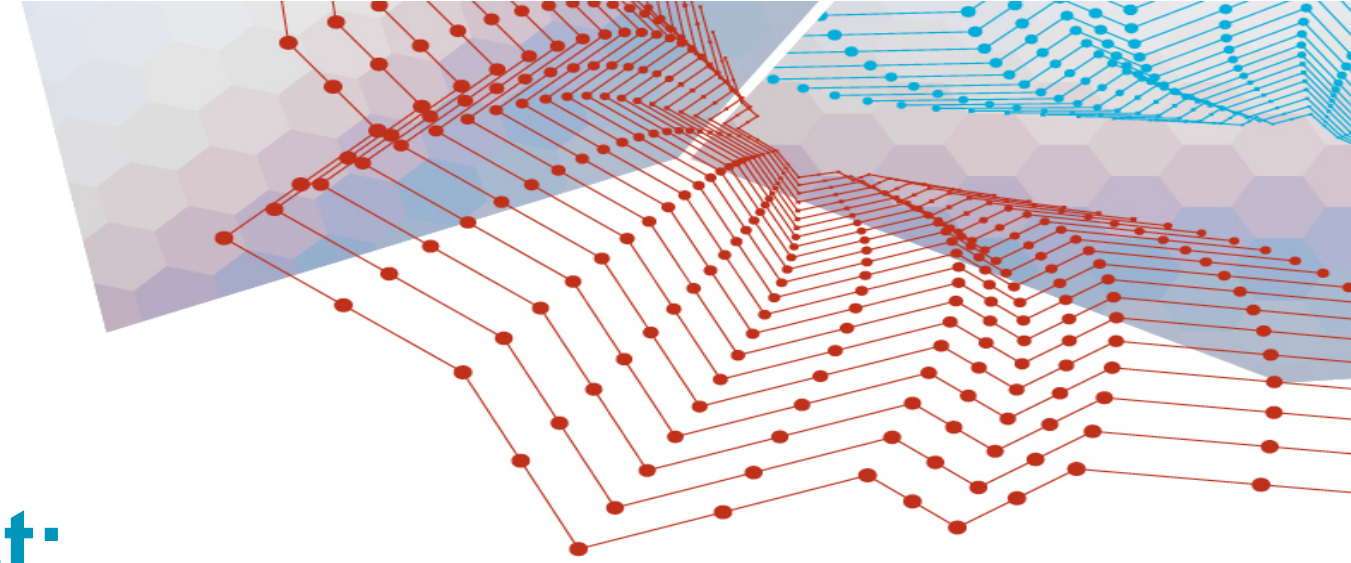

Open Energy Networks Project:

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

Violette Mouchaileh

Stuart Johnston

Great Expectations: The Interactive Grid - 27 March 2019

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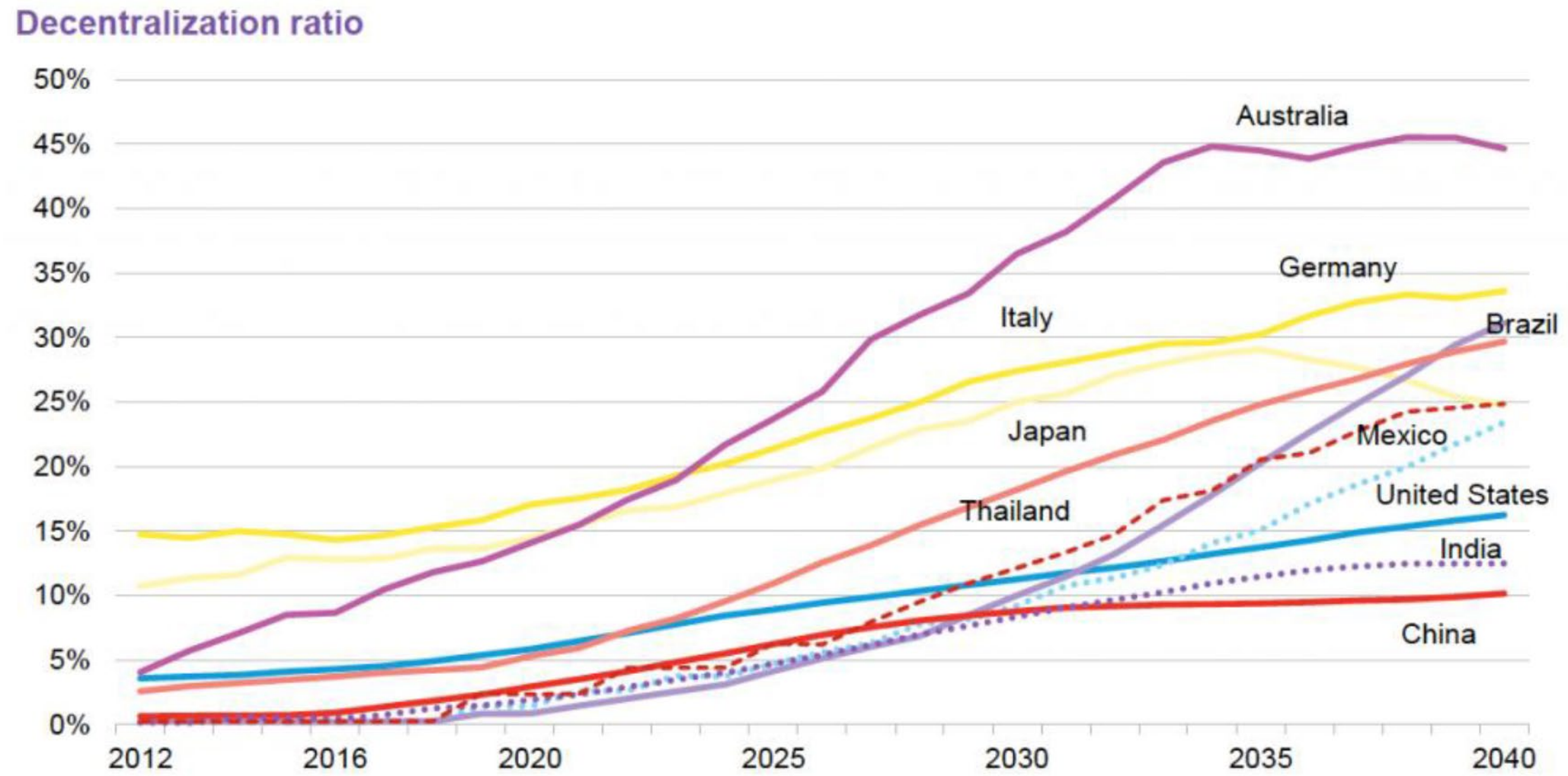
A Changing World – Australia moving to a hyper-decentralized future



Overview of the Electricity Network Transformation Roadmap

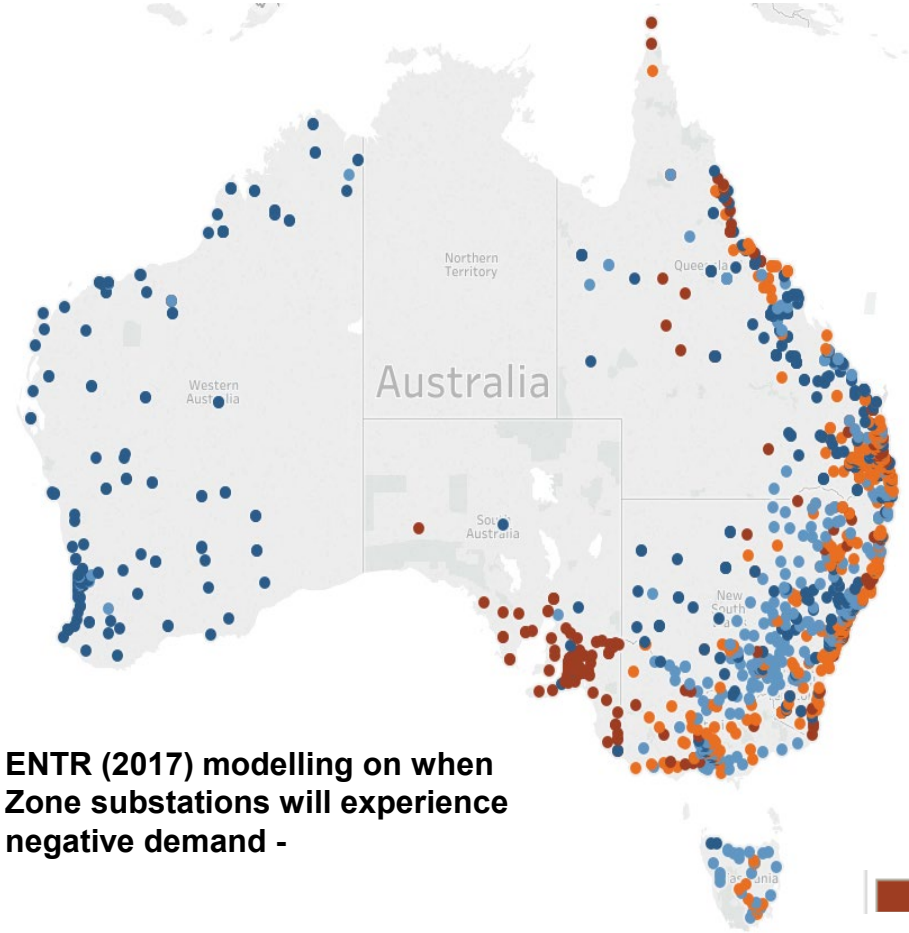
	FOUNDATION						IMPLEMENTATION					
	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2027+
CUSTOMER ORIENTED ELECTRICITY	**Improve Trust with Customers** » Enhanced customer engagement and collaboration » Customised choices, better information on services and new connection and advisory services » Demonstrate investment reflects customer value while improving service performance and response times » Review of Consumer Protection and concessions						**Networks provide a service platform** » Open network platforms embrace diverse customer needs and aspirations » Collaborate with customers and market actors to create new value with streamlined connections » Leverage network information and digital services for personalised innovation in a dynamic market					
POWER SYSTEM SECURITY	**New systems to support diverse generation** » Update Transmission Interconnection test » Review frameworks for protection systems, efficient capacity and balancing services » New market frameworks for ancillary services » Develop new power system forecasting and planning approaches to anticipate system constraints » Enhanced intelligence and decision making tools » Close focus on physical & cyber security						**Harmonised System Operations at all levels** » Transmission networks support system stability with new services. » Distribution networks provide visibility of DER and potentially Frequency Control Ancillary Services (FCAS) and delegated balancing services. » Real-time communication and controls					
CARBON ABATEMENT	**A stable Carbon Policy for higher targets** » Develop nationally integrated carbon policy framework » Implement emissions Baseline & Credit Scheme » Set Light Vehicle emissions standard policy to provide incentives for electric vehicle uptake, supporting climate goals » Review Australia's emissions reduction target » Agile network connections and integration of large and small scale renewable technologies						**Reviewing scope for greater efficiency** » Review technology specific incentive schemes to focus on least cost abatement » Review scope for more efficient economy wide carbon pricing where consensus » Review Australia's emissions reduction target (2027)					
INCENTIVES & NETWORK REGULATION	**Incentivising efficiency and innovation** » Ensure extensive smart meter penetration » Assign customers to new range of fairer demand-based network tariffs, with a choice to Opt Out » Enable standalone systems and micro-grids as a substitute for traditional delivery models » New innovation incentives in Regulation and Competition frameworks						**Unlocking value of distributed energy resource orchestration** » Networks pay for distributed energy resource orchestration to provide system support in the 'right place at right time' » New network tariffs that provide beneficial incentives for standalone systems and micro-grids to stay connected to the grid » New and more adaptive regulatory approaches that are customer focused					
INTELLIGENT NETWORKS & MARKETS	**Essential information for an integrated grid** » Establish open standards and protocols to enable secure system operation, management and exchange of information and interoperability with distributed energy resources » Networks enhance current system monitoring and models to inform advanced system planning » Build distributed energy resource maps and feeder hosting analysis to support locational valuation of distributed energy based services						**Networks optimised with distributed energy resources** » Active network management for technical stability, enabling distributed energy resource markets and efficient optimisation. » Networks provide a suite of grid intelligence and control architectures to animate distributed energy resource markets, as well as providing system security. » Establish a new network optimisation market to procure DER services for network support. » A flexible and agile workforce to support the new optimised energy system.					

Overall Customer outcomes by	
2027	2050
CUSTOMER CHOICE AND CONTROL	
» Over 40% customers use onsite resources: 29 GW solar and 34 GWh of batteries. » Concessions to support those who need it most.	» Almost 2/3 customers use onsite resources, including 1/3 customers on a new stand alone system tariff.
LOWER BILLS FOR VALUED SERVICES	
» Avoid over $1.4 BN in network investment. » Average network bills 10% lower than 2016.	» Total system spend is $101BN lower to 2050. » Save households $414 pa by 2050. » Network charges 30% lower than 2016.
FAIRNESS & INCENTIVES	
» Networks pay over $1.1 BN pa for DER services. » Over $1.4 BN in cross subsidies avoided, saving $350 pa for med size family without DER.	» Networks pay over $2.5 BN pa for DER services. » Over $18 BN in cross subsidies avoided, saving $600 pa for med size family without DER.
SAFETY, SECURITY, RELIABILITY	
» Planned and efficient market response avoids security & stability risks. » Robust physical & cyber security management.	» Real time balancing, reliability and quality of supply at small and large scale, with millions of market participants.
CLEAN ENERGY TRANSITION	
» Electricity sector carbon abatement to reach 40% by 2030 – greater than current national target of 26-28%.	» Electricity sector achieves Zero Net Emissions by 2050.

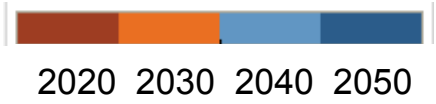
Optimisation concepts recognised as key for high DER future

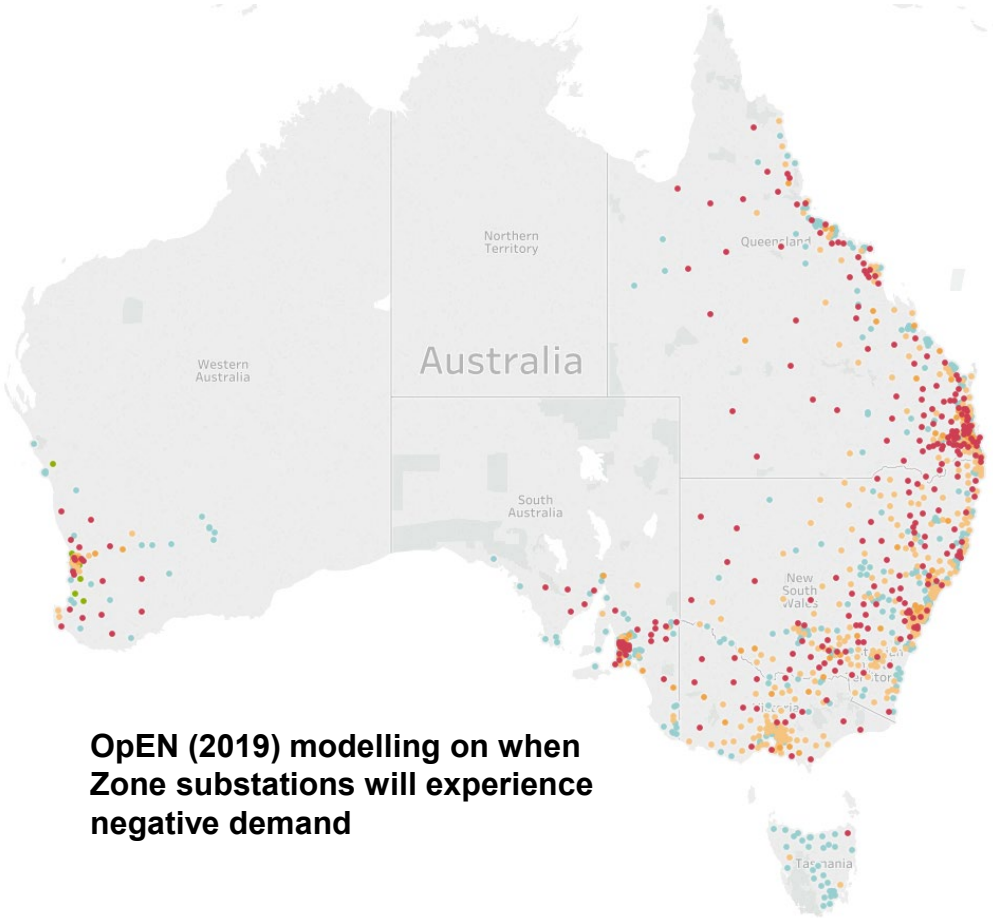
Regional Modelling: Distributed energy resources adoption

Within the next few years, whole regions of Australia's electricity system must be capable of operating securely, reliably and efficiently with 100% or more of instantaneous demand met from distributed energy resources



ENTR (2017) modelling on when Zone substations will experience negative demand -





OpEN (2019) modelling on when Zone substations will experience negative demand

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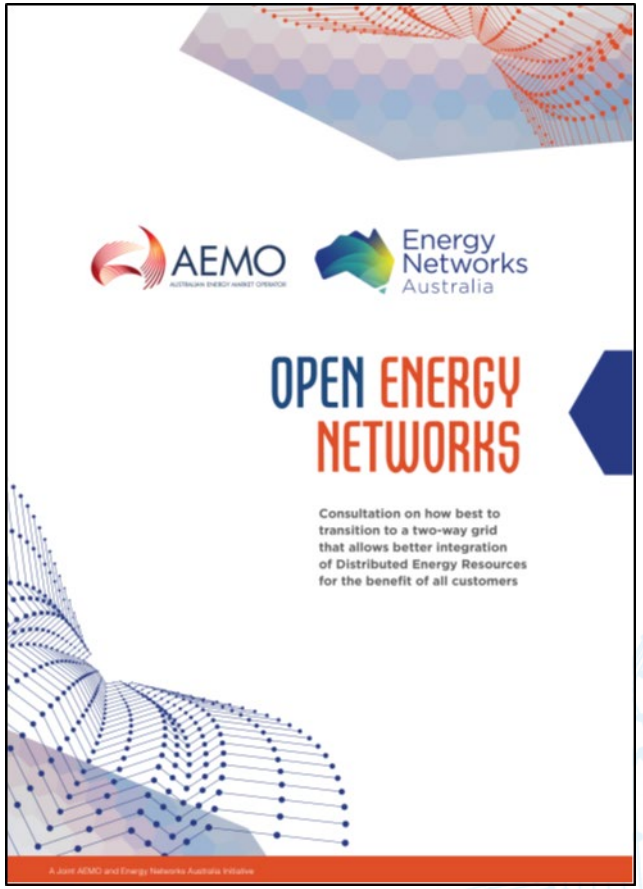
“Open Energy Networks” - Purpose

- The purpose of this project is to work with all stakeholders on how to best facilitate the entry of DER into the market

- Our objective is to identify the:
  1. Technical system requirements and
  2. Accompanying regulatory framework
     - that must be developed for the optimisation of DER connected to the distribution system, in order to
     - reduce barriers for entry into the system and best facilitate innovation and competition that releases value to all customers.



- For OpEN we started with 3 models:
  - **Single Integrated Platform**
  - **Two Tiered Platform**
  - **Independent DSO**

- After consultation a 4th model
  - **Hybrid model**

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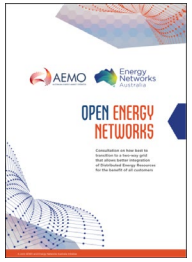
Required Capabilities – what?

Smart Grid Architecture Modelling

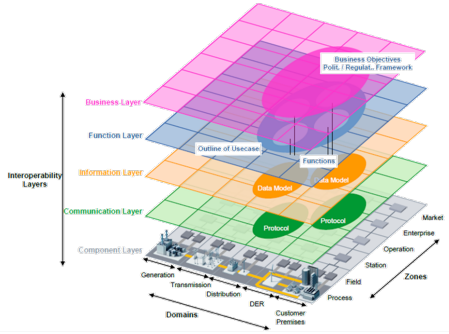
Further development of industry preferred market models through a series of industry workshops with consideration of additional functions and processes required for DSO.

Open Energy Networks Consultation Paper (2018)

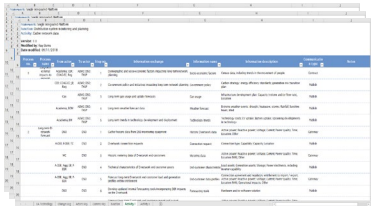


Consulted industry on commercial principles to promote flexibility markets and potential market models.

SGAM



Future Worlds (metamodel) Consultation



The Smart Grid Architecture Model (SGAM) methodology is a way to represent a complex electricity system and break it down into is individual parts. It is three dimensional which allows complex aspects of the electrical network to be considered from a variety of perspectives

Required Capabilities and a Hybrid Model

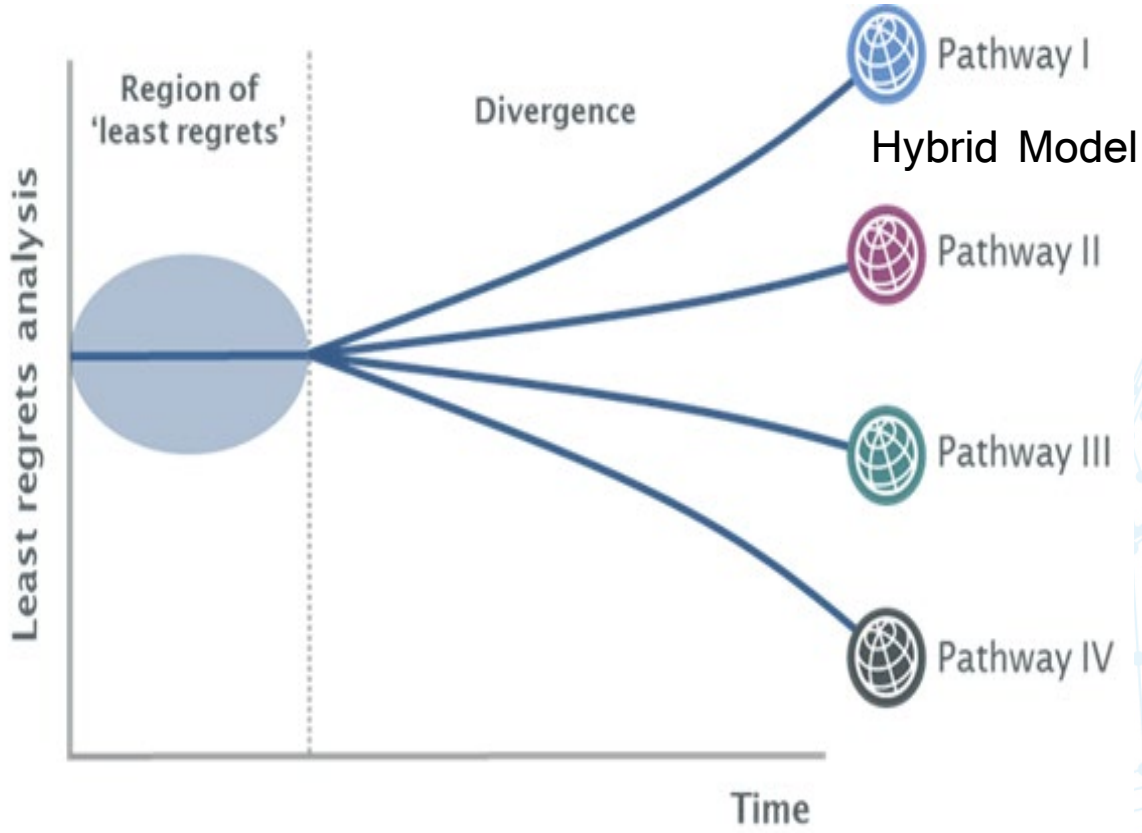
Least regrets approach

The least regrets analysis explores the four framework pathways the electricity system may travel down to progress towards a DSO optimisation.

Least regret actions exist at the convergence of the four frameworks where commonality is present across them.

Least regret actions can be implemented over the short term, irrespective of the ultimate pathway that actually manifests with:

- Minimal risk of additional work requirements;
- Investments being sunk;
- Or value not being realised.



First Order Required Capabilities:

These are critical actions that must be undertaken to manage the current issues associated with DER Integration and will be required to support any of the model frameworks

MILESTONE 1:
DNSPs define network visibility requirements and network export constraints

- Define DNSP requirements for increased network visibility to maintain network operations within required parameters
- Define how to achieve increased network visibility to maintain network operations within required parameters (operating envelopes)
- Establish an iterative and targeted approach for the timing of investments required to provide network visibility to maintain network operations within required parameters

MILESTONE 2:
DNSPs define communication requirements for operating envelopes

- Define protocols for operating envelope communication
- Establish a Australian standards and/or guidelines to support the establishment of operating envelopes
- Define data access permissions

MILESTONE 3:
DNSPs establish industry guideline for operating envelopes for export limits

- Develop an Industry guideline that outlines the requirements and use of operating envelopes

Required Capabilities: an iterative and targeted approach

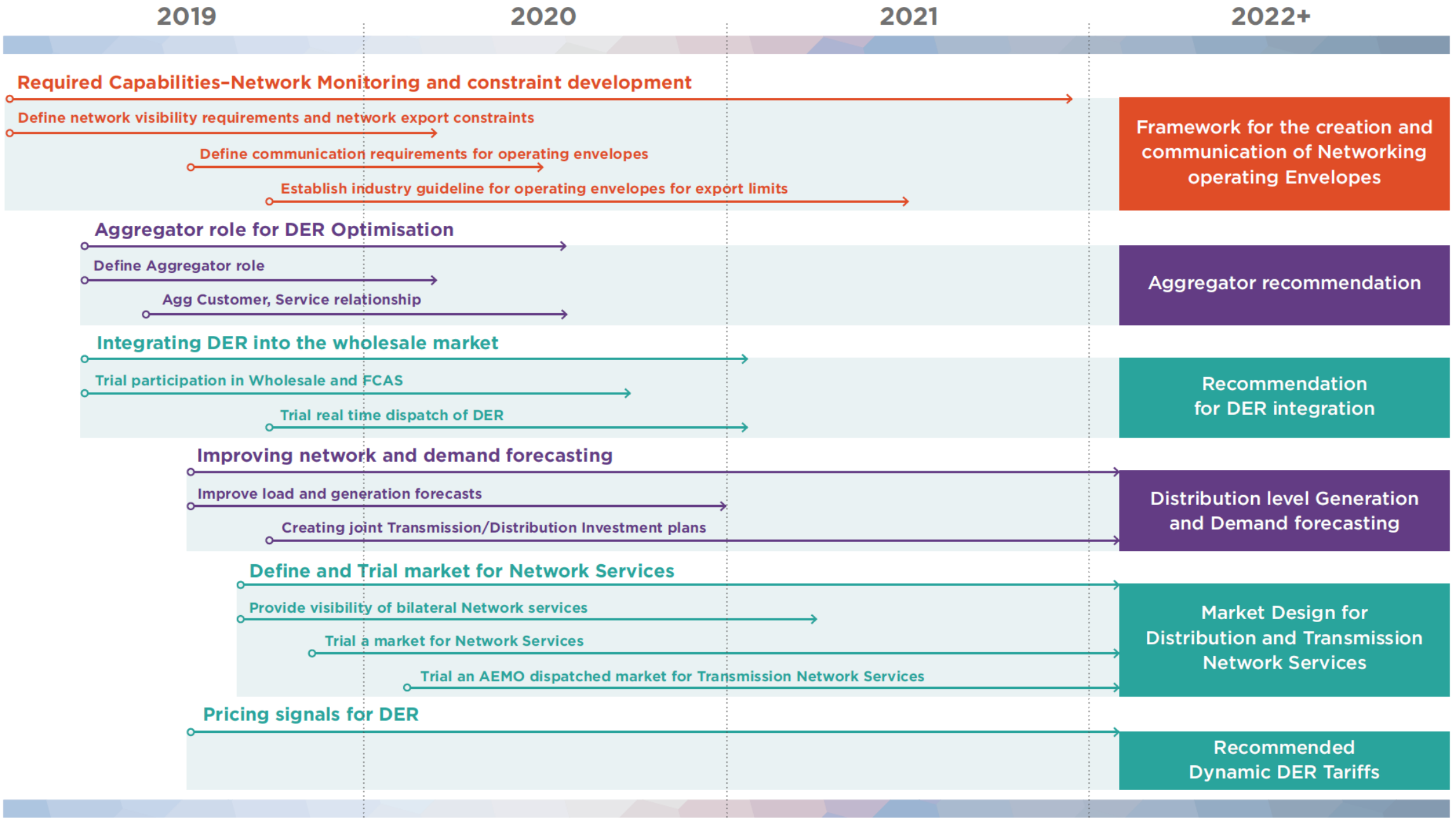
- The Open Energy Networks project agrees that the frameworks for DER optimisation will be rolled out in a targeted way.

- Network monitoring and Operating Envelope calculation and communication will be needed as a required capability for all networks to determine hosting capacity.

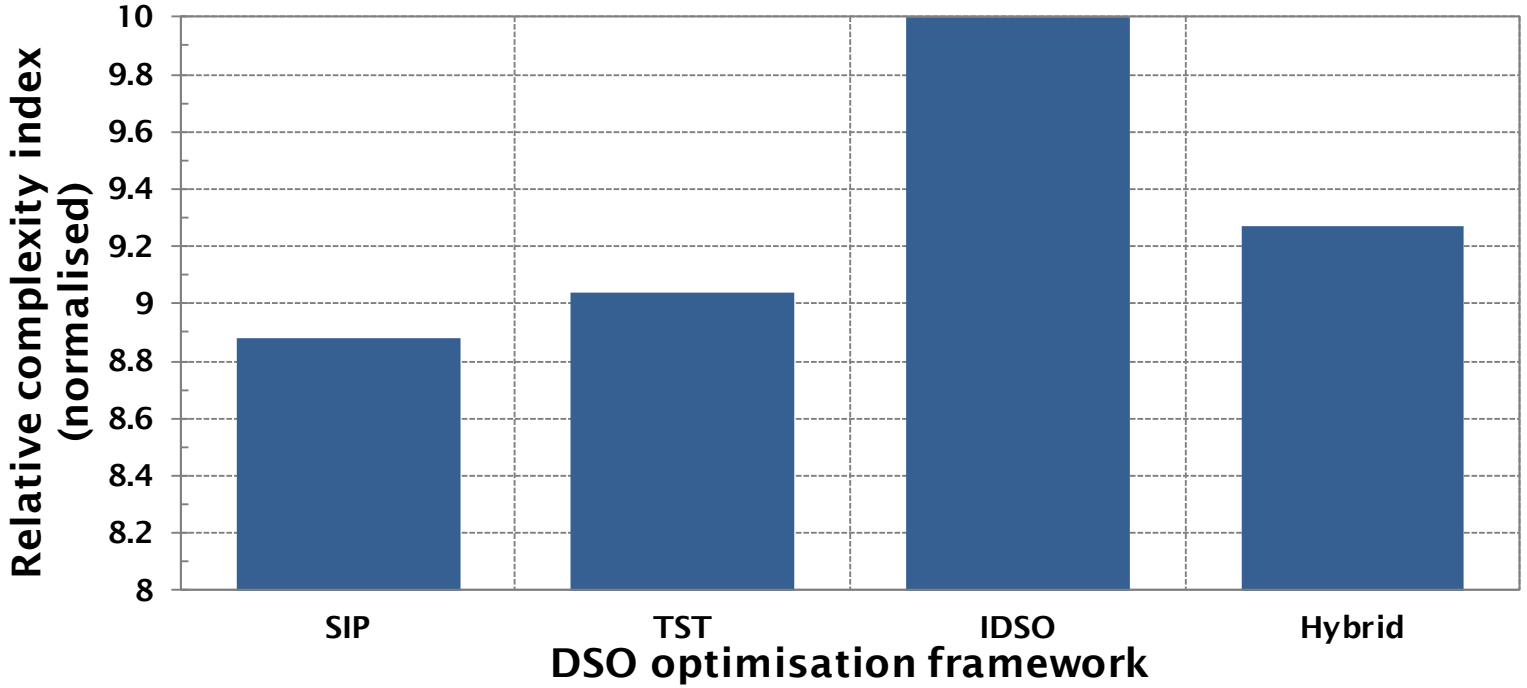
	Low Hosting Capacity (<20%)	Medium Hosting Capacity (20% - 40%)	High Hosting Capacity (>40%)
DER Low < 20%	Monitor	Operate (as today)	Operate (as today)
DER Medium 20% - 40%	Optimise	Monitor	Operate (as today)
DER High>40%	Optimise	Optimise	Monitor

- Initially operating enveloped may be deterministic and static, but in order to optimise DER in the network, technical and market operators will require increasingly dynamic (system and local) envelopes

Required Capabilities and Recommendations - Timeline for action



Framework analysis - complexity

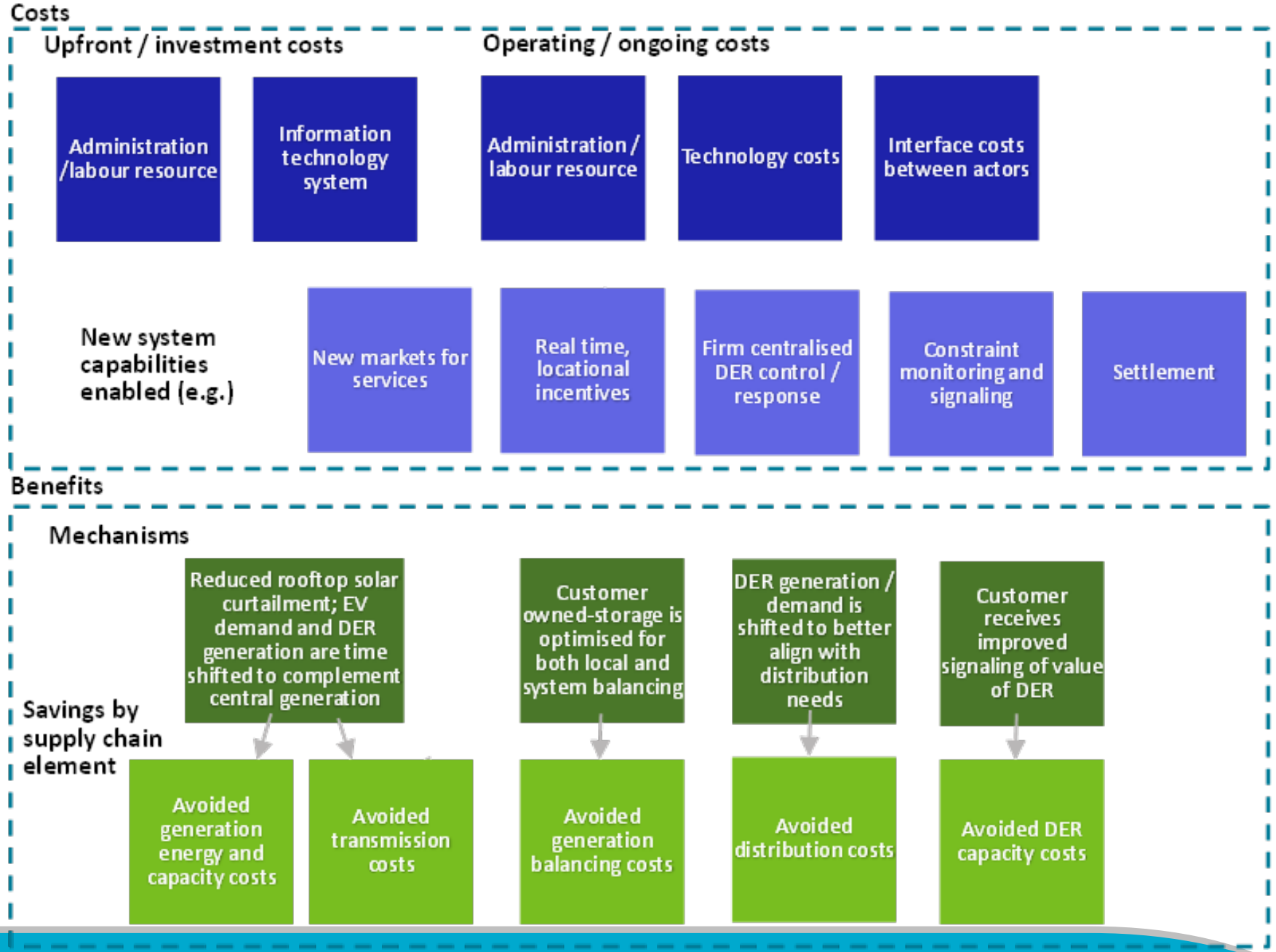


Relatively stable across frameworks

1. SIP – Lowest complexity as closest to current practice
2. TST – Raised complexity due to requirement for new market platform
3. Hybrid - Raised complexity due to requirement for new market platform and increased AEMO-DSO communication
4. IDSO – Highest complexity due to requirement for new market platform and new regulated entity

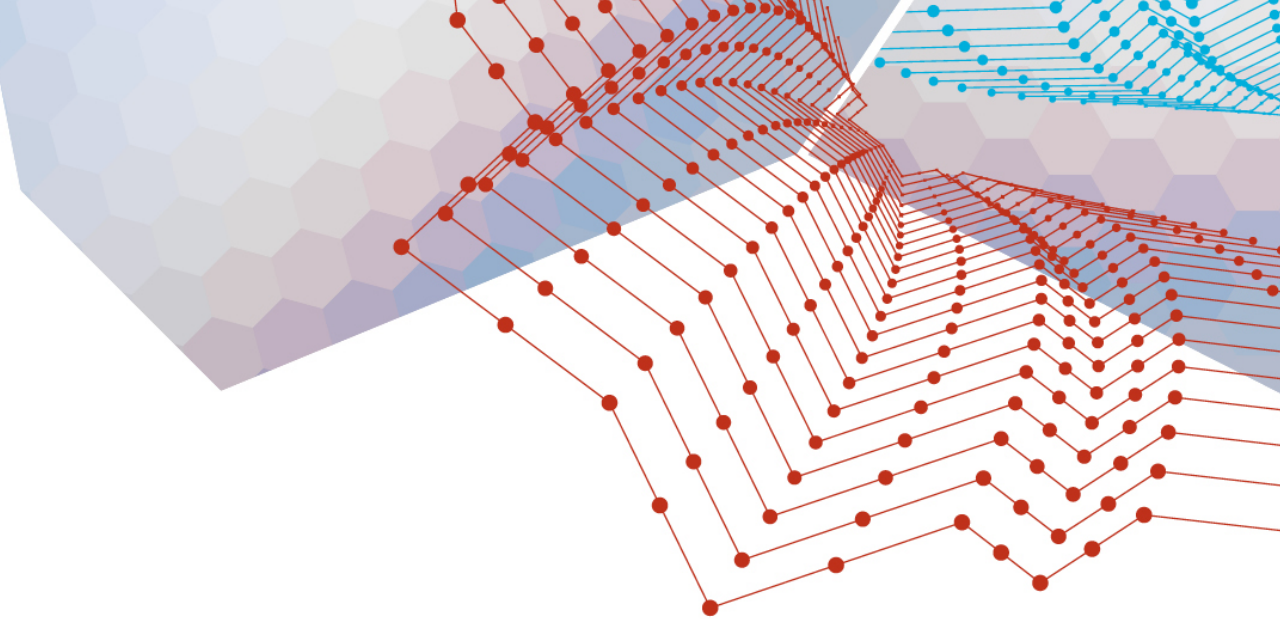
High complexity should not exclude a framework as it may correspond with greater value to customers.

Proposed CBA



Next Steps

Publication/Activity	Date
Open Energy Networks workshops - outputs summary	Early April 2019
Publish Required Capabilities and Actions paper	Apr 2019
CSIRO Cost-Benefit analysis for Distribution level optimisation	Mar/Apr 2019
Stakeholder Workshops testing draft framework recommendation	May 2019
Final Distributed Market Framework recommendation	July 2019
Stakeholder consultation on Final Distributed Market Framework recommendations	Aug/Sept 2019
Publish Final Distributed Market Framework recommendations	Oct 2019
Distribution Market trials in QLD, Victoria and SA to test Hybrid Model variations	Ongoing



Thank you!!!

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