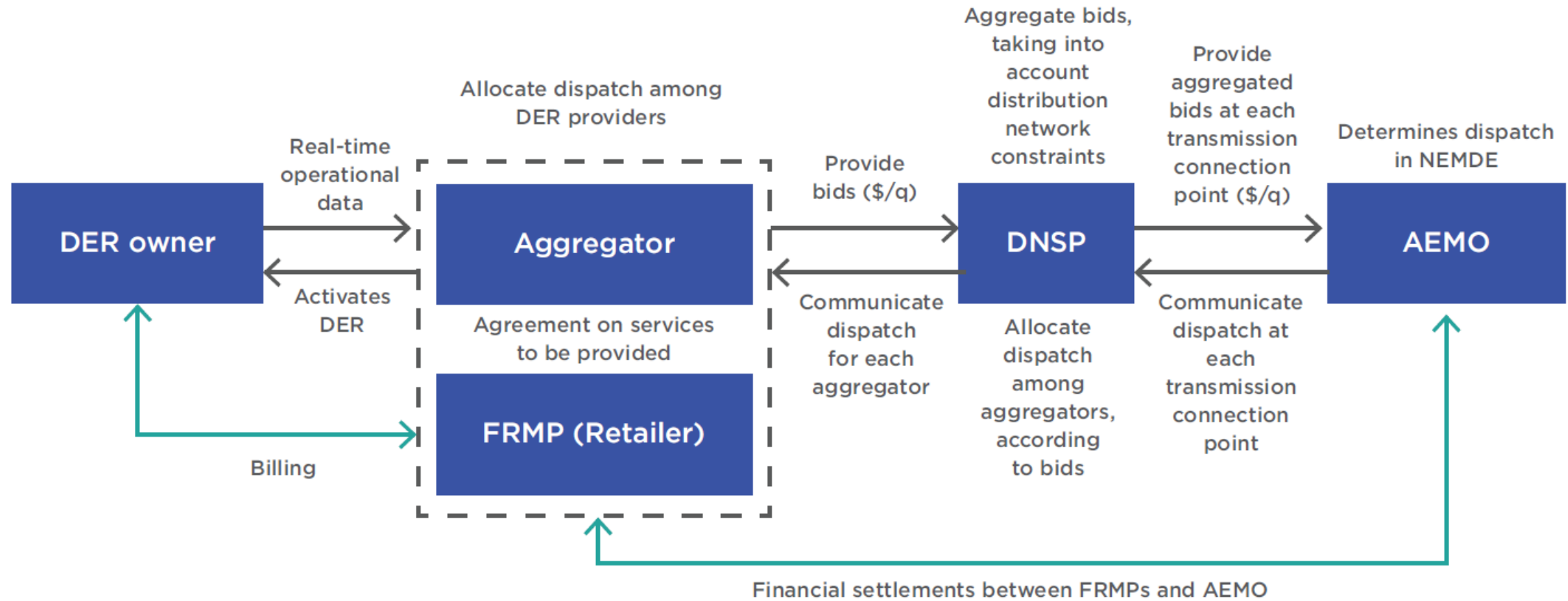
Principles for framework design

1. Simplicity, transparency and adaptability of the system to new technologies
2. Supporting affordability whilst maintaining security and reliability of the energy system
3. Ensuring the optimal customer outcomes and value across short, medium and long-term horizons – both for those with and without their own DER
4. Minimising duplication of functionality where possible and utilising existing governance structures without limiting innovation
5. Promoting competition in the provision and aggregation of DER, technology neutrality and reducing barriers to entry across the NEM and WEM
6. Promoting information transparency and price signals that encourage efficient investment and operational decisions
7. Lowest cost.

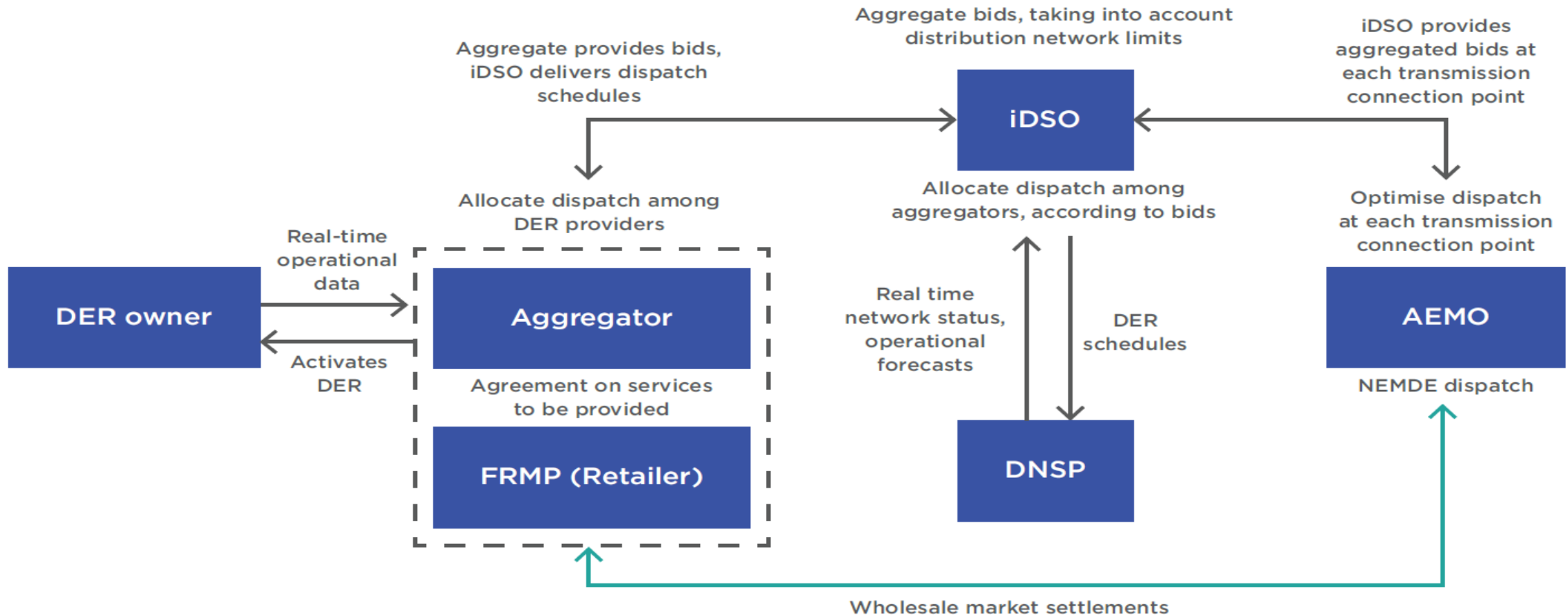
Option 1 - Single Integrated Platform: AEMO central platform



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



Option 3 - iDSO optimises distribution level dispatch

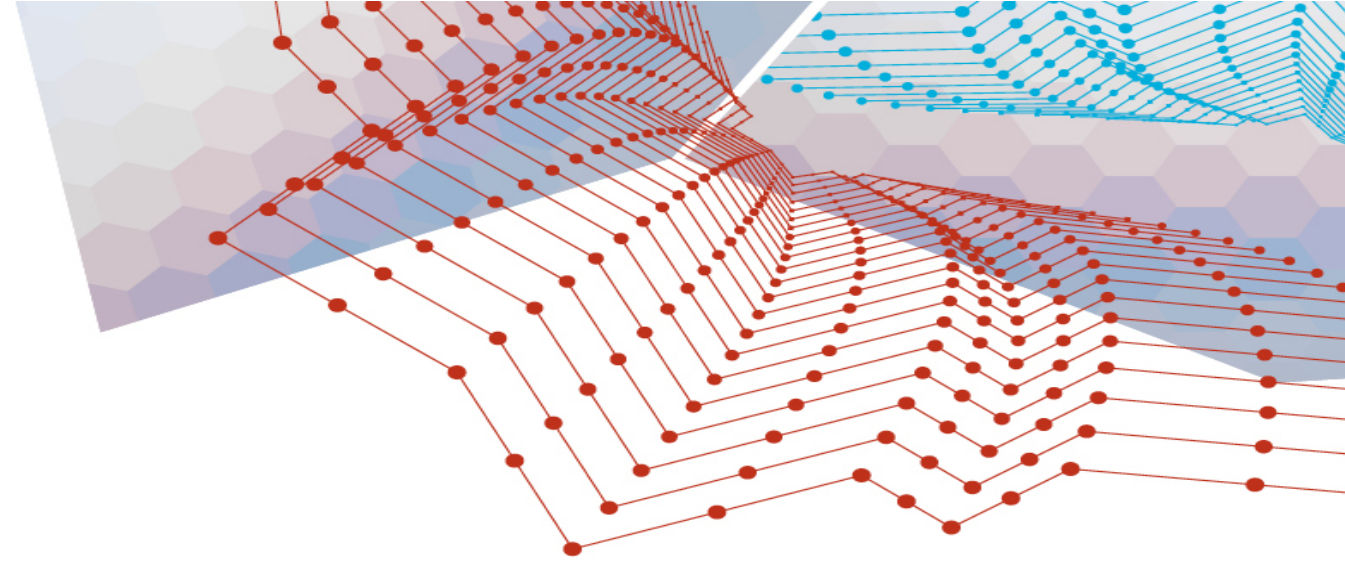




Session 5: Immediate Actions Required

Session Objective

- Revisit Key Functionality, key actions identified in Session 3 and the Framework Models discussed in Session 4, and identify what functions and actions should be considered as immediate no-regret actions



Final Activity :

5. ACTIONS

Least Regrets and
long term [TOP 5]

4. Frameworks

Roles and
Responsibilities

3. Functions
and
Capabilities for
active DER

2. Value

- Barriers
- Enables
Actions

1. Context

DER – challenges and
benefits

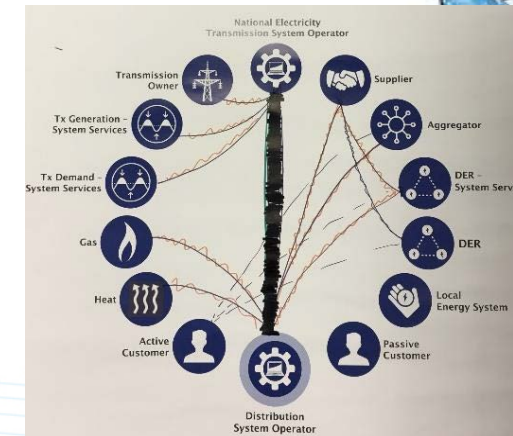
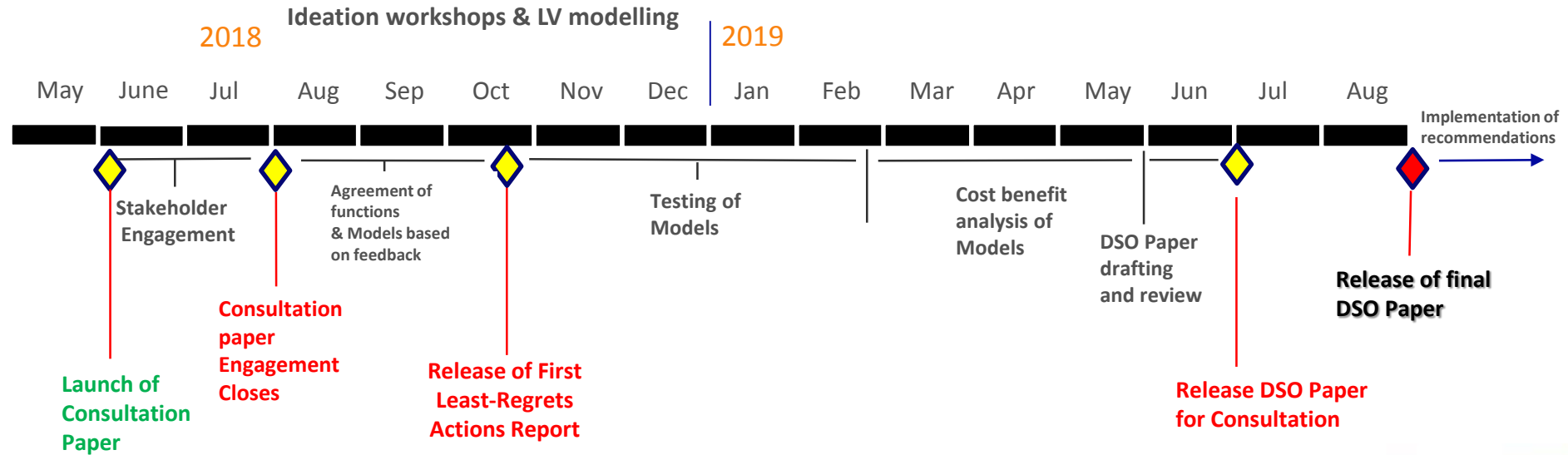


Wrap up & Next Steps

Next Steps

1. Circulate slides from these sessions, including summarised worksheets
2. OpEN Consultation paper: **closes 3/8/2018**
3. Establish industry reference group: **July/August 2018**
4. Commence work on Phase 2: **August 2018**
5. Incorporation of consultation paper input from stakeholders to finalise models: **August 2018**
6. Testing of models with Stakeholders and LV modelling: **August – Sept 2018**
7. Establish agreement of key no-regret actions required to manage current DER orchestration issues – Publish report: **late 2018**
8. Testing of models: Oct 2018: **Feb 2019**
9. Undertake assessment and cost benefit analysis of models: **February - April 2019**
10. Use outcomes of cost benefit analysis to select optimal model and provide basis for drafting DSO paper: **May – June 2019**
11. Release DSO Paper for consultation: **Mid 2019**
12. Final DSO paper: **September 2019**

Development Plan for the DSO Paper





Thank You!!

Want to know more?

For more information on the Open Energy
Networks Project, please contact

Dr Stuart Johnston at Energy Networks Australia
at **sjohnston@energynetworks.com.au** or 02
6272 1555

or Chris Cormack at AEMO at