



Electricity Engineers'
Association

DSO Workshop 2026

Building DSO Capability in Aotearoa

Tuesday, 22 September 2026, 9.00 am – 12.45pm, NZICC, Auckland



Electricity Engineers'
Association

Welcome & Opening Remarks

Dr Kannan Munisamy

EEA Engineering and Technical Lead

DSO WORKSHOP

How do we collectively turn the DSO Roadmap into practical capability across Aotearoa?

Co-hosted by the Electricity Engineers' Association and the Electricity Authority

ROADMAP



CAPABILITY



IMPLEMENTATION

Content for the day

9:00 – 9:20

Welcome, purpose and progress stocktake

Sheila Matthews & Geoff Parr, EA

9:20 – 9:50

Objective 1: Design and delivery of DSOs

Mark Paterson, Energy Catalyst, then discussion

9:50 – 10:15

Objective 2: Driving efficiencies

Counties Energy case study, then discussion

10:15 – 10:40

Objective 3: Accelerating flexibility

Powerco case study, then discussion

10:40 – 10:55

Morning tea

10:55 – 11:10

Objective 4: Connections and pricing

Dr Stuart Johnston

11:10 – 11:35

Objective 5: Consumers

Orion case study, then discussion

11:35 – 12:35

Workshop: implementation priorities

EA facilitated round tables

12:35 – 12:45

Group playback and closing comments

12:45

Close



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**Thank you to all the presenters
and attendees for joining us today.**

Enjoy today.



Electricity Engineers'
Association

DSO From roadmap to action

Sheila Matthews, Manager - Future Security & Resilience, Electricity Authority

Distribution system operation (DSO)

From roadmap to action

EEA 2026 conference

22 September 2026

AGENDA

- Background and context *Electricity Authority*
- Presentation on:
 - Design and delivery of DSOs *Mark Paterson*
 - Driving efficiencies *Counties Energy*
 - Accelerating Flexibility *Powerco*
 - Prioritising consumers *Orion*
 - Connections and Pricing *Electricity Authority*
- Testing the DSO Roadmap – progress, gaps and priorities

Background and context

- The *Future Security and Resilience* (FSR) programme of work focuses ensuring the power system remains secure and reliable during the transition and beyond.
- *Future System Operation* (FSO): Falls within the wider FSR programme of work.
 - Considers how the operation of the power system needs to evolve to address greater decentralisation with bi-directional power flows.
 - Distribution system operation (DSO) is a key part of this transition – requiring new capabilities, coordination and market arrangements at the distribution level.

The journey to the DSO Roadmap



The DSO Roadmap moves the conversation from what DSO might look like towards what needs to happen to get there.

DSO Roadmap: Vision and Purpose

The vision is of DSOs coordinating CER and integrating them into the power system for the benefit of consumers.

The purpose is to

- close gaps between where we are and where we want to go, with DSO capabilities and functions
- develop the market for flexibility services
- identify workstreams of the EA and other agencies that can help take us there.

Today's workshop is an opportunity to test the roadmap against practical experience.

DSO Roadmap groups related workstreams

Design and delivery of one or more DSOs

Driving efficiencies

Accelerating flexibility

Distribution network connection and pricing

Prioritising consumers

Some questions the Roadmap asks us to explore towards the design and delivery of DSOs

- DSO functions and model(s)
- How many DSOs are needed for New Zealand
- Market power: guardrails and transparent procurement
- Decentralised participation in DSOs by local energy hubs
- Price-led v contract-led flexibility

Potential enablers – what is on the 'critical path'?

- Interoperability
- Data sharing
- Standardised market arrangements
- Pilots, funding, subsidies, research
- Flexible connections, hot water control
- Dynamic tariffs, DOEs
- Transparent flex procurement

What matters most?
What needs to happen first?
What is missing?

Testing the Roadmap against experience

- Are we on track?
- Where are the gaps?
- What is critical?
- Who needs to act?

We will come back to these questions together in the final session of this workshop

Ngā mihi
Thank you



Electricity Engineers'
Association

Objective 1: Design and Delivery of DSOs

Lessons from global DSO journeys

International speaker — Mark Paterson, Principle / lead system Architect, Energy Catalyst

Distribution System Operator (DSO) models

A critical enabler of whole-system grid transformation | 22 September 2026

Acknowledgements

In the context of one of the world's fastest electricity system transformations, CSIRO is acknowledged as the key sponsor of Australia's Power Systems Architecture (PSA) effort over the last five years in collaboration with AEMO and numerous network businesses.



CSIRO and RACE for 2030 are further acknowledged as sponsors of the groundbreaking *2035+ Flexible Grid* and *Consumer Grid Summit* initiatives. These multi-stakeholder projects are designed to holistically advance key elements of Australia's grid transformation priorities.

Finally, the U.S. Department of Energy (Office of Electricity) is acknowledged for the decade of prior research investment that has informed Australia's program of work and its subsequent augmentation.

Mark Paterson

Principal / Lead Systems Architect



Mark Paterson leads [Energy Catalyst](#), a globally connected consulting firm specialising in enabling collaborative, scalable and future-ready power system transformations.

Over the last two decades, Mark has collaborated internationally and led significant grid transformation initiatives in Australia involving all parts of the electricity value chain. Significant projects have included the Consumer Grid Summit, Electricity Network Transformation Roadmap and the Future Grid Forum initiatives. As a leading expert in Power Systems Architecture, Mark also led the development of the seminal Reference Architecture of Australia's National Electricity Market (NEM) informing DSO and T-D Coordination implementation.

Mark's disciplined and collaborative approach is grounded in his Engineering, Business and Master of Enterprise qualifications and electrical-mechanical technology background. He is a Fellow of the Pacific Energy Institute and an Associate of the US Department of Energy's GridWise Architecture Council (GWAC). Mark is formally trained in both the Systems Architecture and Grid Architecture methodologies developed respectively by the Massachusetts Institute of Technology (MIT) and the US Department of Energy's Grid Modernisation Laboratory Consortia (GMLC).

Email: mpaterson@energycatalyst.au

Questions to Explore

1. **Drivers:** System changes driving the transition to DSOs and T-D Coordination?
2. **Definitions:** What are DSOs? Is there a universal definition?
3. **Comparisons:** How do EDBs and DSOs compare?
4. **Systems Integration:** Is there a relationship between DSO deployment and the wider system architecture?
5. **Scalability:** Are all systems architectures equal? Does it matter?
6. **Enablers:** Tools for Structural Analysis + Taming Complexity
7. **Further reading**



OUR LEGACY GRIDS



Large-scale
generation



Transmission



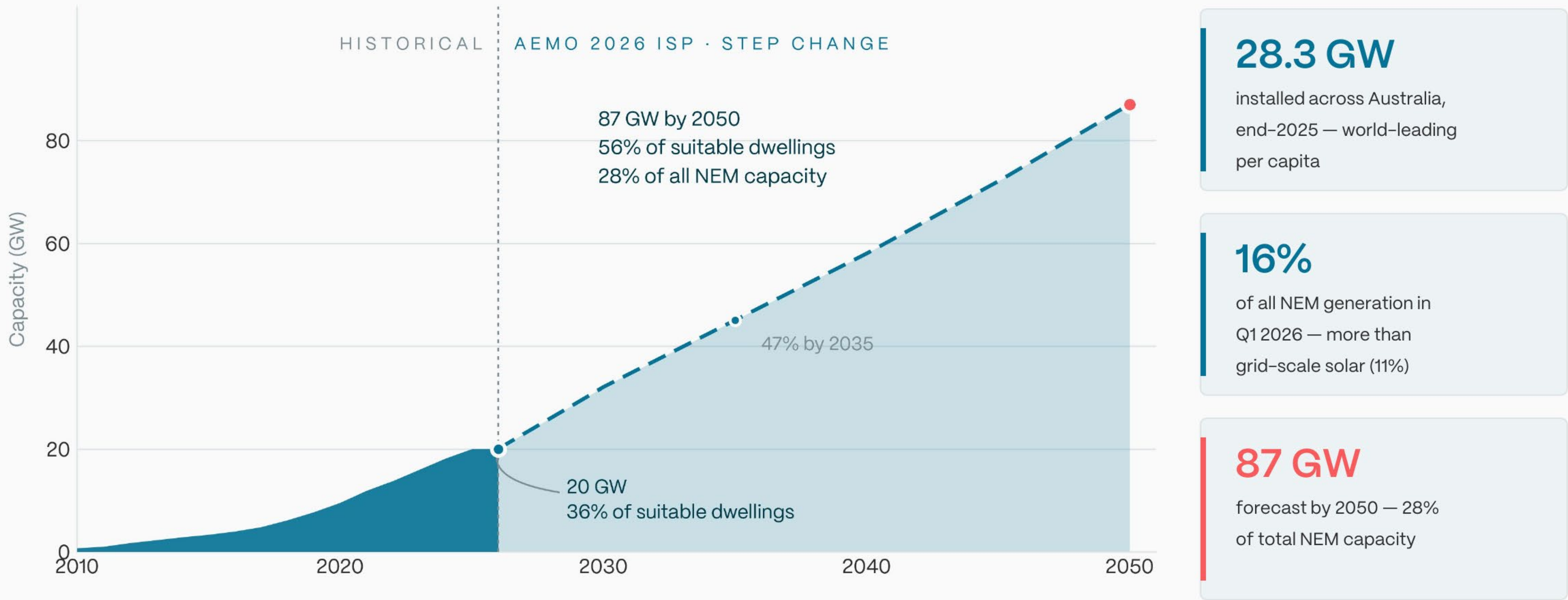
Local
Distribution



End Consumption

One in three Australian homes. 4.3 million systems.

Rooftop solar is no longer a connections issue — it is the largest single source of capacity in the power system.



Sources: AEMO, 2026 Integrated System Plan (Step Change) — Fig. 1 and s.2.1; AEMO Quarterly Energy Dynamics Q1 2026; Clean Energy Regulator / APVI. Historical trajectory indicative, scaled to AEMO’s stated 20 GW NEM rooftop capacity at 2026; Australia-wide small-scale PV (incl. WA/NT) reached 28.3 GW at end-2025.

When rooftop solar became a whole-of-system problem

Minimum demand, not peak demand, became the binding constraint — and that changes who owns the problem.

99.9%

of South Australia's electricity demand met by rooftop solar (31 Aug 2025). Grid-scale demand fell to 2 MW.

-209 MW

SA operational demand went negative for the first time in the NEM (19 Oct 2024).

60%+

of NEM-wide underlying demand met by consumer resources on a single sunny weekend (4 Oct 2025).

~115%

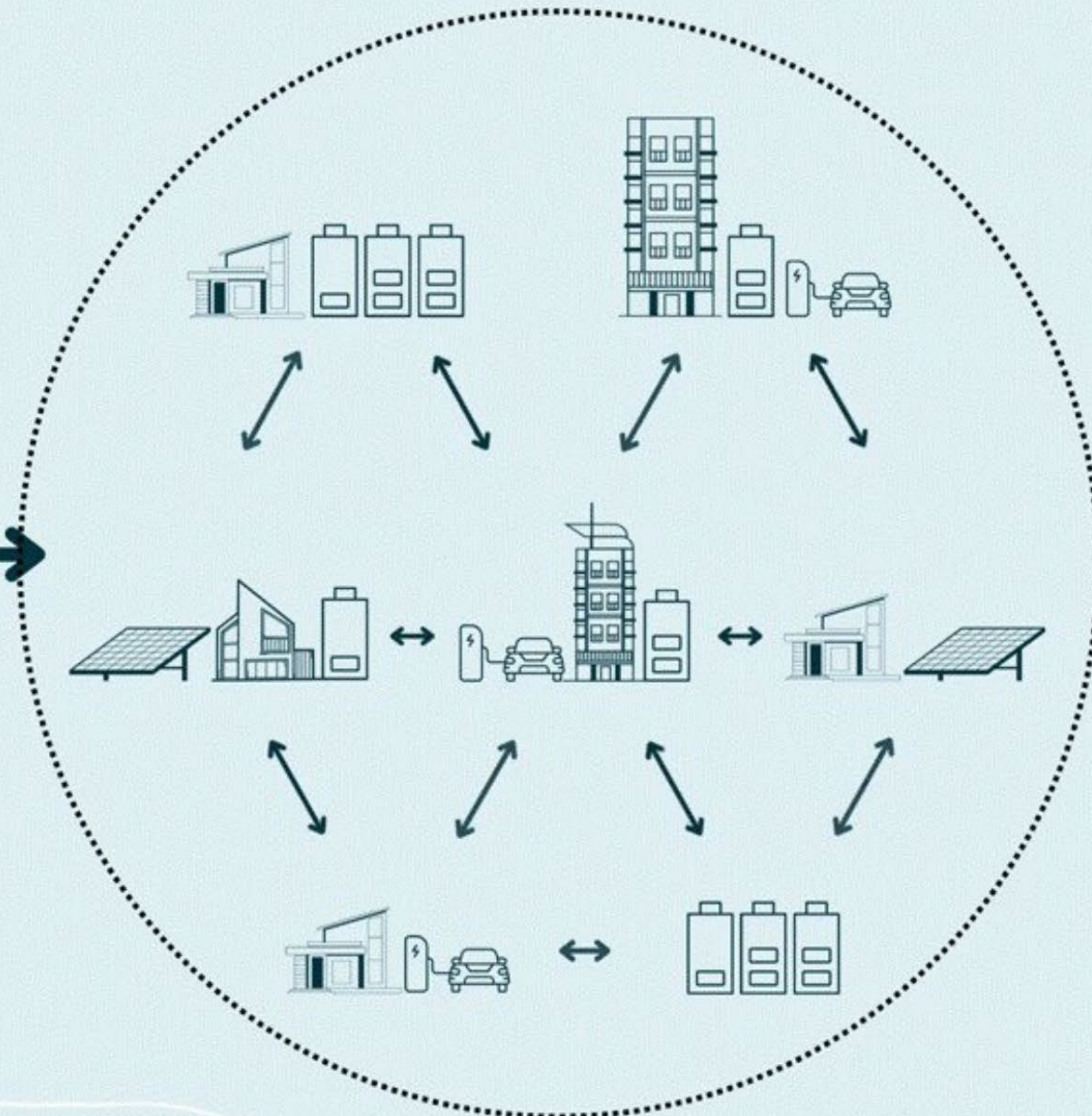
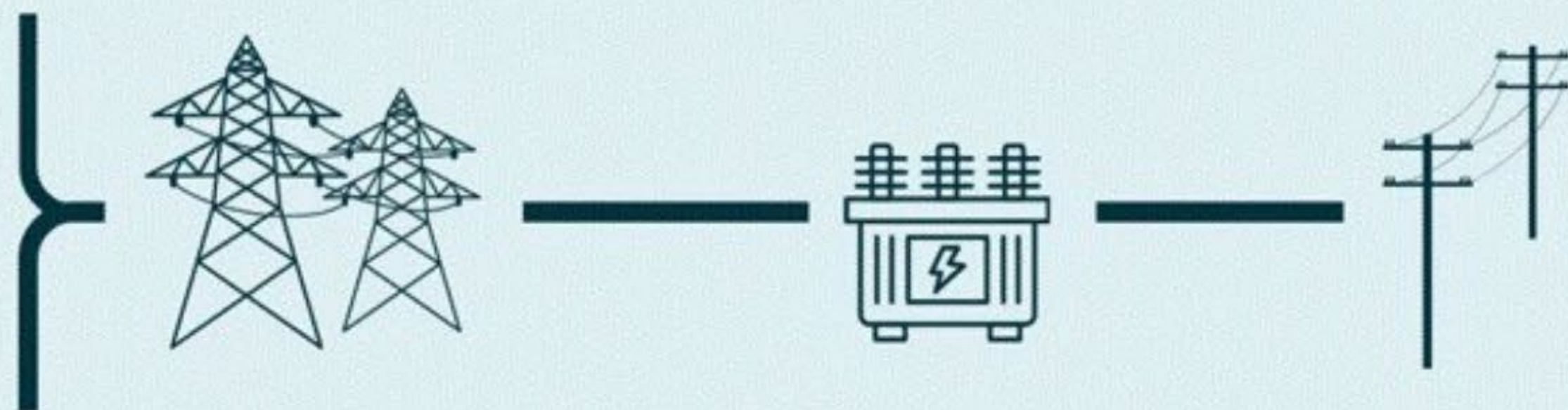
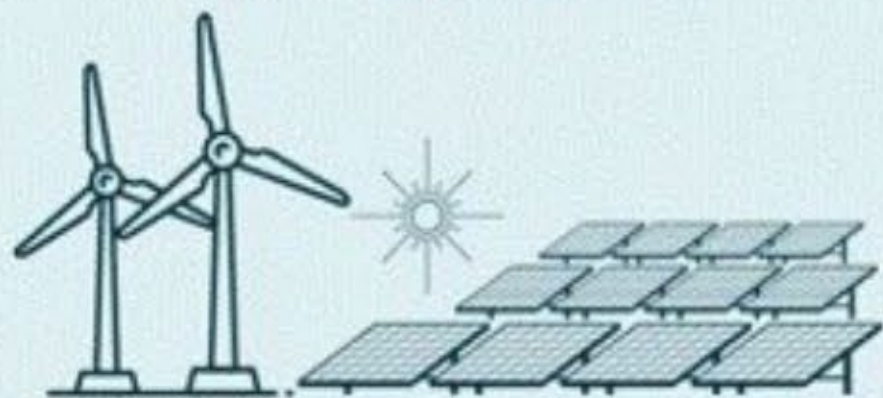
of NEM demand that renewables could have supplied on 5 Oct 2025 — about half of it from rooftops.

What actually changed

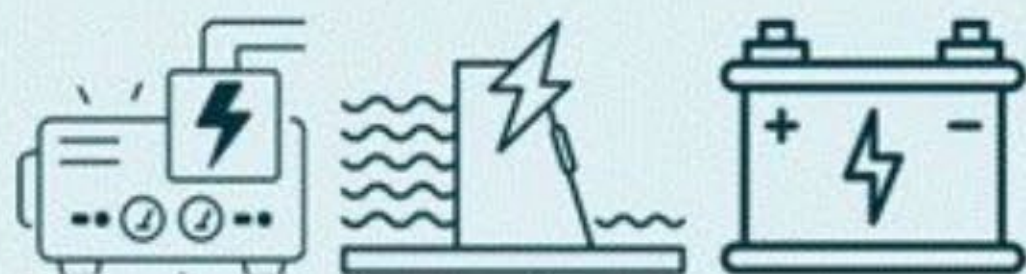
Below a certain level of daytime demand the system runs out of synchronous generation, voltage control and frequency headroom. At that point a distribution-connected consumer device becomes a transmission-level security question — and the System Operator needs visibility and control it never designed for.

Sources: AEMO, 2026 Integrated System Plan, s.1.3 and s.2.1; AEMO media releases on SA minimum demand; AEMO Quarterly Energy Dynamics.

Large-scale
renewables



Large-scale
firming / flex



OUR EMERGING FUTURE GRIDS

Image: Adapted from IRENA System Operation Collection (2020)

Summary Context for DSO Deployment

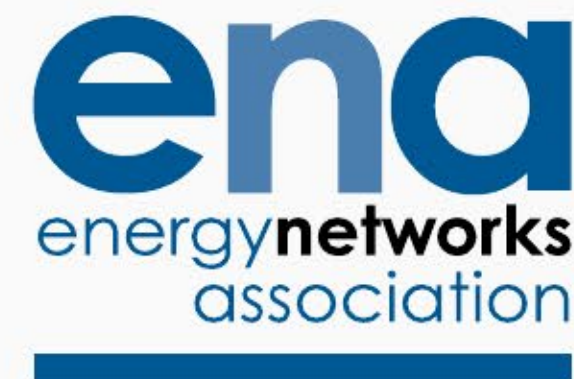
More **volatile + bi-directional** power systems

Require

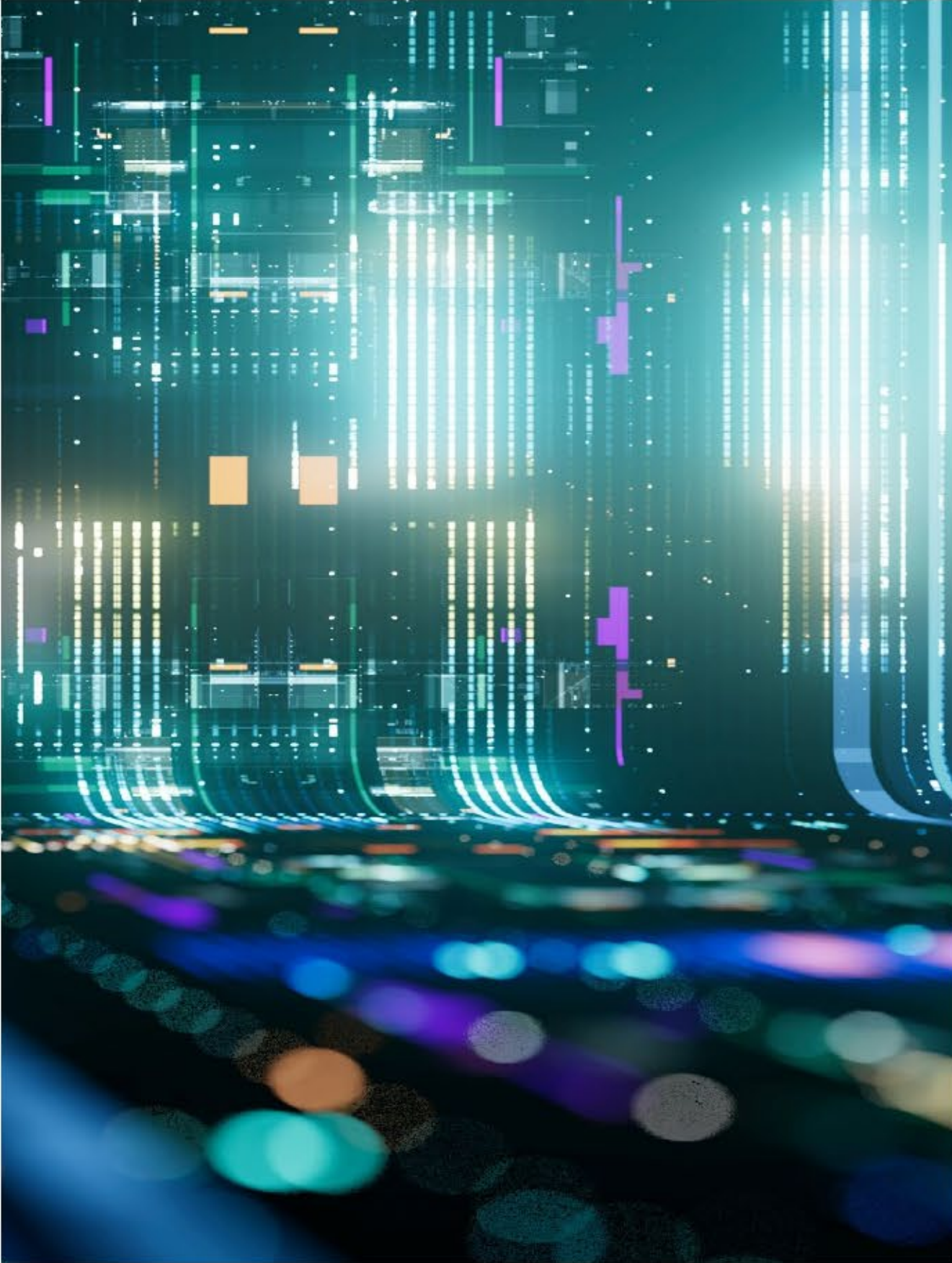
More **flexible + interdependent** whole-system operation



International Survey of DSO Models



Conventional Distribution Business / EDB



The entity which owns, operates and maintains an electricity distribution network, with a primary focus on safe, reliable and efficient one-way power delivery to consumers.

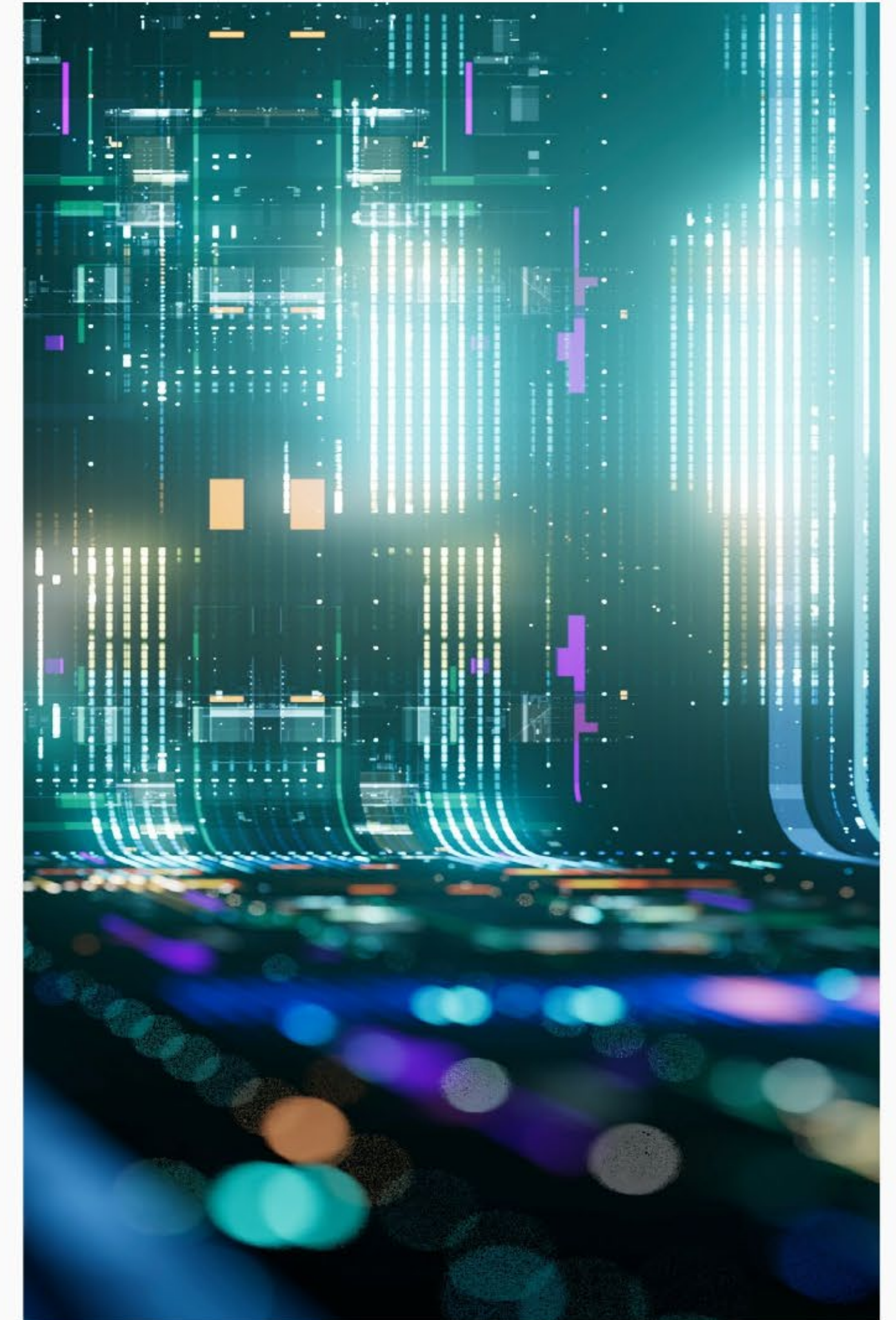
Key activities include network management, infrastructure planning, maintenance and augmentation, customer connections, pricing and tariff settings, supporting energy metering and data, and compliance with regulatory requirements.



What is a Distribution System Operator (DSO)?

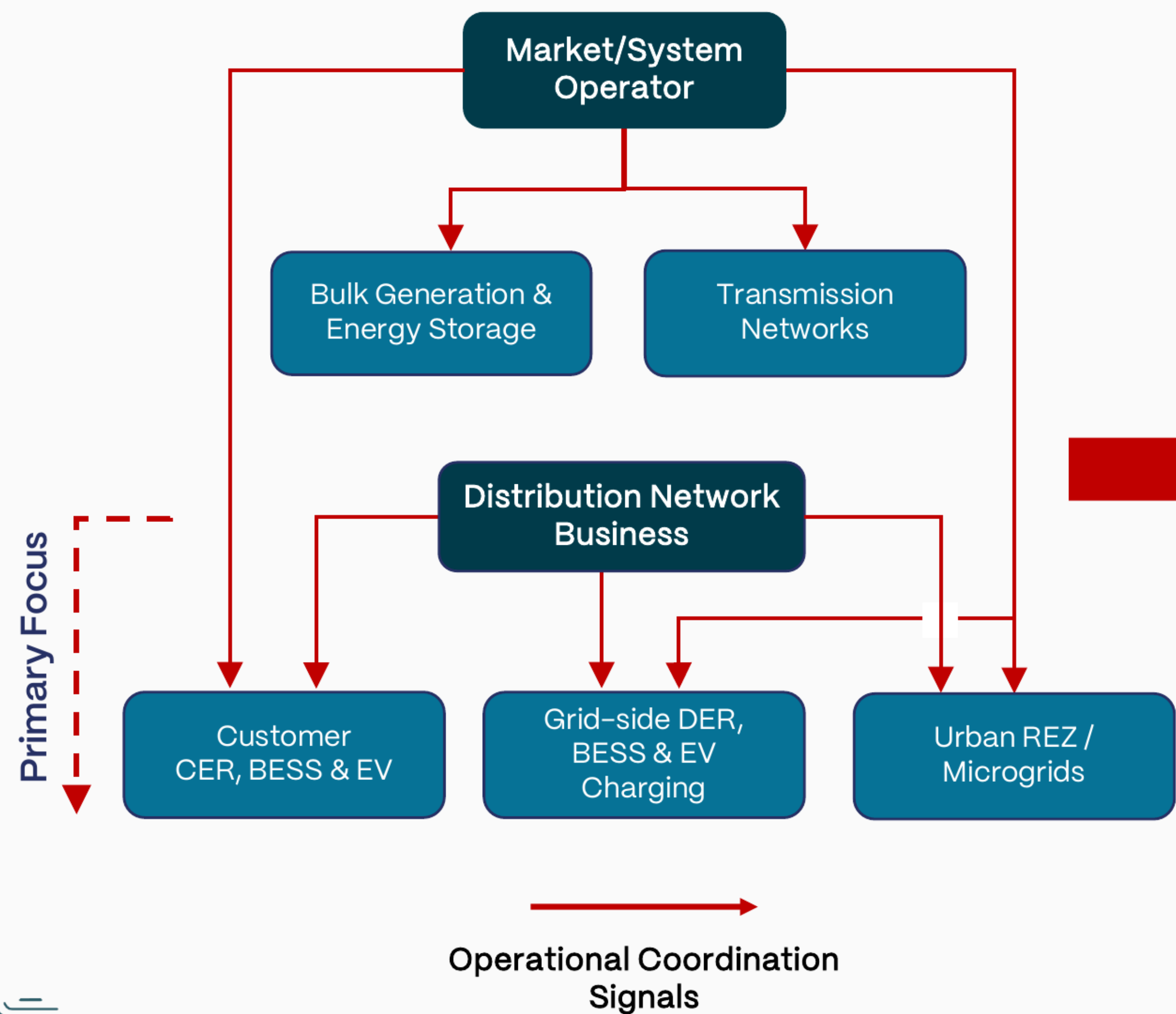
Somewhat analogous to a conventional BPS System Operator, a DSO is the entity responsible for the **active management and optimisation of a high-CER/DER distribution system**, and its **two-way interoperation with the bulk power system**, as the decarbonised grid becomes more volatile and bidirectional.

At the heart DSO operations is the real-time coordination of the '**system**' of network assets, flexible and inflexible demand, customer-owned CER and large-scale DER to deliver enhanced technical and economic outcomes not possible by managing network assets alone.

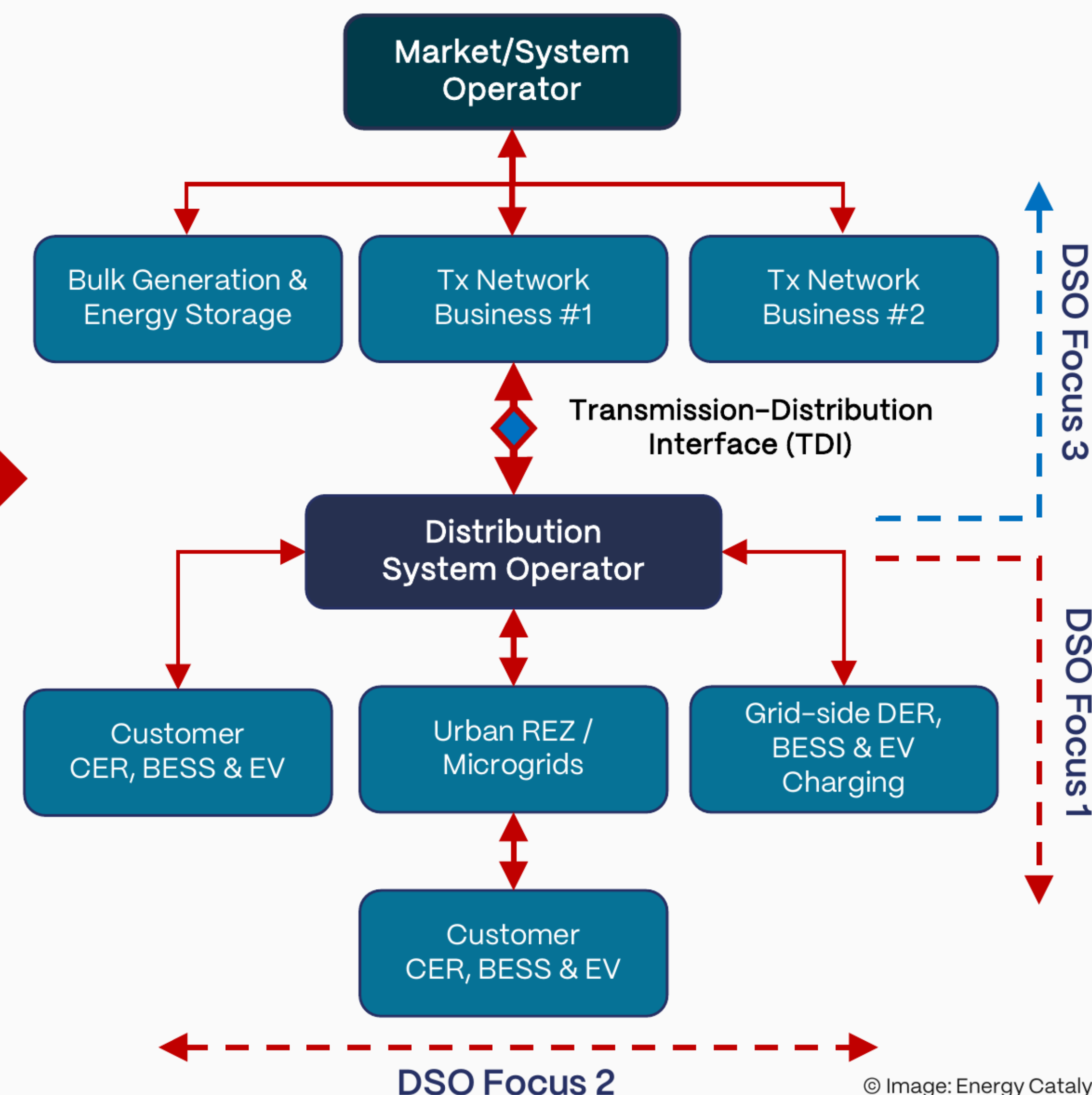


Illustrating EDB:DSO Similarities/Differences

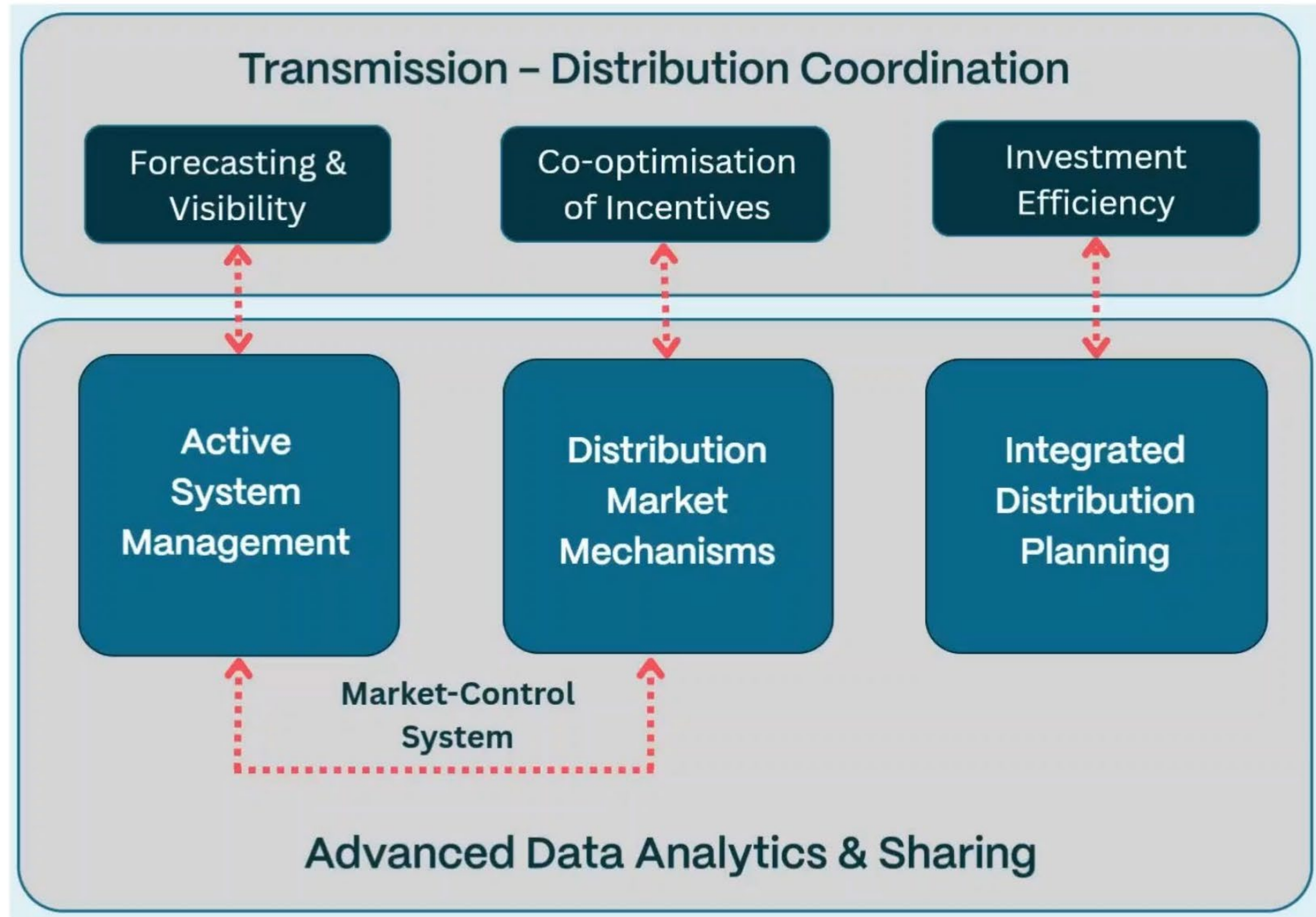
1-way System Architecture



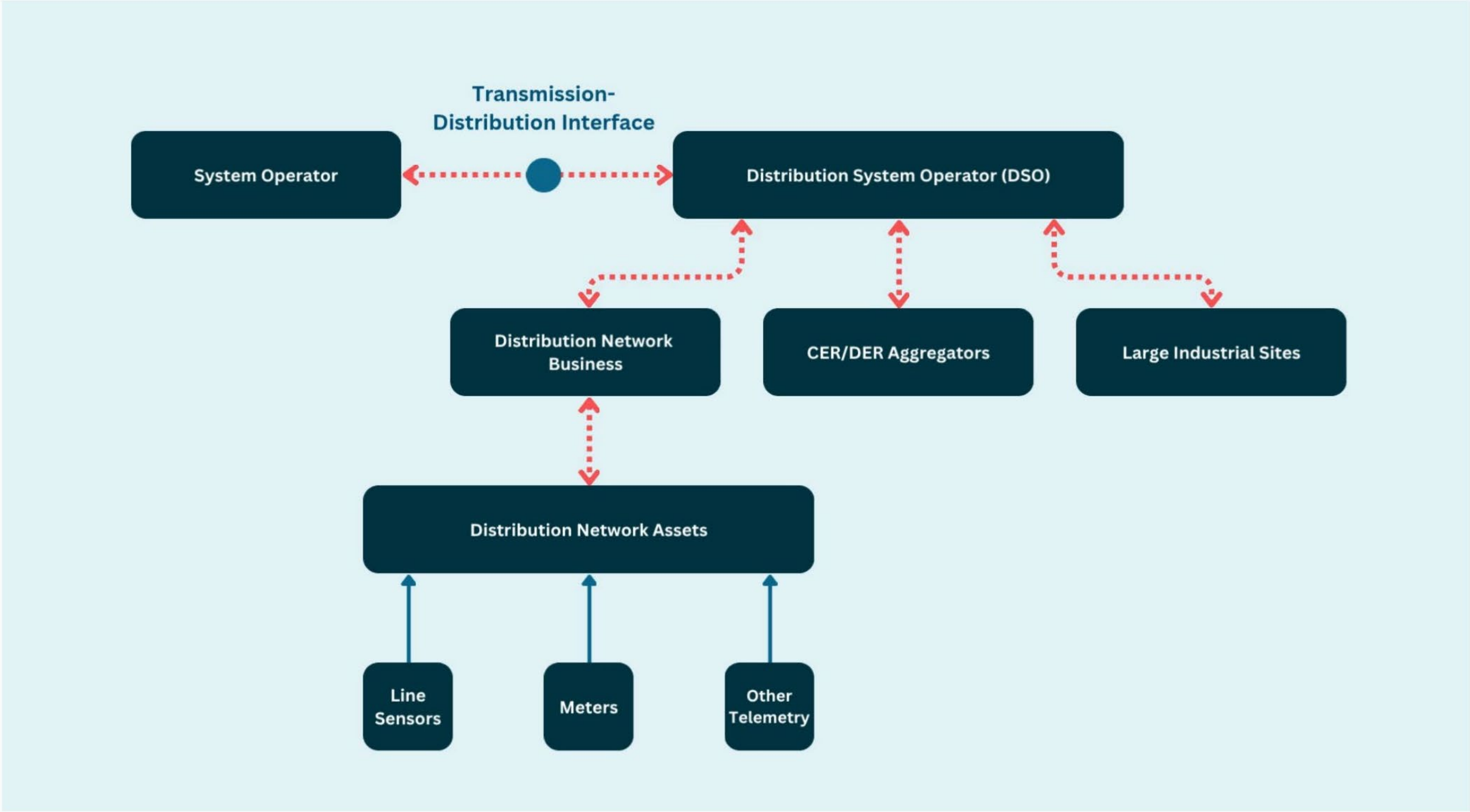
2-way DSO & TDC Architecture



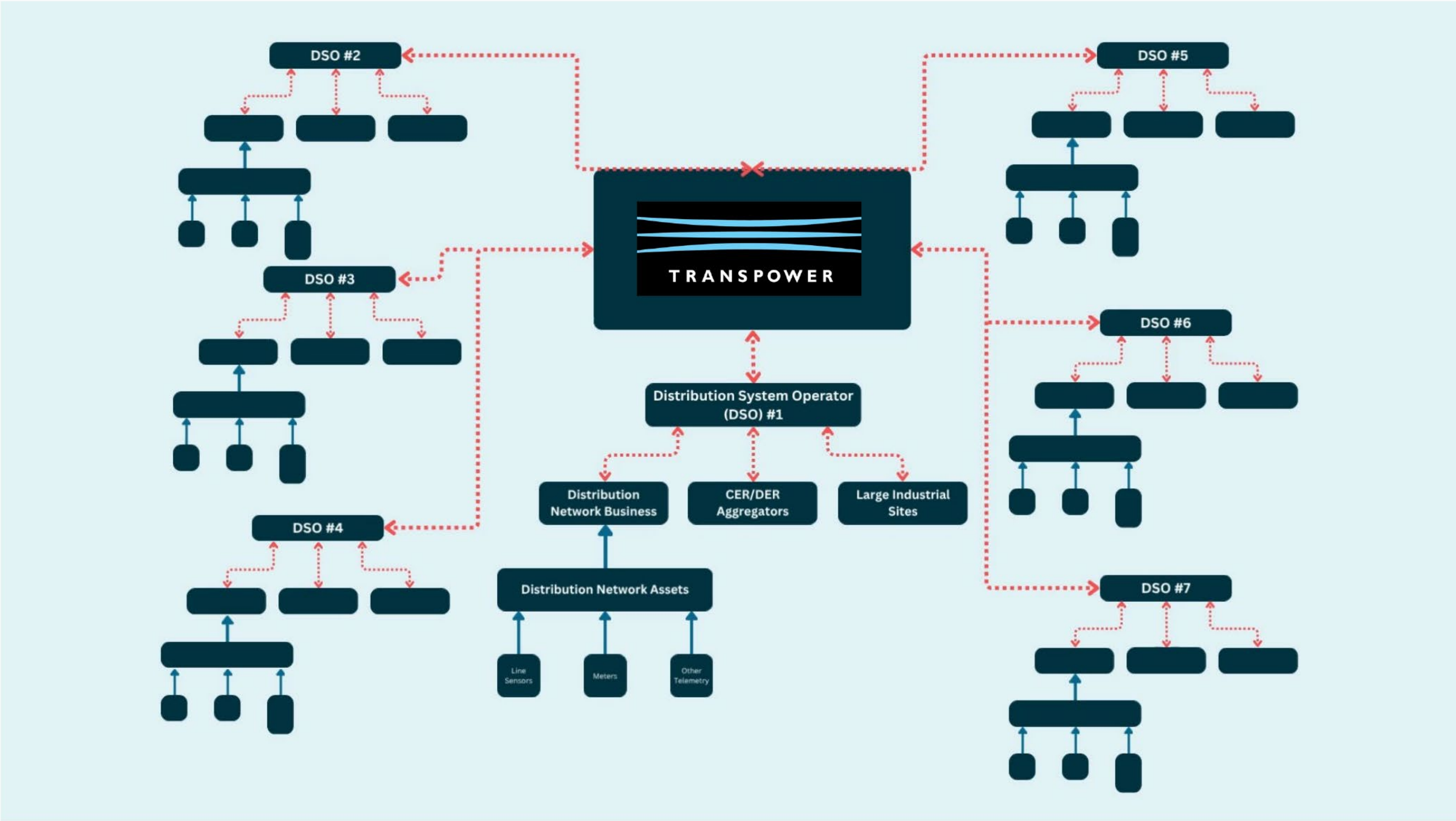
Five Universal DSO Functions



DSO + EDB Functions



DSOs + Wider System Coordination



Quick Recap: Key Enablers of Grid Transformation

- In an increasingly decarbonised, distributed and bi-directional grid, an entirely new set of capabilities, functions and operational attributes are required end-to-end.

- **Distribution System Operator (DSO)** models
 - **Transmission-Distribution Coordination (TDC)** models
- New Enabling Capabilities / Functions

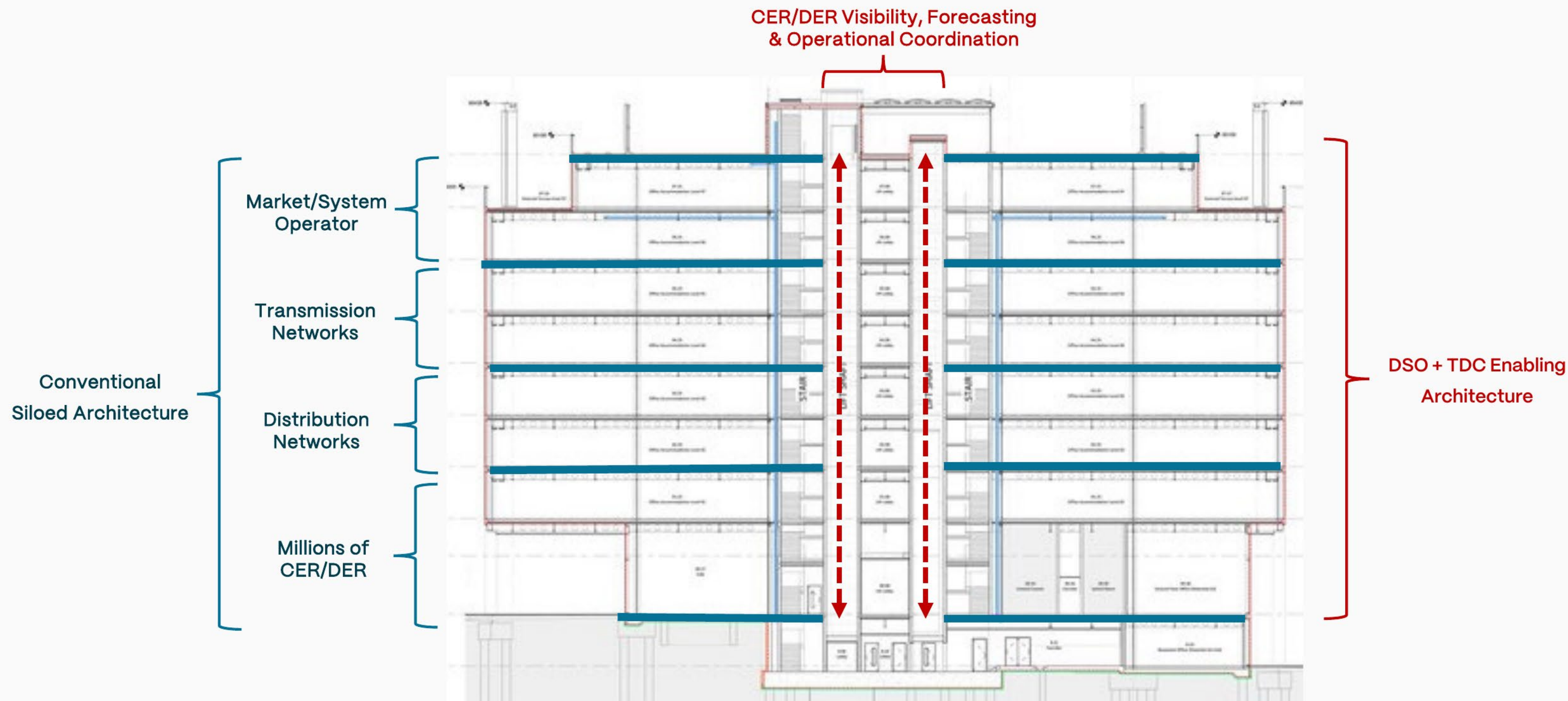
- **CER/DER Visibility** (Operational Visibility)
 - **CER/DER Predictability** (Operational Forecasting)
 - **CER/DER Orchestration** (Dispatch & Control)
 - **CER/DER for System Security** (Emergency Management)
- Essential System Operational Attributes

By 'end-to-end' we mean:

System Operator ↔ Tx Network ↔ DSO/EDB ↔ Aggregators/VPPs ↔ CER/DER



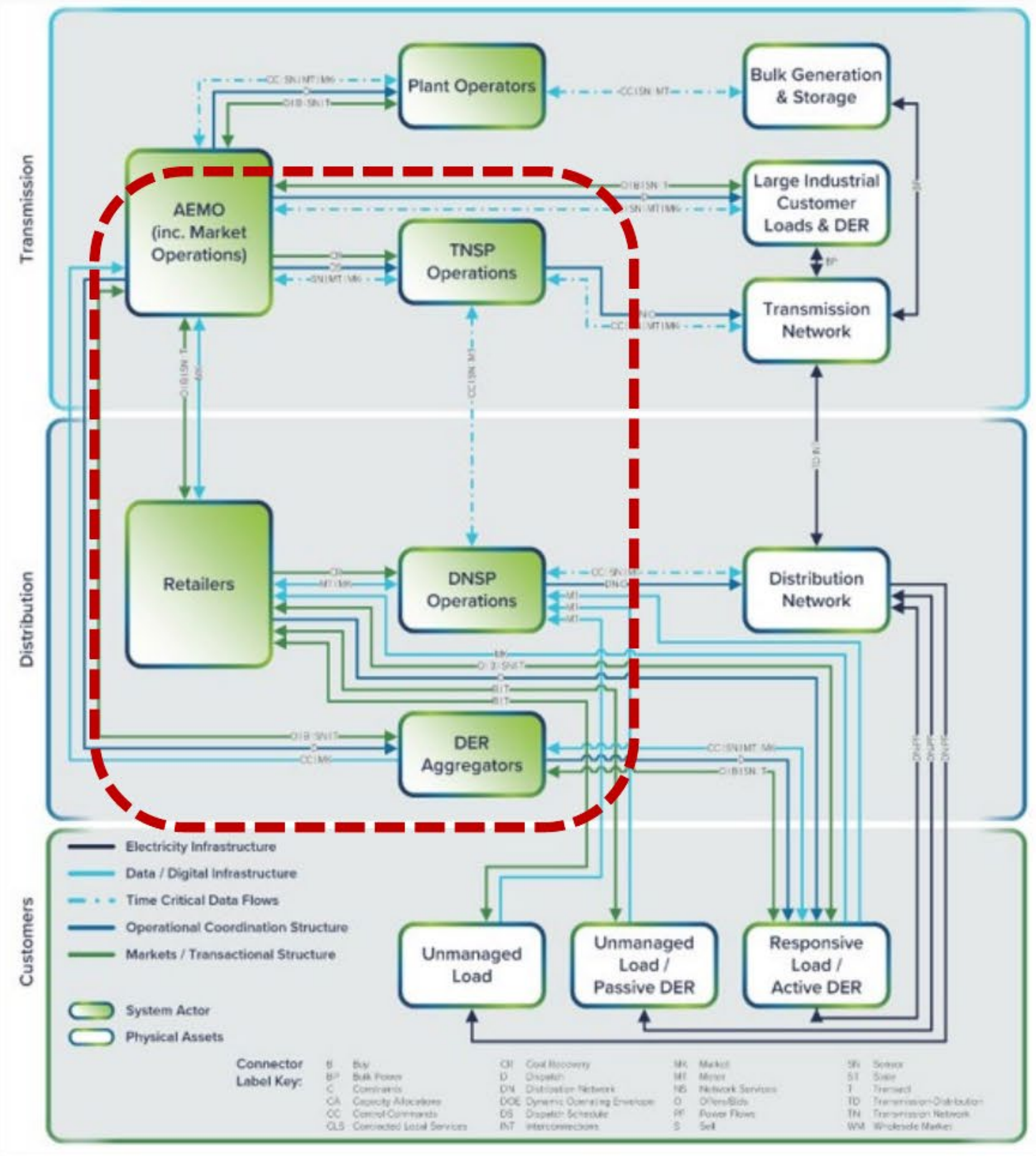
The Pivotal Role of DSO & TDC System Architecture



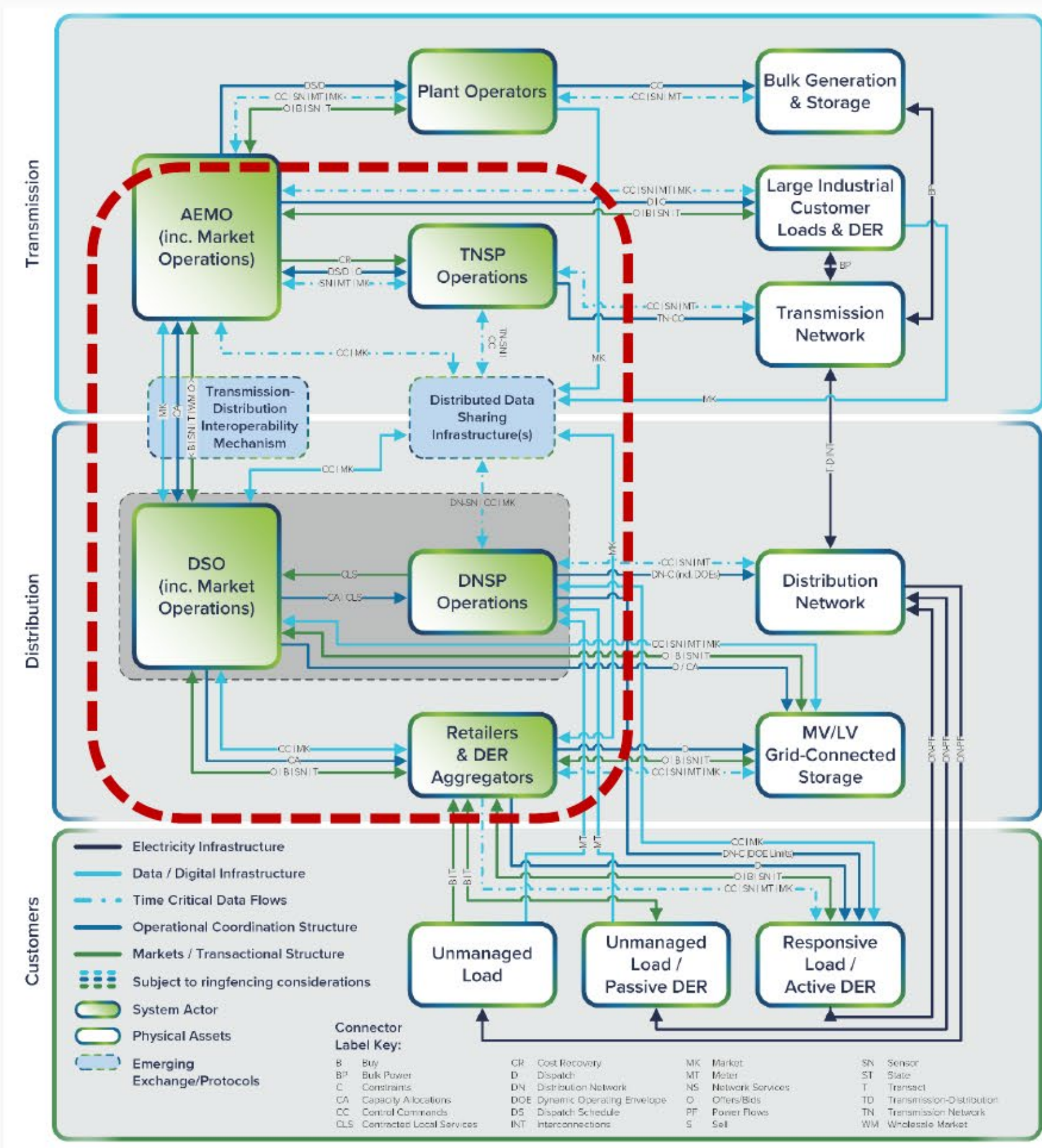
Analogous to a multi-story building, GW-scale power systems consist of several discrete vertical tiers/layers.

Why Pivotal? System Structures enable Capabilities

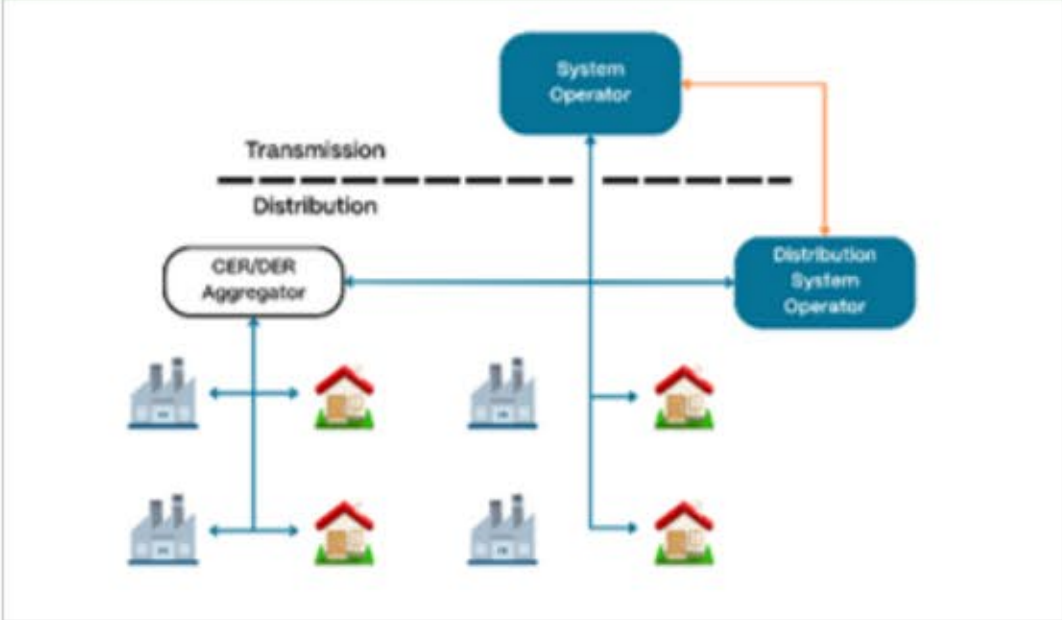
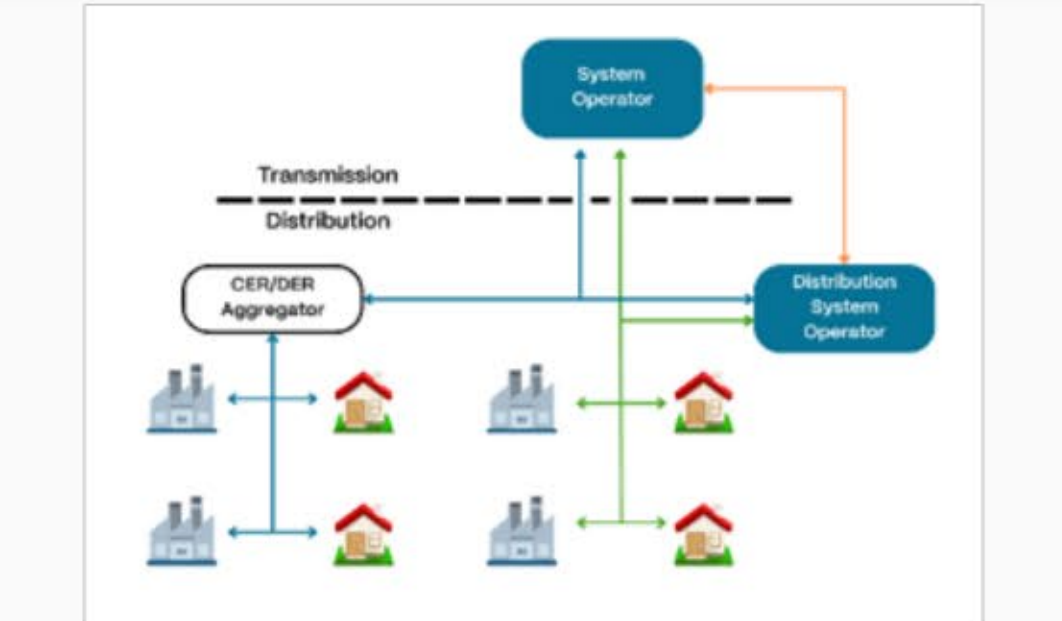
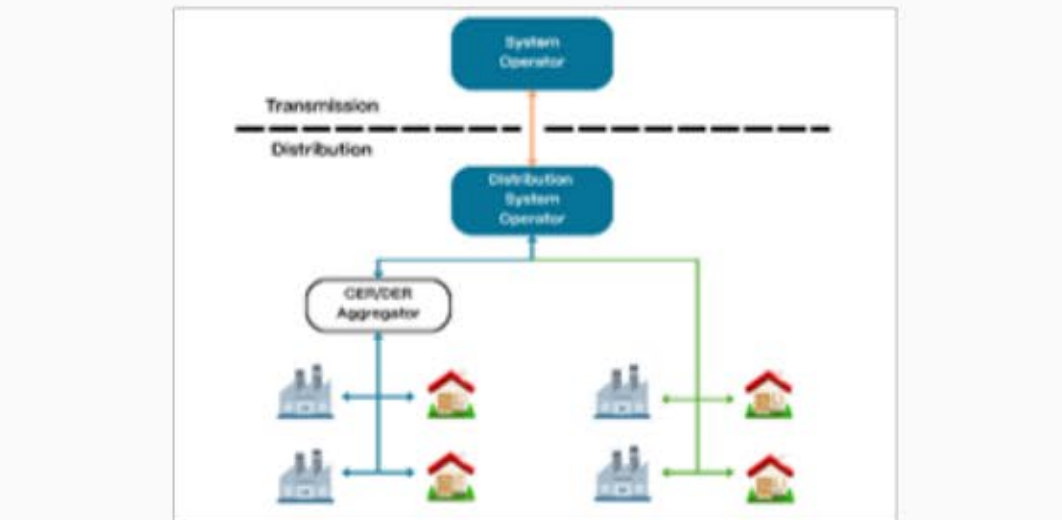
Conventional 1-way Architecture



Example DSO + TDC Enabling Architecture

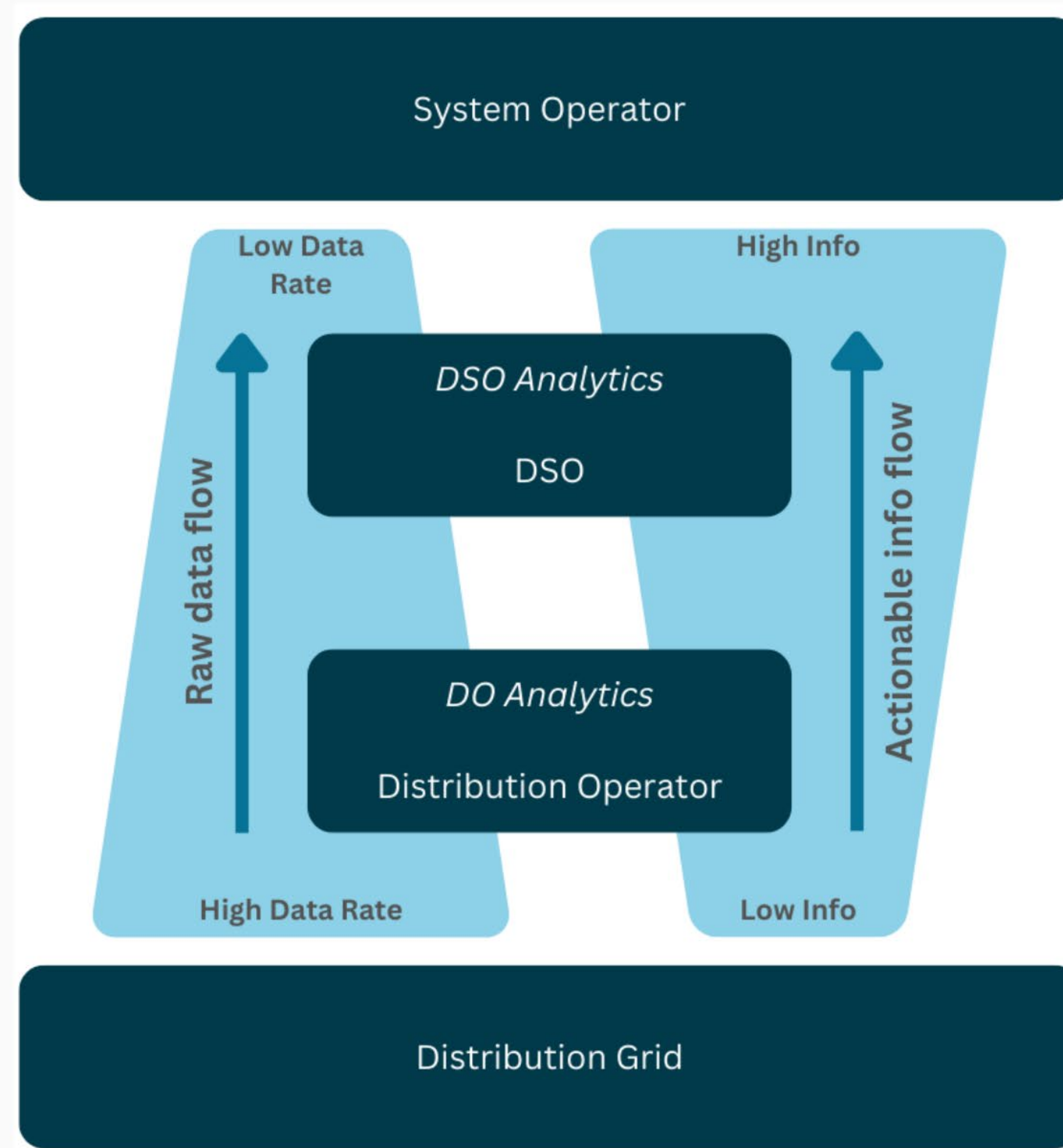


Important: DSO + TDC Architectures are *not* Equal

Category	Conceptual Schema	High-level Description	Sources & Different Terms Used
Top-down*		The System Operator (SO) of the bulk power system has responsibility to manage all participating resources that are connected across the transmission system and each related distribution system, including all CER/DER. The DSO role in this case is limited and is closer to that of a conventional DNSP than in any other category.	• Total ISO [49] • Total TSO [48], [49], [50], [51] • ESO Coordinates [53] • Single Integrated Platform [54], [55]
Multi-entity		The upstream SO and the relevant downstream DSO both have operational responsibilities for managing and/or influencing the operation of distribution-connected resources as do CER/DER aggregators. Enabling scalable operational coordination and market co-optimisation under this model requires significant additional cyber-physical and computational platform investments.	• Hybrid Model [48], [50], [51], [52], [54], [55] • Coordinated DSO and ESO Procurement [53]
Layered Coordination		The DSO has overall responsibility to manage the reliable and cost-optimised performance of the distribution system as an interdependent system layer, including network and non-network assets such as CER/DER. The DSO communicates aggregated data to the SO, and both entities actively manage the two-way interdependencies between the bulk power and distribution systems.	• Total DSO [48], [49], [50], [51], [52] • Two-Step Tiered Platform [54], [55] • DSO Coordinates [53]

* Note: The 'top-down' structure is closest to the legacy 'as-built' arrangements of the NEM.

DSO + TDC Architectures Underpin Grid Digitalisation



DSO + TDC Architectures and Structural Analysis

Each of the DSO + TDC Architectures must be evaluated for their ability to scale securely over the long-term (many issues do not materialise at trial scale).

1. **Tier/Layer Bypassing:** The creation of information flows or coordination signals that 'leapfrog' a vertical tier/layer of the power system's operational hierarchy.
2. **Coordination Gapping:** An element of the power system does not receive an explicit flow of coordination signals from any higher tier/layer of the system and therefore operates in isolation.
3. **Hidden Coupling:** Two or more control entities with partial views of system state issue simultaneous but conflicting coordination signals to a CER/DER or component of the power system.
4. **Cluster Coupling:** Where CER/DER are addressed in groups that do not allow for separation of edge device commands by specific criterion: location, device type, device service provision, etc.
5. **Latency Cascading:** Creation of compounding latencies in information flows due to the serial routing of data through various computational systems, processes and organisations.
6. **Computational Time & Cost Excursions:** Where massive data volumes, latencies and processing 'bottlenecks' occur, compounded by unresolved structural issues, optimisation engines risk hitting a computational 'time wall' where no amount of computing resource will be adequate to solve the optimisation problems in an acceptable time and at an efficient cost.
7. **Cybersecurity Structural Vulnerabilities:** Ill-informed and often unnecessary structural choices result in communication and routings that create non-cyber vulnerabilities to system penetration.
8. **Back-end Integration Constraints:** Multiple vertical silo structures found in many supply-chain organisations drive significant back-end integration costs, anti-resilience and are anti-extensible due to the coupling of applications in which where failure in one can ripple through to degrade others.



Tools for Structural Analysis + Taming Complexity

Power Systems Architecture

Formal disciplines for collaboratively determining what the future system must be able to do, who does what.

To reason from constraints and required capabilities down to the components that deliver them.

Deliberately whole-of-system: the seams between organisations are inside the scope, not outside it.

Model-Based Systems Engineering

MBSE provides one connected, machine-readable representation of the evolving power system.

One change, all views change.

It holds what the system **IS**: parts, their connections, and what moves between them, and what the system **DOES**.

Represented by views that query the model.

Model Outputs

1 Diagrams

Context, interconnection, sequence and allocation views – regenerated whenever the model moves.
Autonomous rendering.

2 Tables

An itemised interface register. A taxonomy of every signal conveyed.
Capability-to-actor allocation.

3 Bespoke queries

"Every data flow that crosses the T-D boundary." "Every capability with nothing realising it."

MBSE Models Enable Multi-party Collaboration

Core Taxonomy per Structure Class:

1 Elements

The actors and infrastructure that make up the system – AEMO, a TNSP control room, a DNSP's SCADA, a customer's inverter. Each one catalogued once.

2 Interfaces

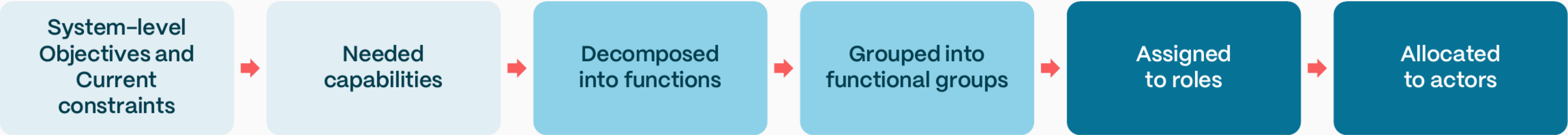
The relationships between them and formal semantics to capture how they interact.

3 Flows

What actually crosses an interface. Named payloads, with a direction and a source: a curtailment instruction out, an execution conformance signal back.

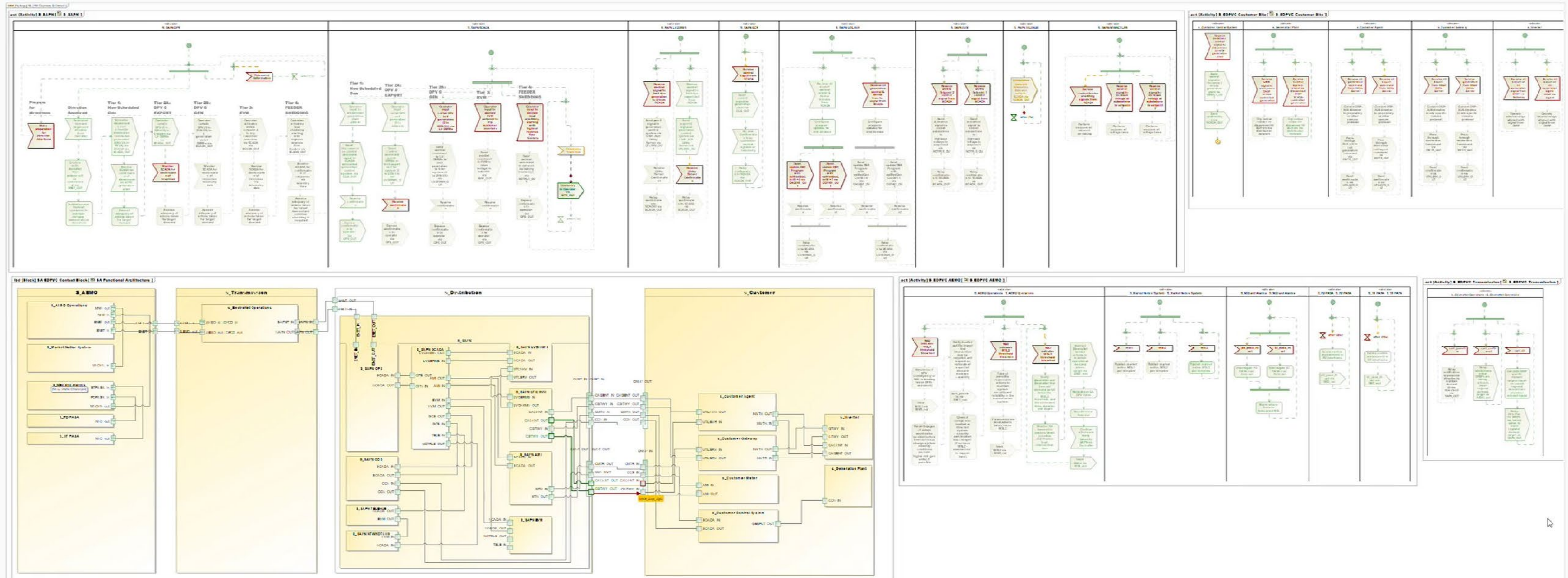
Decision Logic:

Supporting the Power Systems Architecture discipline:

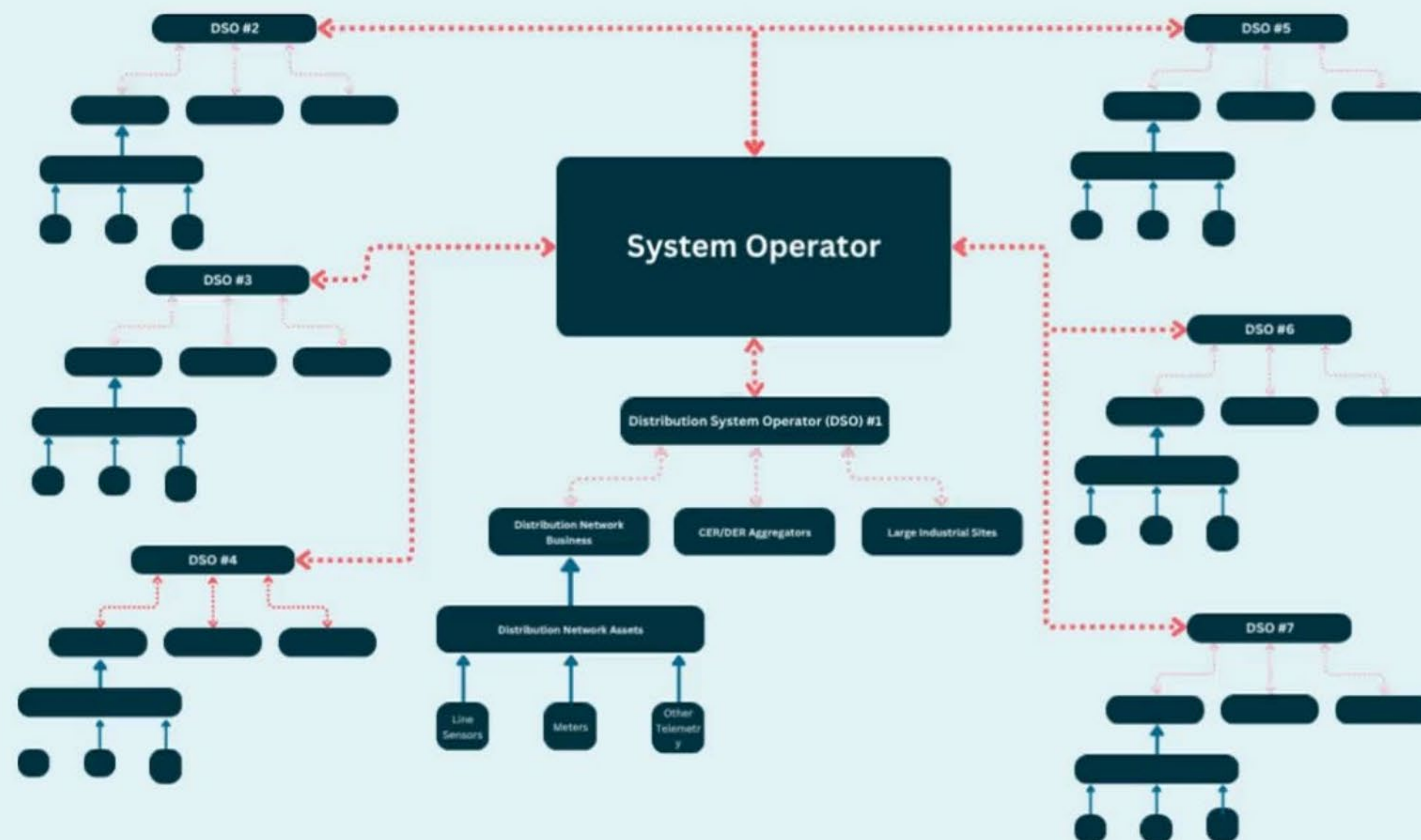
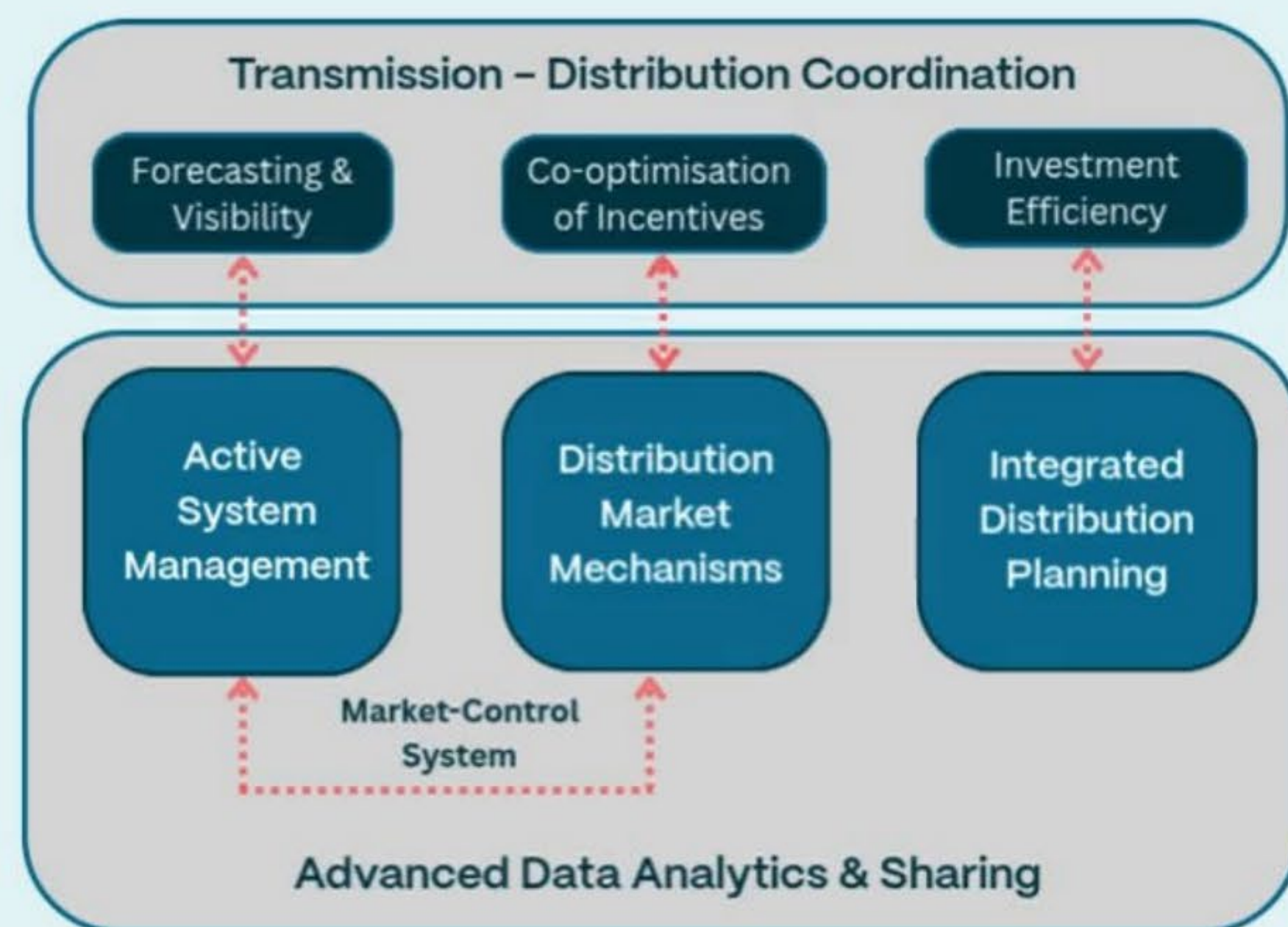


Both informed by and cognisant of the impacts on actor interactions at their external boundaries

MBSE Models Enable Whole-system Digital Engineering



Thank you!



Reference Set of 5 x Reports: <https://energycatalyst.au/futuregrid/>

Objective 2: Driving Efficiencies

Case study: **Counties Energy DSO in action**

Moonis Vegdani, Chief Network and Digital Officer, Counties Energy

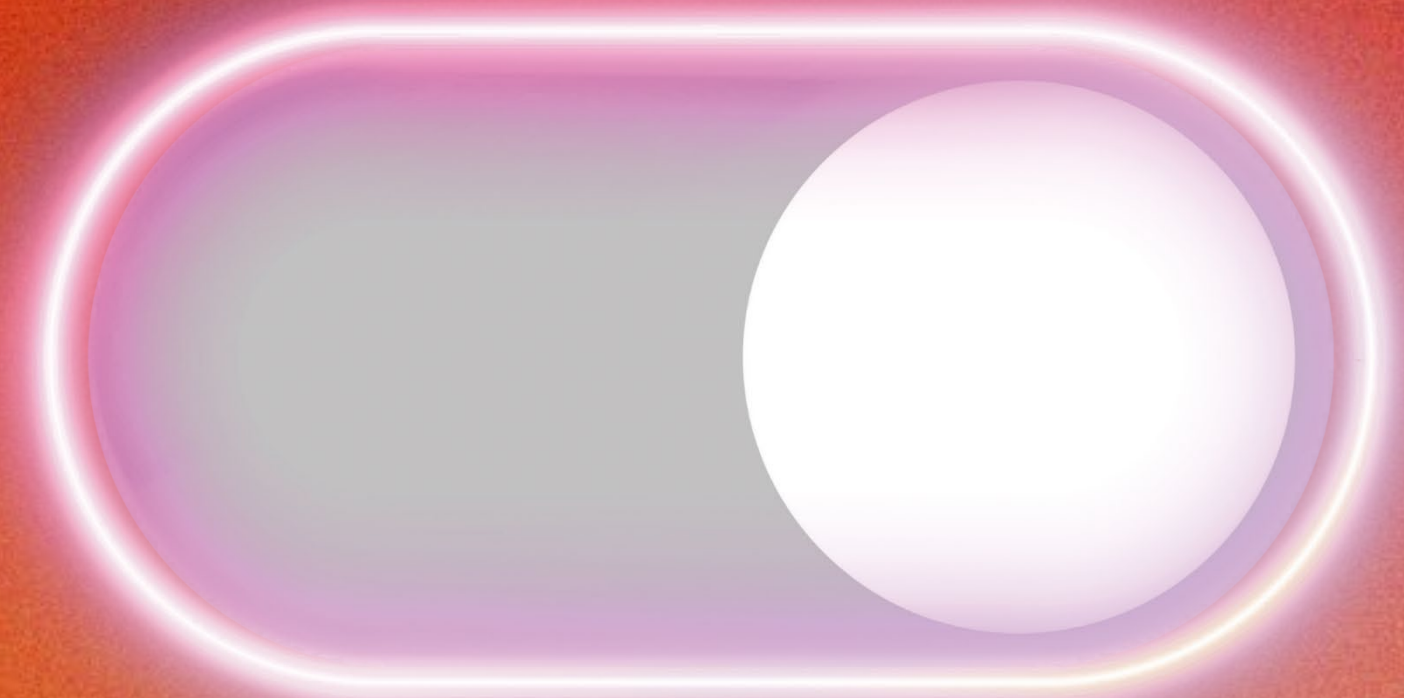
Astad Kapadia, Head of Connections and DSO Services , Counties Energy

Case Study

Counties Energy DSO in action

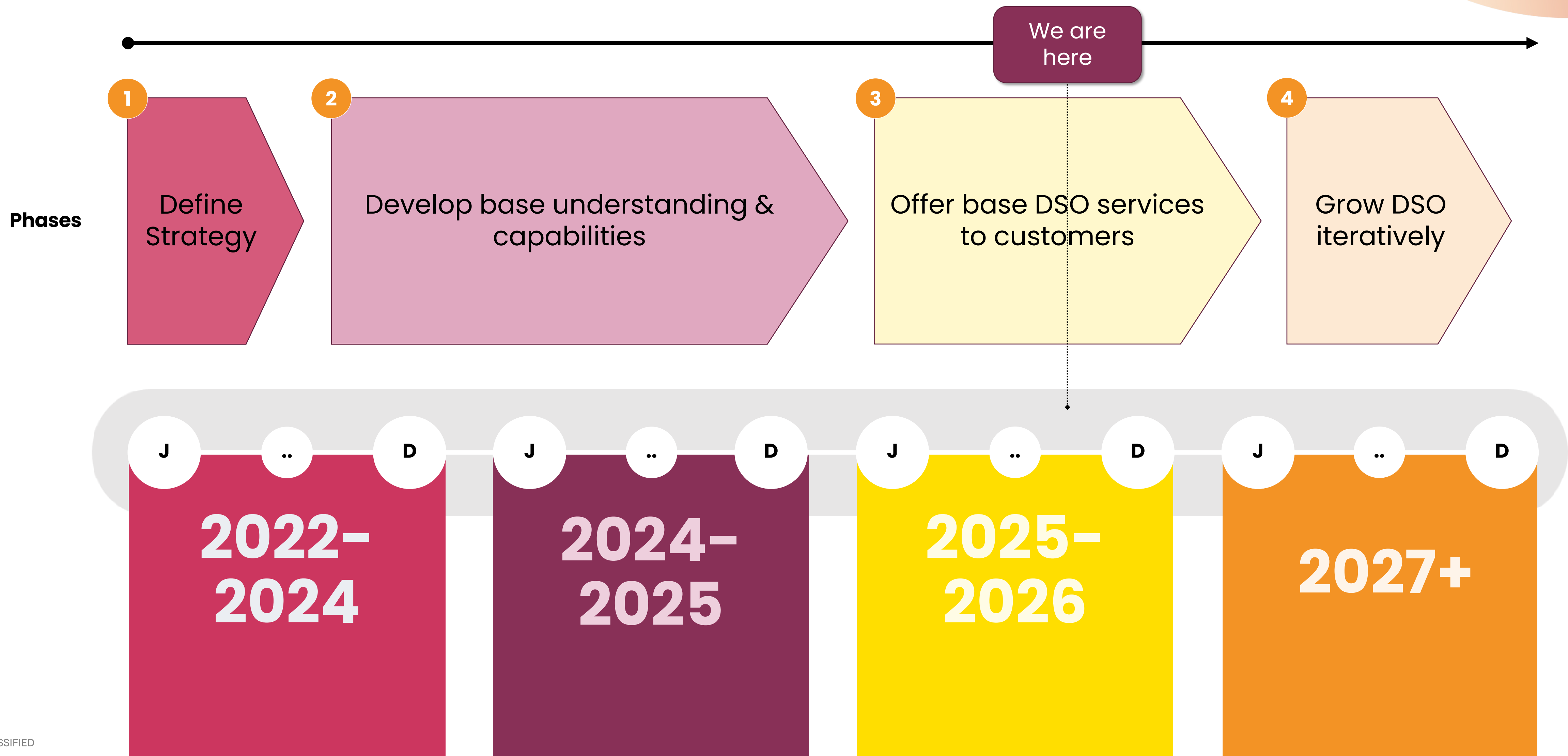
EEA Conference 2026 –
Pre-conference DSO Workshop

22nd September 2026



Off | On

High-level Strategic Roadmap (simplified)



Our Strategic choice – Orchestration-first DSO approach



Bi-directional Orchestration-first

- Build visibility and dispatch layer, then layer markets on top
- Value is unlocked at the point of connection, today
- Flexibility becomes a network operating tool instantly
- Services have a process, a price and a customer agreement
- Customer sees a faster connection and a lower bill

Capacity Marketplace-second

- Design the market, then find the technology to serve it
- Value is unlocked when the market eventually scales/matures
- Flexibility could remain a procurement question
- Trials demonstrate capability; they do not deliver a service
- Customer sees nothing until the market exists/grows

The Centerpiece – Gridex our DSO Orchestration Platform

A platform product, not a project

Gridex is a standing capability with a roadmap and an owner.

It does not have an end date, a closure report or a benefits realisation memo. It has releases.

Standards-compliant by design

A CSIP-AUS compliant server means any conforming inverter, battery or aggregator connects without bespoke integration.

Onboarding is configuration, not a project.

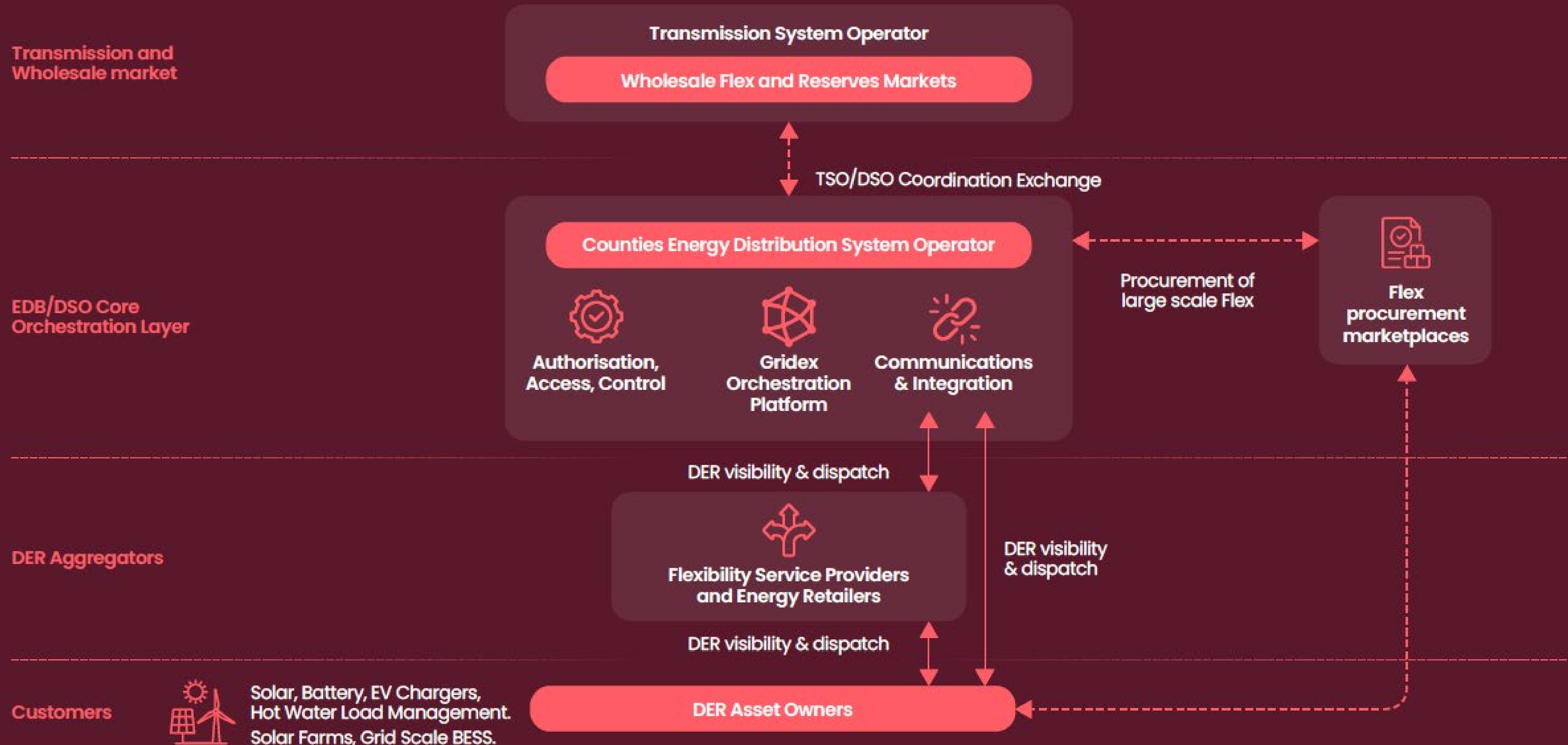
Independently conformance tested

Australian National University and Australian market conformance testing is the credibility anchor.

This is not self-certified capability – it is tested against the standard, by a third party.

Understanding CSIP-AUS – <https://www.csipaus.org/about>.

Gridex – the heartbeat of the DSO



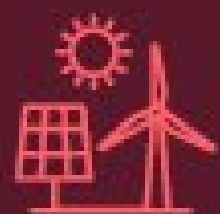
What can Gridex do?

Transmission and
Wholesale market

EDB/DSO Core
Orchestration Layer

DER Aggregators

Customers



Solar, Battery, EV Chargers,
Hot Water Load Management.
Solar Farms, Grid Scale BESS.

Wholesale Flex and Reserves Markets

TSO/DSO Coordination Exchange



Authorisation, Access, Control



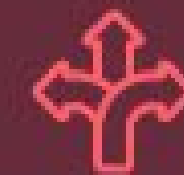
Gridex Orchestration Platform

- DOE calculation
- DER asset register
- DER visibility & dispatch
- DER forecasting
- CSIP Aus 2030.5 Utility server
- Plug 'n play for Aggregators and DER owners



Communications & Integration

DER visibility & dispatch



Flexibility Service Providers
and Energy Retailers

DER visibility & dispatch

DER visibility
& dispatch

DER Asset Owners

Core Network Systems

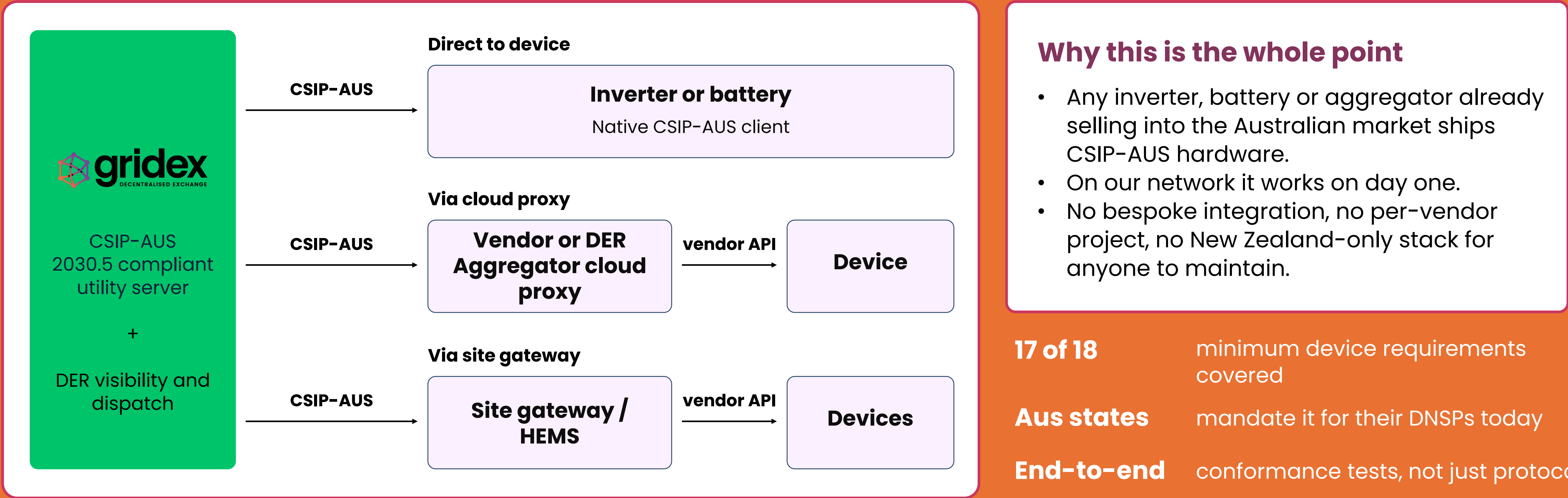


Key interfaces:

- Network topology
- Load forecast
- Smart metering data
- Customer Connection Info.
- Near real time situation awareness
- Registry data

Open Standards and Interoperability Aligned to Australia by design

Gridex speaks CSIP-AUS (SA TS 5573:2025, on IEEE 2030.5) and supports every connection pathway the Australian market uses.



Full comparison of CSIP AUS and OpenADR 3.0 can be found in [Standards Australia CER Interoperability Report, June 2026](#).

DSO Flexibility Service Catalogue

	DSO Service Category	Firmness Level (Aligned to Australian Tiers)	Service Name	Customer Segment	Service Status
1	Flexible Connections	High	Flexible capacity for Large Commercial Loads	Commercial customers	Completed, Scaling up to BAU
			Flexible capacity for Public/Commercial EV Charging	Public CPOs, eBus and eTruck Operators	Completed, Scaling up to BAU
2	Flexible Imports	Low/ Medium	Retailer Hot Water Demand Flex	Retailers and Aggregators	Completed, BAU service
		Low/Medium	Flexible Imports for Residential EV customers; V2X/V2G (next)	Residential EV customers	Customer testing WIP, Go-live by Oct 2026
3	Flexible Exports	Low/Medium	Flexible Exports for Residential Solar	Residential Solar customers	Customer testing WIP, Go-live by Nov 2026
		Medium/High	Flexible Exports for Commercial Solar	Commercial Solar customers	Customer testing WIP, Go-live by Nov 2026
			Flexible Exports for large Generation	Large scale generation customers	Customer testing WIP, Go-live by Nov 2026

Three DSO Flexibility Services, in service today

LIVE

Flexible Connections

Large load connected at full requested capacity against constrained firm capacity, with agreed curtailment exposure.

- **Connect in weeks, not upgrade cycles**
- **Avoids or defers a capital investment**

LIVE

Flexible Imports

Managed charging and controllable load on constrained transformers and LV circuits.

- **New load absorbed without reinforcement**
- **Avoids LV and transformer investment**

LIVE

Flexible Exports

Dynamic export headroom replaces a static limit. Customers export more, more often, without a network breach.

- **More export, more equitably allocated**
- **Headroom is equally allocated amongst customers**

DSO Flexibility Services with Real customers. Real dollars.

Flexible Connection

Awhitu School • Auckland

- Awhitu School requested 110kW solar plus two 120kW/240kWh batteries on an existing 3-phase 63A (45kW) connection.

Customer savings

\$137,400

Flexible Connection

Daybreak Solar • Auckland

- Daybreak Energy requested to connect 4MW of solar and 4MW of BESS, only 1.14MW available in the network

Customer savings

\$1,978,900

Flexible Import

Drury • Auckland

- A residential battery (15 kW/29 kWh) customer needed connection on a 50 kVA Tx facing up to 120% overload risk.
- Standard assessment: restricted to zero grid-charging capacity.
- Flexible Import via Gridex allows dynamic charging during network headroom, avoiding a transformer upgrade and its capex.

Network capex avoided / customer savings

\$50,000

Flexible Export

Karaka • Auckland

- Customer requested 5kW export on a 25kVA Tx, but the standard assessment resulted in 0kW export due to DG thermal headroom.
- Flexible Export via Gridex allows the customer to dynamic export when headroom is available, achieving the requested 5kW through the day and sometimes more.

Additional export revenue for customer

\$1,095 / year

Scaling up our DSO Flexibility Services

10

Aggregators tested
and onboarded onto
Gridex.

36,000

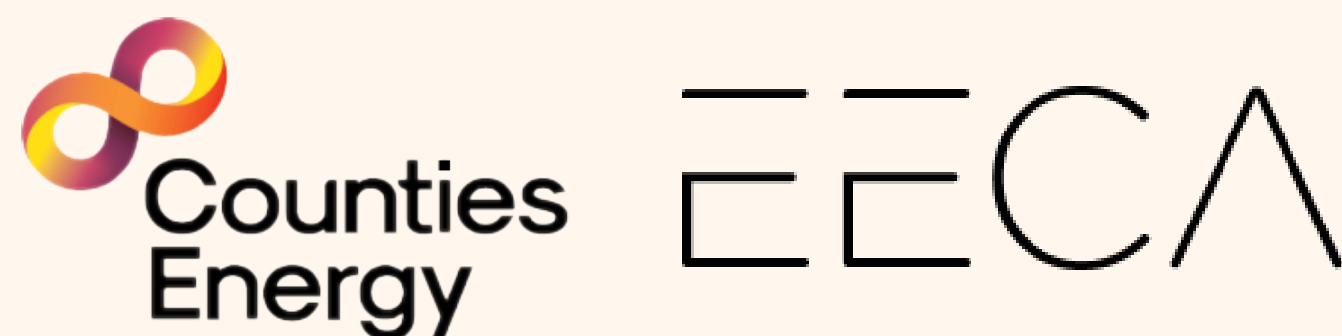
DERs connected and
managed by Gridex.

40MW

Flex available
via Gridex nationally.

New Zealand's first smart energy neighbourhood

- 500 – 550 ICPs
- 5min smart metering data
- 300kVA average Dtx capacity
- Average Demand
 - Peak 70%
 - Off-peak 5%
- Peak Times
 - Morning 5am – 8am
 - Evening 5pm – 8 pm



Harbourside Flex: Lessons Learnt

Network Visibility allows us to:

- Map DTx <> Phase <> LV Circuit <> Open Point <> ICP → Accurate and Reliable LV network model
- Data collection of Consumption and PQ → Operational context of network and forecasting
- Identify and monitor DG, EV Chargers, BESS → Behavioural context of DERs
- Identify abnormal operating conditions → Enhance network and public safety + outages

Standardisation and interoperability

Integration point	Comms. approach	Justification
Core network systems (GIS, AMI, ADMS, Historian, Maximo, DERMS)	use available proprietary API	• Too difficult to move, and too slow to adapt • OT/IT cyber security considerations • Compute requirements within each environments
DER Aggregation / Direct Control	CSIP AUS IEEE 2030.5	• Common for direct IBRs control • Major aggregators support out-of-box (e.g. Tesla, Sigenenergy, and more) • V2G/EV Chargers not far away

Harbourside Flex: Reimagining ourselves

Reimagining the way we run our business

Business unit	Action taken	Observed Result	Challenge
Connections	- Documenting triggers that create consideration for NNS/NWAs and Flexible Connections solutions - Training staff on benefits of NNS/NWAs and Flexible Connections - Creating appropriate Ts&Cs and Pricing that is attractive for customers and provides assurance to asset managers	Since April, in the pipeline: 5 x Flexible Connections; 2 x NNS/NWAs; 2 x Flexible Imports/Exports Totalling >10MW of capacity Happier customers 😊	- Training people - Resistance to change
Planning	- Documenting an approach that creates consideration of NNS/NWA and flex procurement/dispatch solutions as part of project justification process - Training staff and creating tools that can be used to compare Traditional and Alternative solutions - Providing and creating evidence to demonstrate reliability and performance of the solutions	- Consideration of HW Flex as part of Planning process - Active consideration of EOIs/RFI/RFPs for flex procurement to defer large projects - V2G/EV Chargers not far away	- Demonstrating evidence to establish trust in flex - Testing financials and landing on a value for flex
Operations	- Creating tools through Gridex that provide transparency and appropriate override capability - Training staff on the benefits, expected behaviours and complexity of data interpretation and decision-making	- Used flex in both in unplanned and planned outage scenarios - Made available for dispatch during CAN/WRN/GEN notice	Scaling back expectations

Harbourside Flex: Industry opportunity

Opportunities to take a common/standardised approach

- **Product and Service offers**
 - Flexible Exports / Imports and the Terms and Conditions for operation
 - Flexible Connections and the Terms and Conditions for operation
 - Direct market flex procurement
- **Software**
 - Network Systems (e.g. GIS, ADMS, etc.)
 - Aggregators and direct to DER Devices (where necessary),
 - Energy Retailers and Transpower
- **Commercial & Legal**
 - Standardised flexibility dispatch hierarchy
 - Terms & Conditions for procurement, dispatch, acceptable SLAs, obligations and liabilities
 - Value of flex under different procurement scenarios; i.e. high, medium, low firmness
 - Flexibility tariff naming, structure, and pricing methodology
- **Regulatory**
 - Alignment on the above will create a strong position for informed regulation

To learn more about Gridex, our publicly available resources and our journey, please scan the QR code:

Ngā mihi



Objective 3: Accelerating Flexibility

Case study: **Flexibility markets and practical implementation experience**

Neville Goodwin, DSO Programme Principal ,Powerco

Adrian Lobb, DSO Retailer and Flexibility Manager, Powerco

Flex – Powerco's journey

September 26 update

Adrian Lobb/Neville Goodwin|

Objective:

Demonstrate Flex Market

DSO 1.0 - Identify and mitigate network constraints through flex and non-traditional solutions

Neville Goodwin| 5 June 2024



Basic steps

To demonstrate a flex trading platform

[illegible]

Identify Constraints

Project selection

(Posited 2024)

Select projects for flex trial

Projects selected for the demonstration of a Flex market needed to be selected carefully to ensure the delays associated with taking these to market did not adversely affect our customers and did not unduly disrupt the capital works programme. We need some degree of confidence that a subset of these will actually attract offers that are practical to be implemented. We were aiming for a shortlist of between 10 and 15 projects, with at least 3 Flex contracts being successfully awarded.

The steps required were:

- Develop a risk matrix for assessing projects to be considered for the demonstration
- Investigate upgrade projects in Copperleaf, those not currently in delivery
- Long list projects that may suit non-network solutions
- Discuss possibilities with Planners
- Short list developed
- Projects officially 'put on hold' pending trial.
- Projects split into "enablement" and "construction" phases to derisk

Project selection learnings

Issues arising

Selecting the projects was probably the single biggest hurdle initially.

- Limited definition of future network projects
- Forecast and project dependencies changed investment timing
- Multiple project drivers complicated need identification
- Timelines and capital forecasts may have overstated flexibility needs
- Alternative and least-cost solutions may not have been fully explored

Define the requirements

Define the Flex requirement

(Posited 2024)

Develop the Flex parameter requirements

To determine the Flex requirement, we needed to understand the nature of the constraint and what load reduction, or compensatory generation, would be needed, and when. We also needed to understand how much certainty of delivery we require, and if there is any element of pre-warning available (for post contingent flex offerings.) To define the Flex requirement, we will need to:

- Identify the 'Operating Envelope' required to relieve the constraint (DOE for post contingent)
- Determine the growth impact requirements
- Understand the deferral boundaries and risks
- Understand the risk regarding growth forecasts, ability to deliver etc
- Ensure we can achieve peak reduction without creating alternate peaks
- Develop the constraint specific requirements

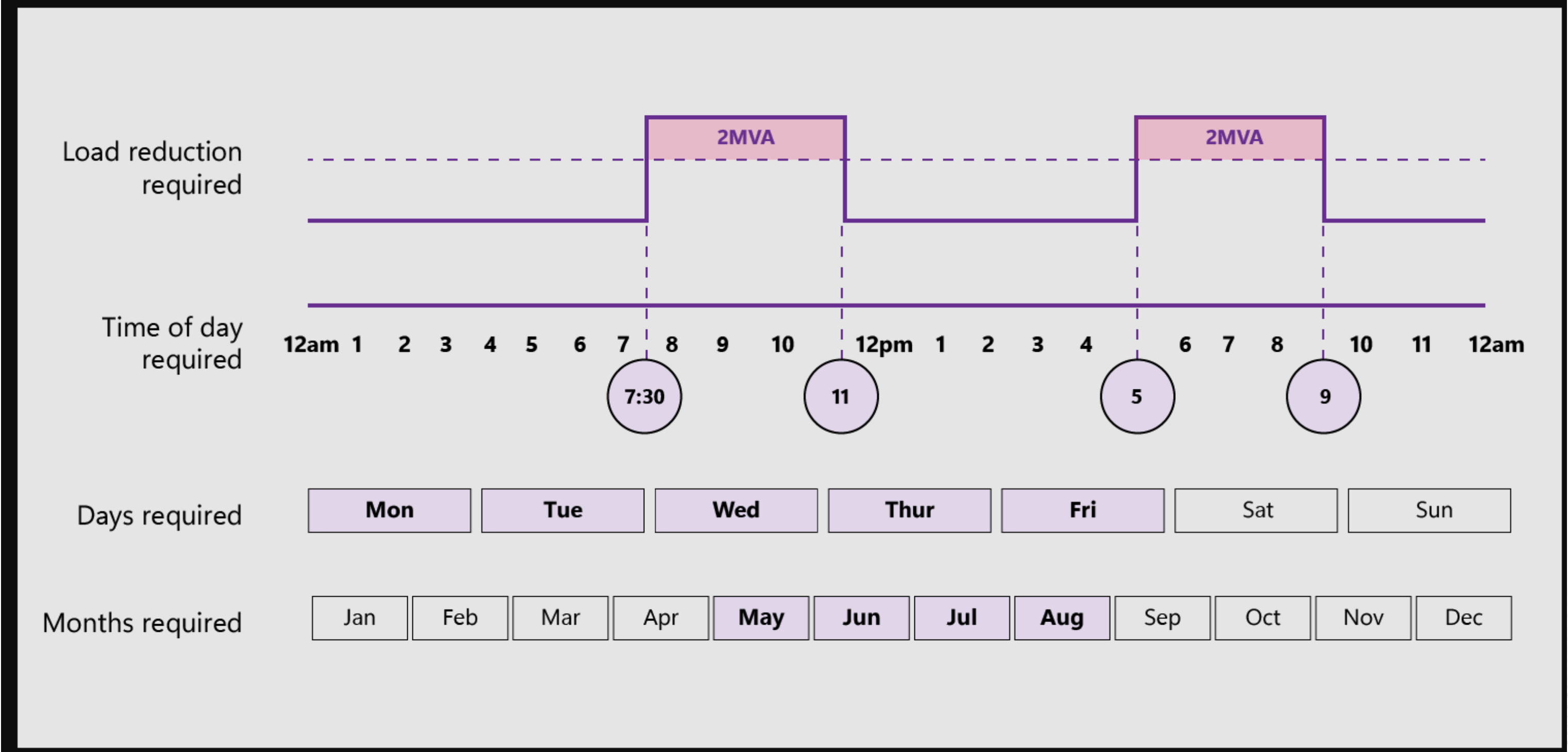
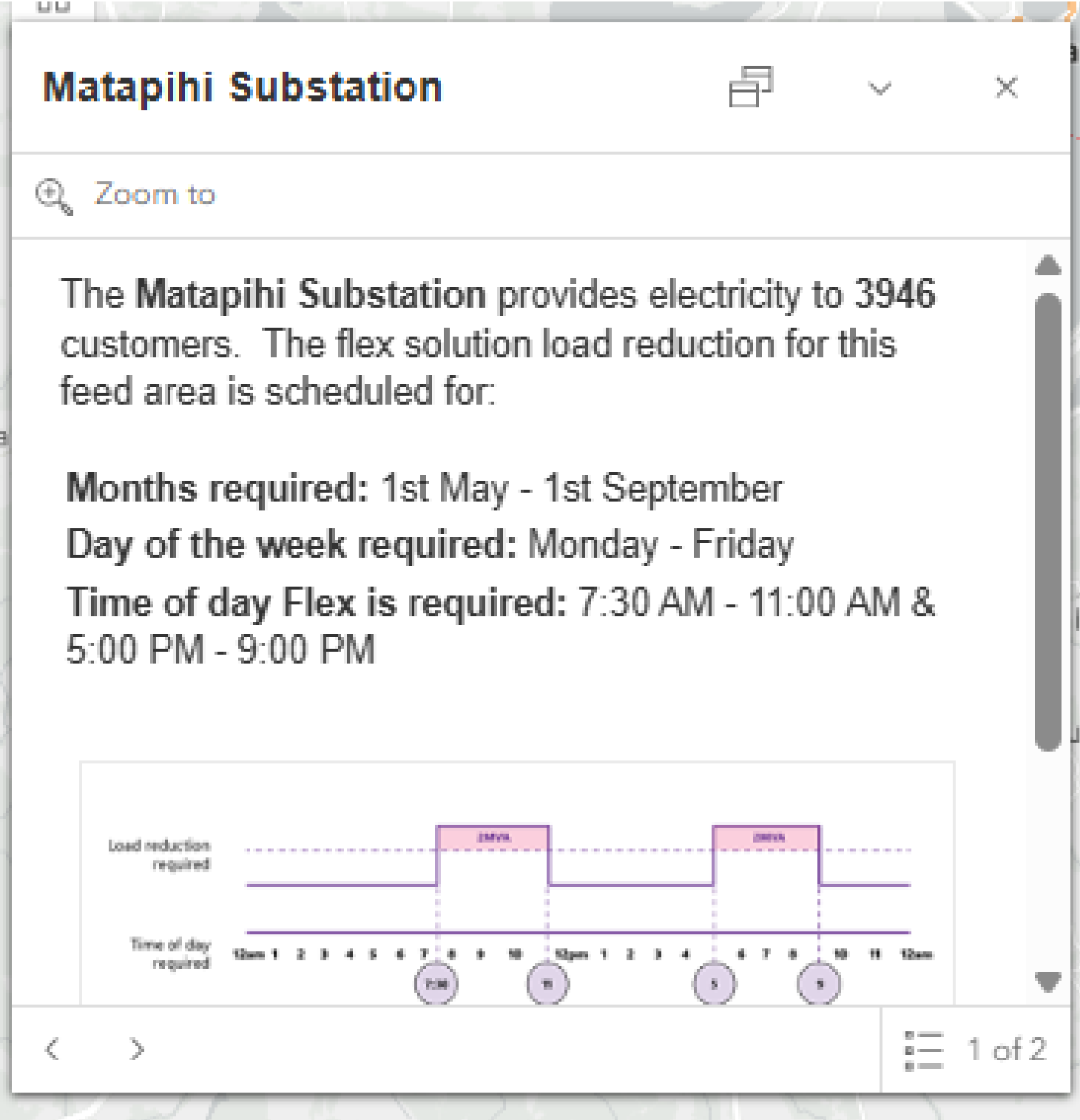
Example: Mt Maunganui

Area need

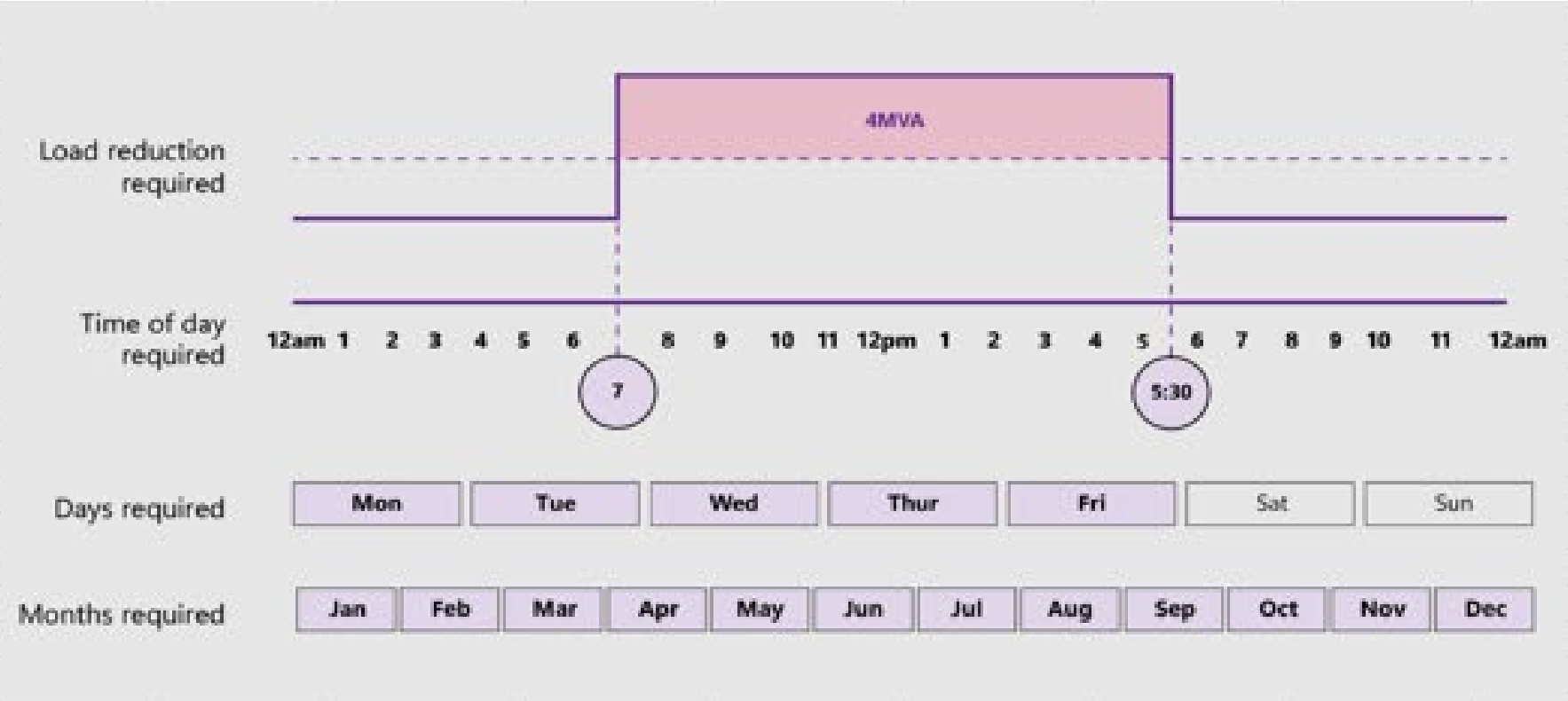
As load increases in the Mt Maunganui area, several security constraints arise.

- Triton substation reaches n-1 capacity, 11kV feeders reach thermal limits.
- The subtransmission to Triton breaches n-1
- A new Port substation is required (Maui St Sub)
- Te Maunga substation can't be supported via 11kV interconnections
- Ultimately, Mt Maunganui n-1 security is breached, necessitating a transfer of load onto Te Matai GXP via the subtransmission.
- This prompts the construction of a new GXP and 110kV circuits at Wairakei (Papamoa East)

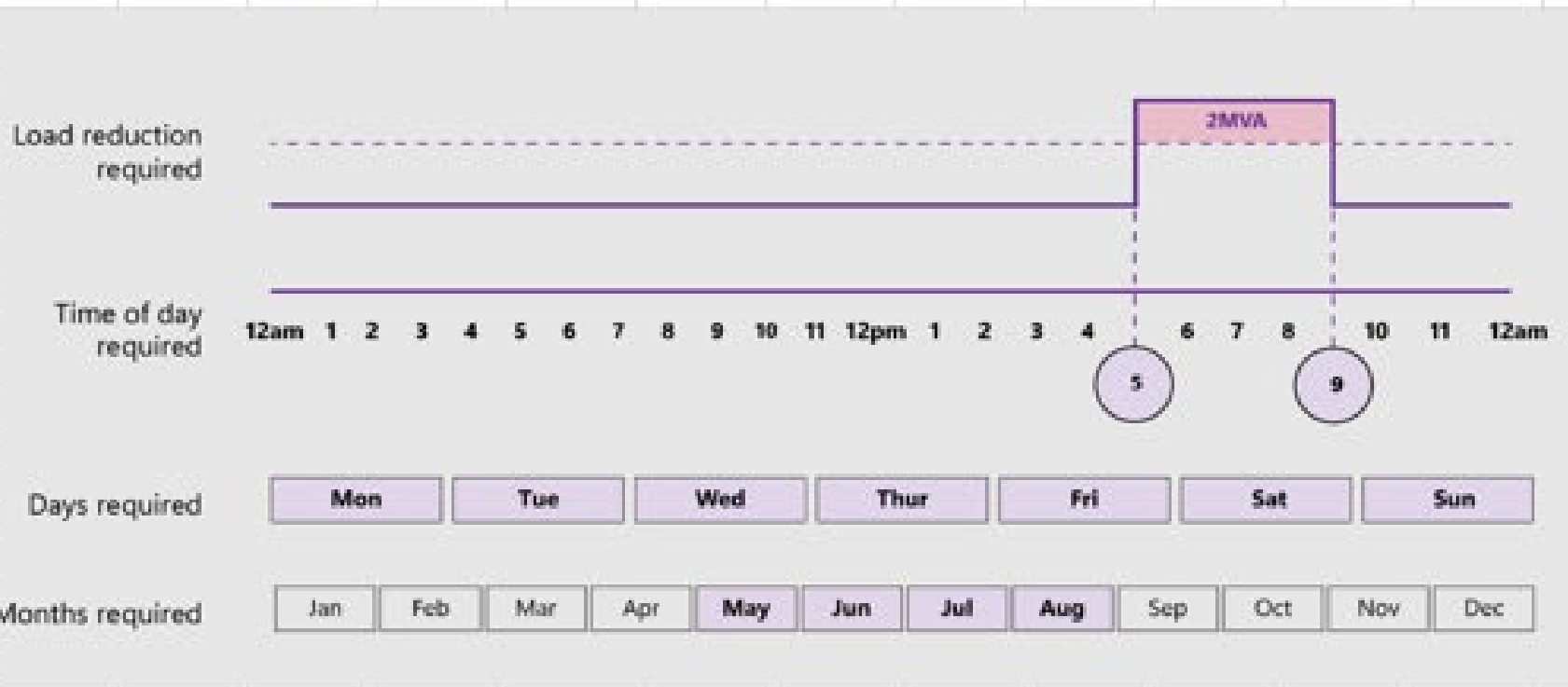
Flex requirement description



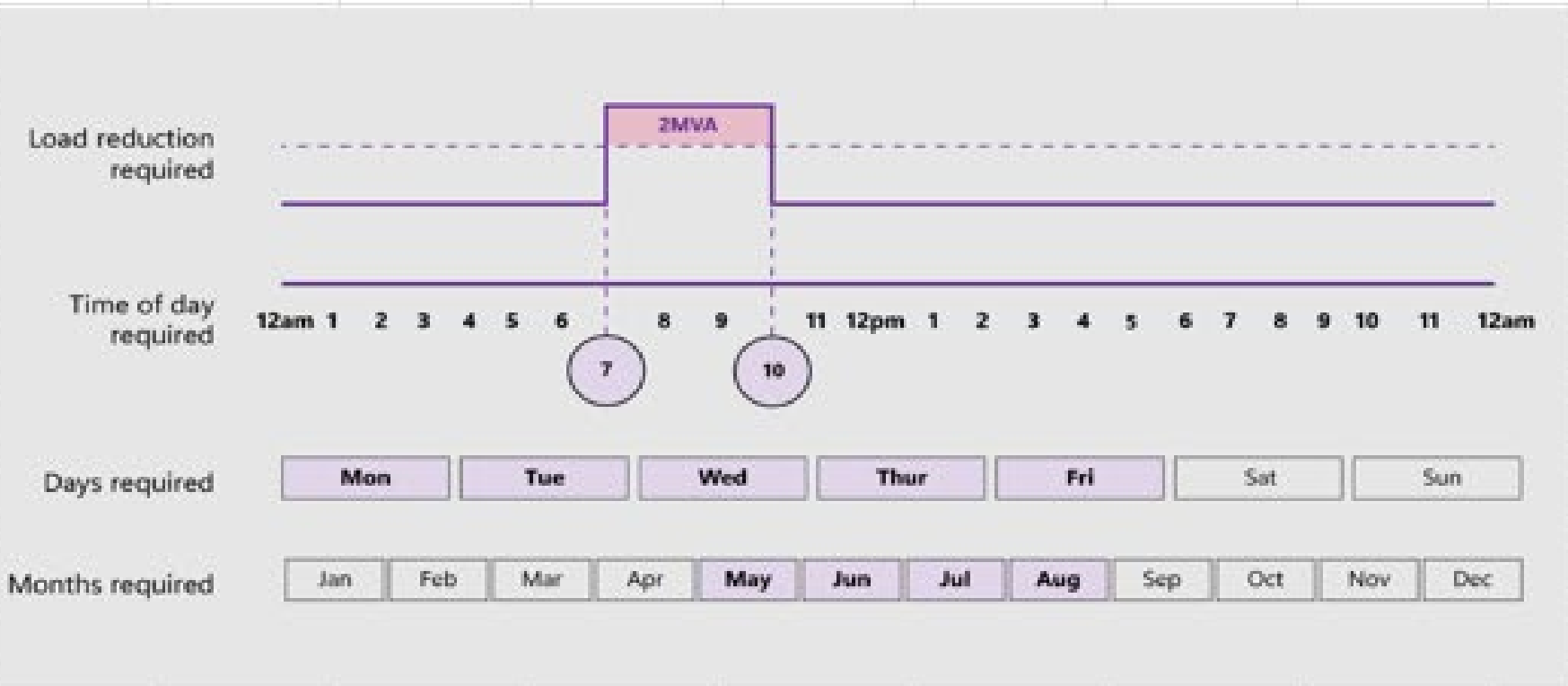
Triton



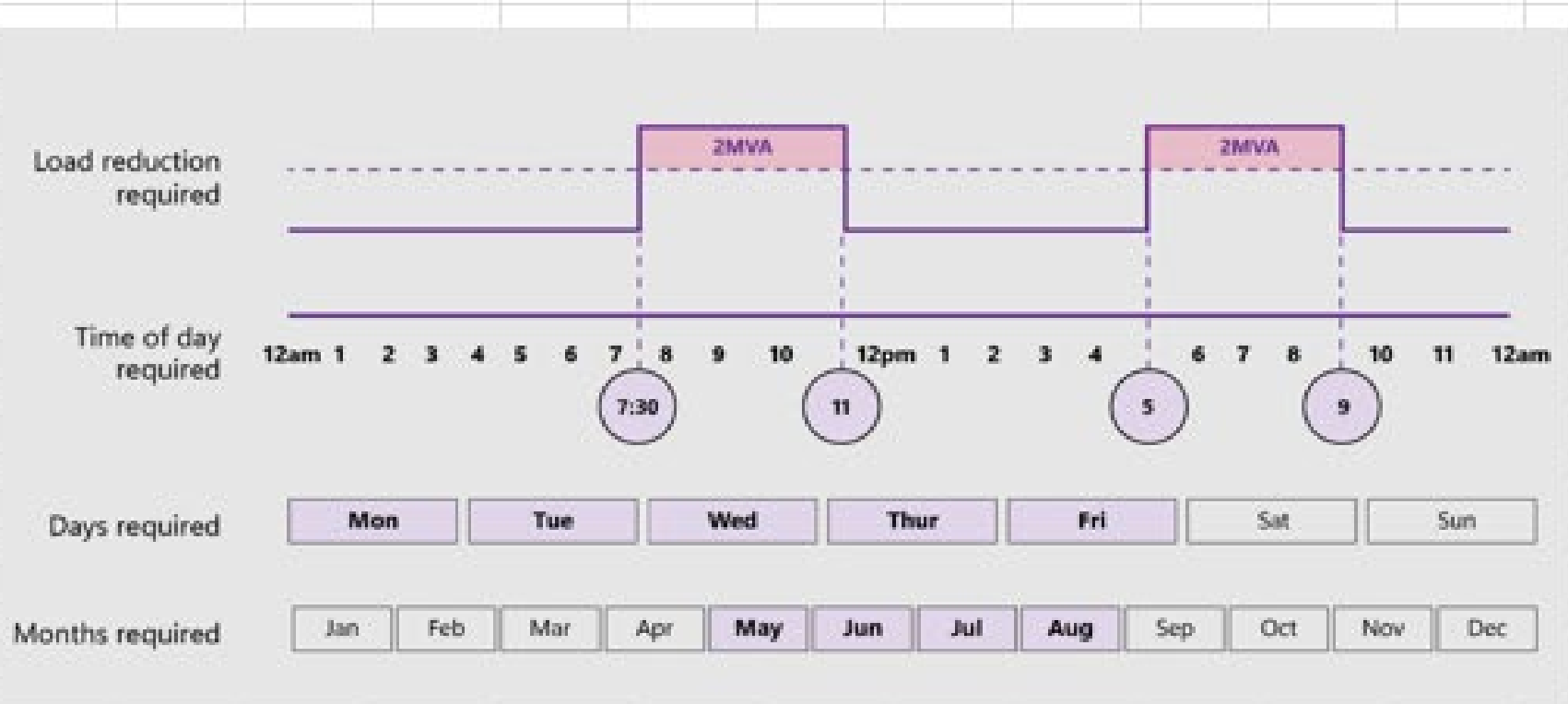
Te Maunga



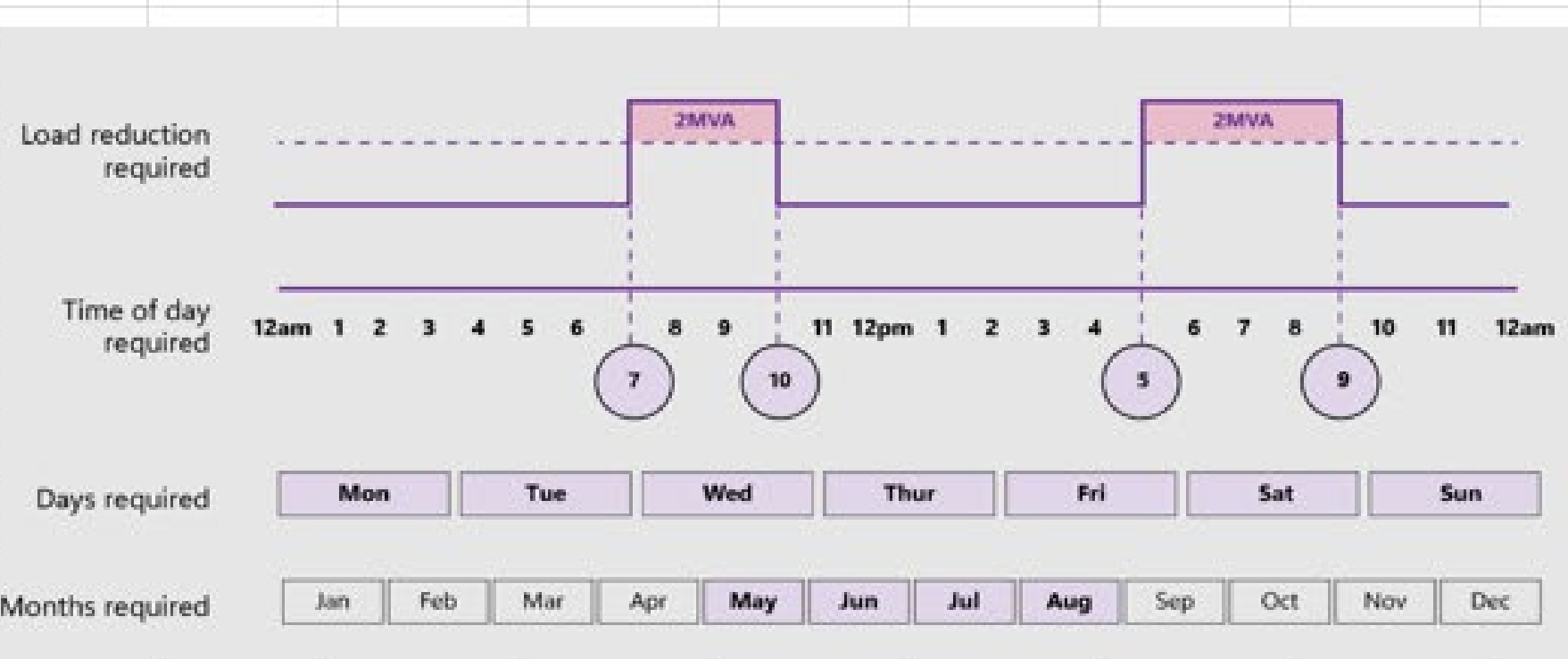
Omanu



Matapihi

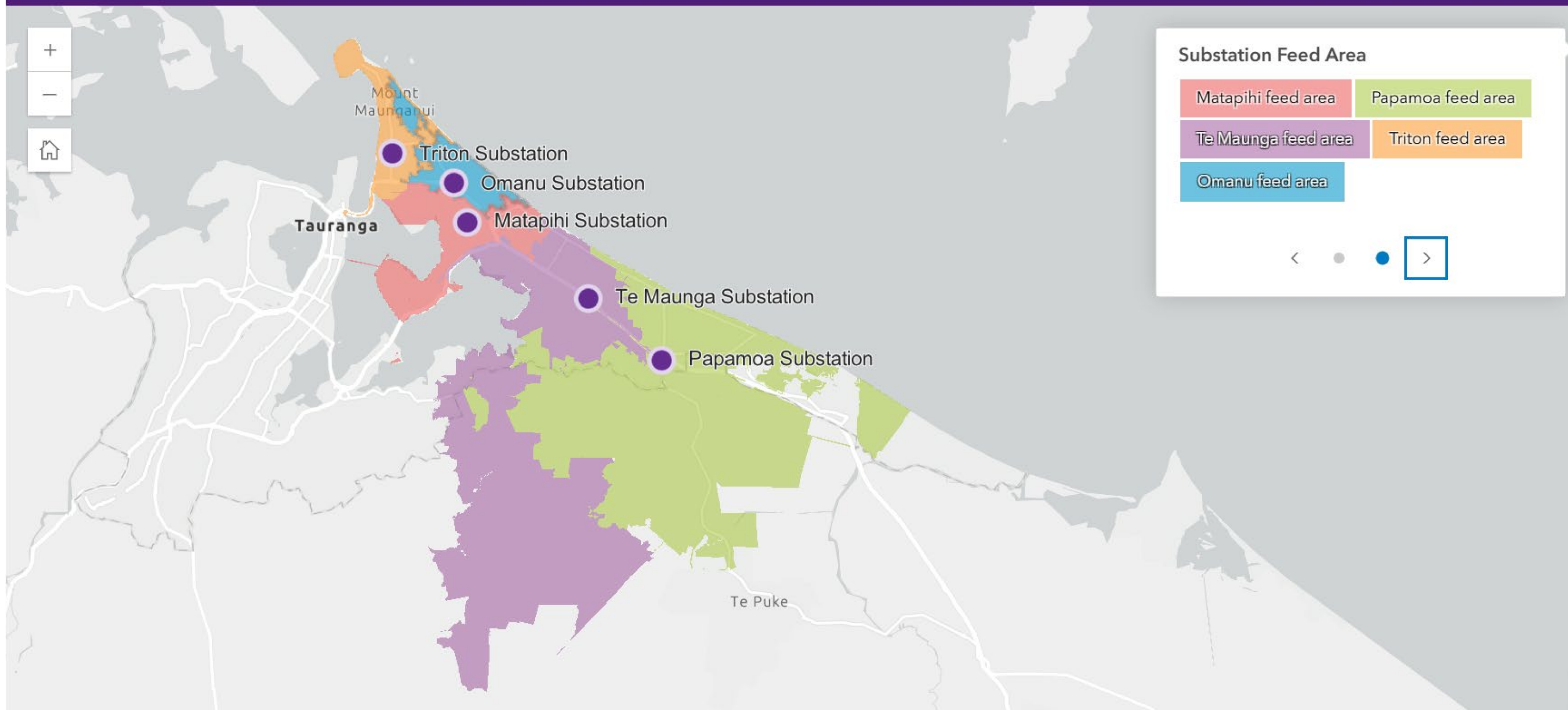


Papamoa



Differing needs across Zone Subs

Flex solutions - Mt Maunganui GXP



Flex requirement learnings

Issues arising

Due to the uncertainty around our forecasts, the option we chose was to simplify the needs into blocks, using the end of deferral forecasts as the need

- Highly conservative approach adopted
- Early-year flexibility needs were overestimated
- Flexibility services will need to develop over time
- Industrial load profiles provide long duration of need
- These factors tend to dilute the value on offer per kWh

Value the service

Value the service

(Posited 2024)

What's it worth to us?

Before we could 'go to market' we needed to understand what the avoidance of investment is worth to our customers. At the basic level, it is the deferral of capex, but we also needed to ensure that we could value the risks associated with an alternative approach. To do this, we needed to:

- Estimate the cost of the traditional solution as accurately as we can
- Value the deferral (NPV)
- Value the risk in terms of assumptions around growth etc
- Value the impact of non-delivery
- Cost of deferral on ultimate solution (eg cable routes become constrained)

Valuation methodology

Overview

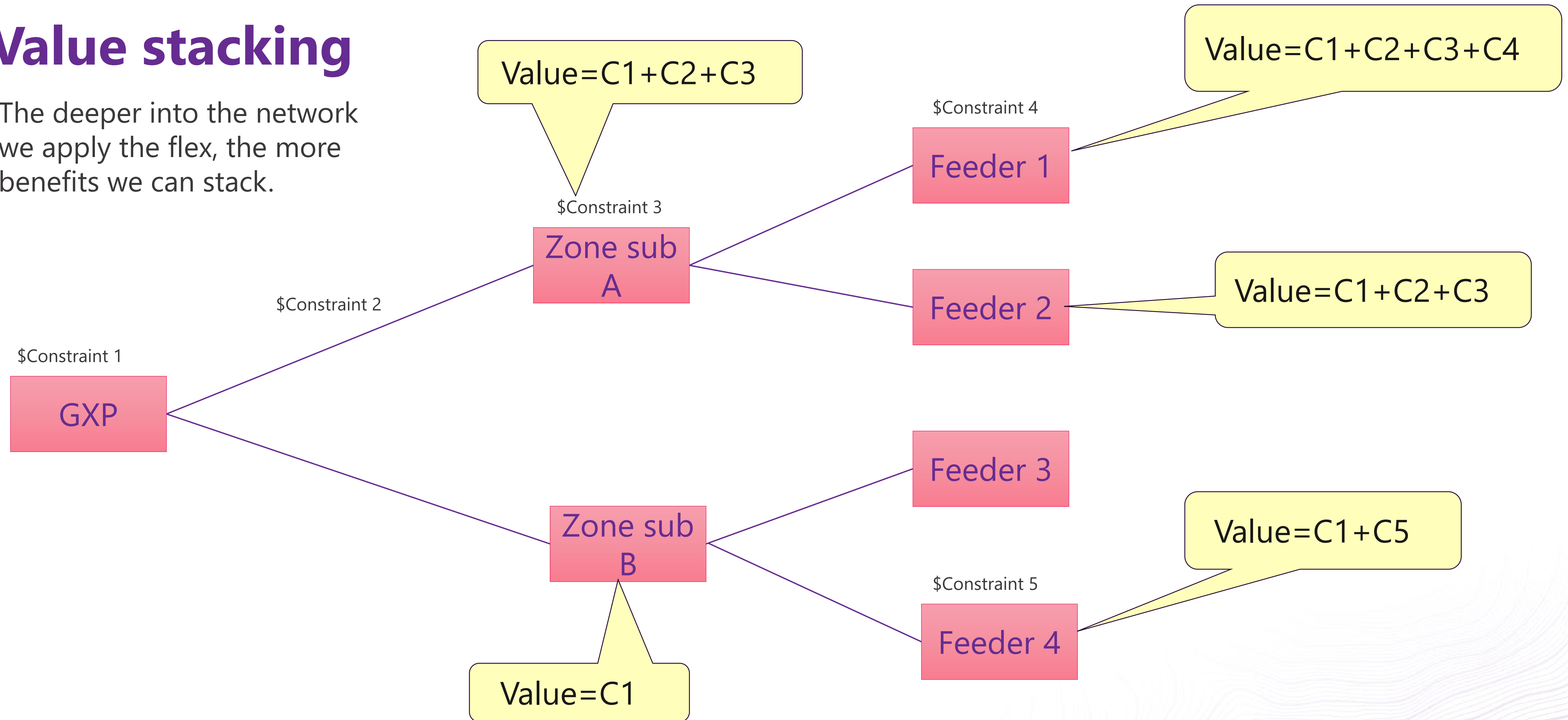
The valuation methodology is based on the assumption that the overall value to Powerco is a **function of the deferral value of capital expenditure** allocated for traditional solutions. The methodology seeks to determine the impact of load reduction (or energy injection) to enable that deferral, and the impact on any adjoining or associated upstream projects that can also benefit (value stacking).

The following steps are applied for each project:

1. Define the current expenditure forecast (lowest cost traditional solution)
2. Set the desired deferral period
3. Set the proposed contract period
4. Calculate the deferral value (NPV before vs NPV after deferral)
5. Determine the load reductions needed to achieve the deferral
6. Determine the duration and timing of the demand reduction (SOE's)
7. Calculate the value of deferral as a per kWh value

Value stacking

The deeper into the network we apply the flex, the more benefits we can stack.



Value stacking - matrix of projects by locations

- Apportioning project benefits across multiple network locations
- Stacking network benefits form multiple projects into flex support by location

EAA multiplied by Location of Flex Offering Percentages													
Copperleaf ID	Project name	EAA	Substation A feed area	Substation B feed area	Substation C feed area	Substation D feed area	Substation E feed area	Location 6	Location 7	Location 8	Location 9	Location 10	Total
Project 1	XYZ feeder upgrade	\$32,736	\$32,736	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$32,736
Project 2	ABC feeder upgrade	\$30,465	\$0	\$30,465	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$30,465
Project 3	Industrial substation upgrade	\$110,394	\$88,315	\$11,039	\$11,039	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$110,394
Project 4	New substation build	\$408,038	\$134,653	\$134,653	\$138,733	Project specific - Deferral value:							
Project 5	Second power transformer	\$56,733	\$0	\$8,510	\$0								
Project 6	Large subtrans project	\$717,899	\$215,370	\$143,580	\$71,790								
Project 7	Project 7	\$0	\$0	\$0	\$0								
Project 8	Project 8	\$0	\$0	\$0	\$0								
Total			\$471,074	\$328,247	\$221,562								

Copperleaf ref	Project name	EAA (\$)
Project 1	XYZ feeder upgrade	\$32,736.13
Project 2	ABC feeder upgrade	\$30,465.20
Project 3	Industrial substation upgrade	\$110,393.83
Project 4	New substation build	\$408,038.24
Project 5	Second power transformer	\$56,732.85
Project 6	Large subtrans project	\$717,899.33
Project 7	Project 7	\$0.00
Project 8	Project 8	\$0.00

Location specific - Flex pricing:

Pricing approach	Duration	
Location	Low (\$/kWhrs)	High (\$/kWhrs)
Substation A feed area	\$0.02	\$0.08
Substation B feed area	\$0.05	\$0.17
Substation C feed area	\$0.08	\$0.29
Substation D feed area	\$0.07	\$0.25
Substation E feed area	\$0.02	\$0.08
Location 6	\$0.00	\$0.00
Location 7	\$0.00	\$0.00
Location 8	\$0.00	\$0.00
Location 9	\$0.00	\$0.00
Location 10	\$0.00	\$0.00

- Operating Envelopes create kWh requirements
- Resolves into Powerco view of what we can pay
- Location specific pricing relative to a traditional network solution

Apply a risk factor

A flex solution can be less certain than a traditional build. It may not offer the full range of benefit a traditional solution could.

Assess the risk associated with flex vs traditional solution and discount the value accordingly



Valuation learnings

Issues arising

You don't know what you don't know. We developed the initial model in house and later had PWC refine it. Some of the things we left out of the initial model were:

- Project cost escalation
- Flex growth over time
- IRIS impacts – we did look at it but didn't include it.
- The impact that chunky load blocks might have on the \$/kWh value
- The cost of ramping up flex so it is available when you need it

We also selected some complicated things:

- Value stacking on a network hierarchy basis is tricky
- Grouping projects with different deferral lengths

Standardise the agreements

Standardise the agreements

(Posited 2024)

For consistency.....

It would be useful to develop our contract standard terms and conditions so we can treat everybody equally and have those evident from day one, rather than negotiating them with individual parties each time. This would mean:

- Sorting out our T&C's for Flex contracts
- Simplicity is preferred
- Templated RFP documents developed
- Templated offer contracts ready to roll
- Published to the Web? With the constraints?

Standardised agreements

Master
Electricity
Flexibility
Services
Agreement

✓ MEFSA

- Terms allow both Bilateral and Platform deals to be added easily

Flexibility
Services
Order

✓ FSO

- Standard template
- Adaptable to incorporate varied commercial terms
- Terms and structure can and will evolve

Go to market



Go to market

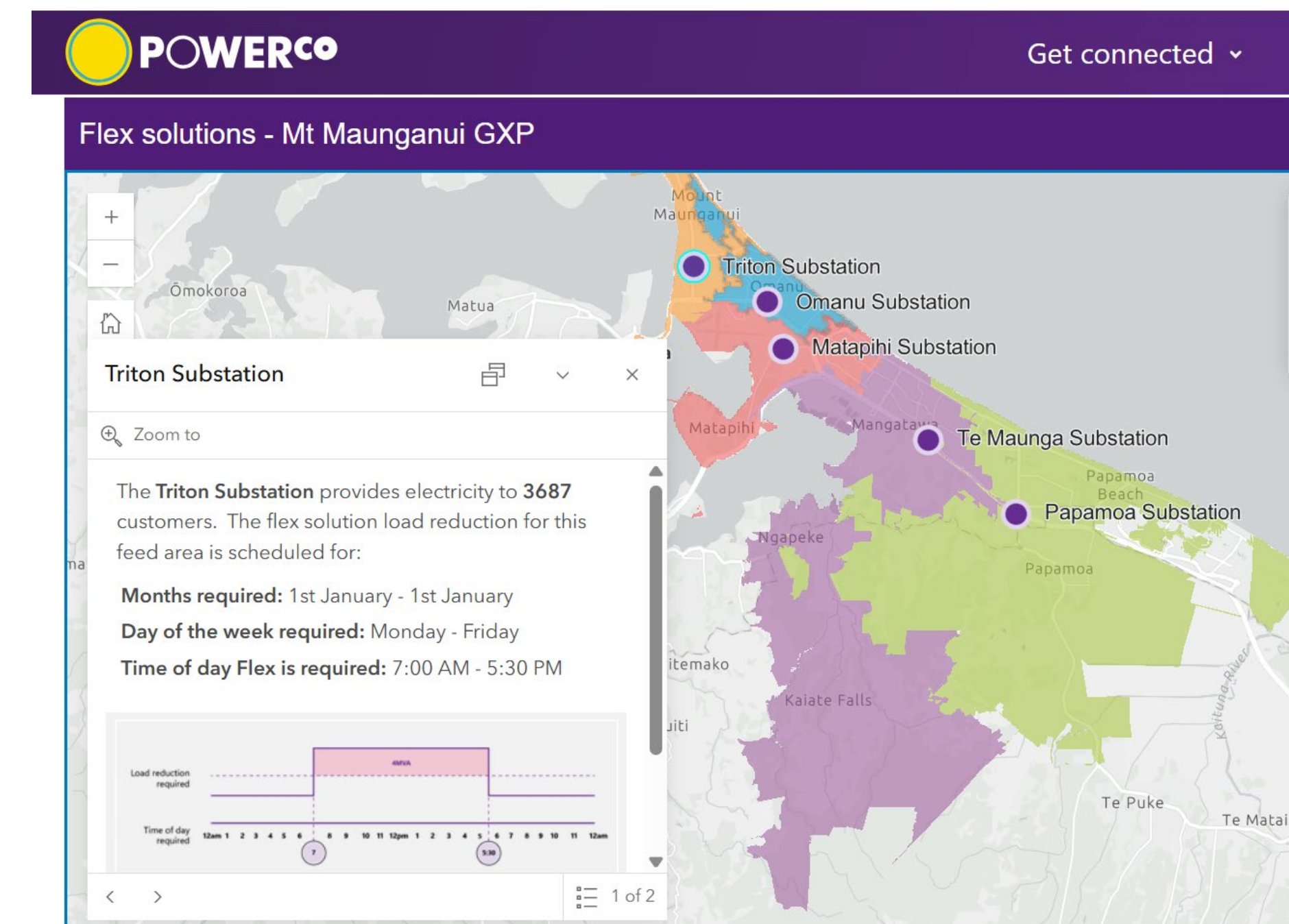
(Posited 2024)

Let's see what's out there.

Opening these constraints up to 'the market' showed that we were actively working with the industry to utilise third party offerings. Having a public facing platform that we could advertise our needs drew out interested parties that we were then able to seek further and more detailed interaction with.

To achieve this, we:

- Published constraints and 'Operating Envelopes' on our website
- Provided an interactive map view
- Defined the 'rules of engagement' Is it first in, first served?
- Developed constraints specific terms and conditions
- Actively engaged with aggregators / retailers and other Flex providers
- Engaged directly with major customers where Flex opportunity was available as a direct agreement (Fonterra etc)

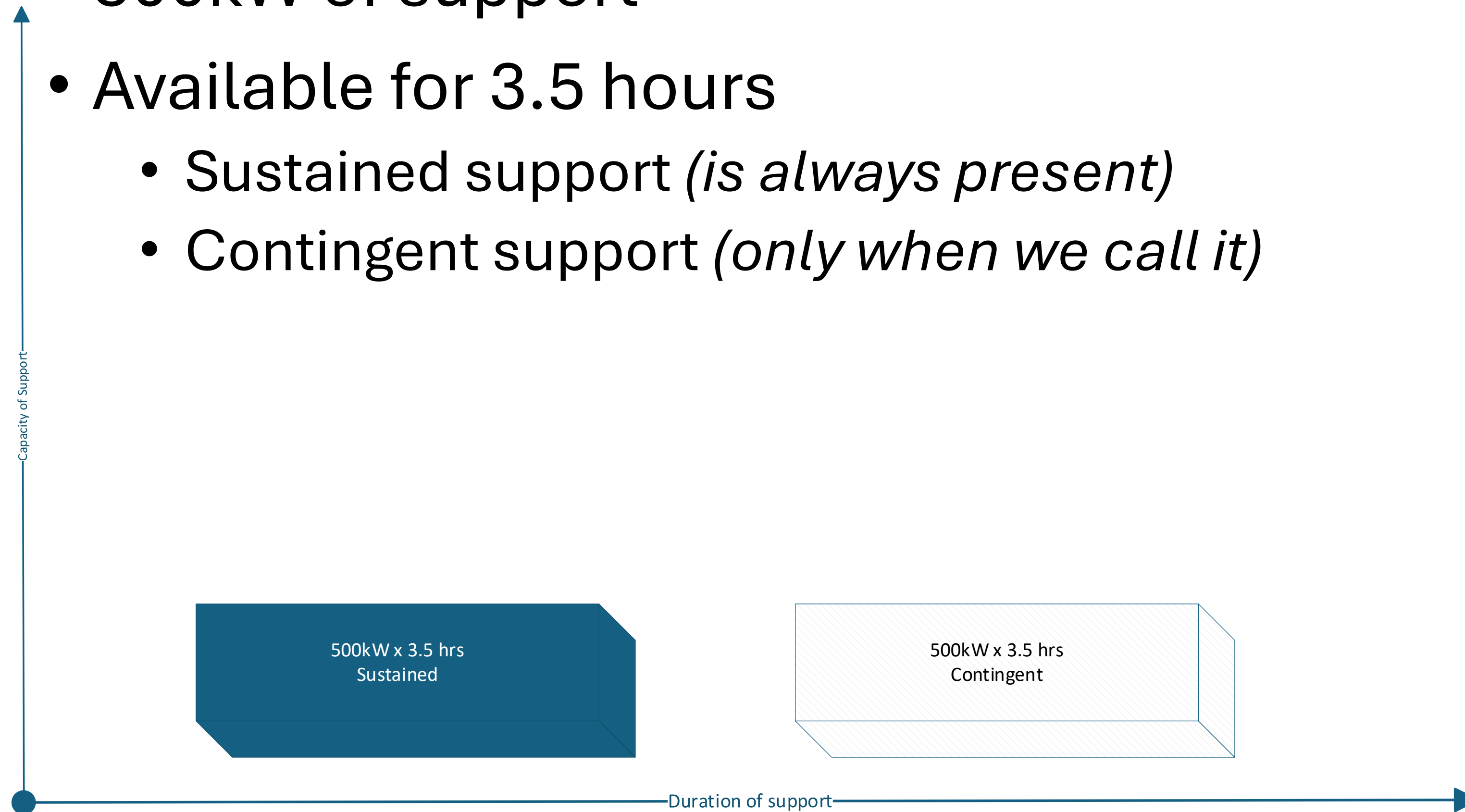


Staged negotiations

- ✓ EOI
 - Called for interested parties
- ✓ NBIO
 - Selected parties put forward a non binding proposition
- **Letter of Intent - outlining the Load Block process**
 - Non binding but sets process
 - Confidence to develop load blocks
 - Invitation to submit a Binding Offer

Consider a block of support

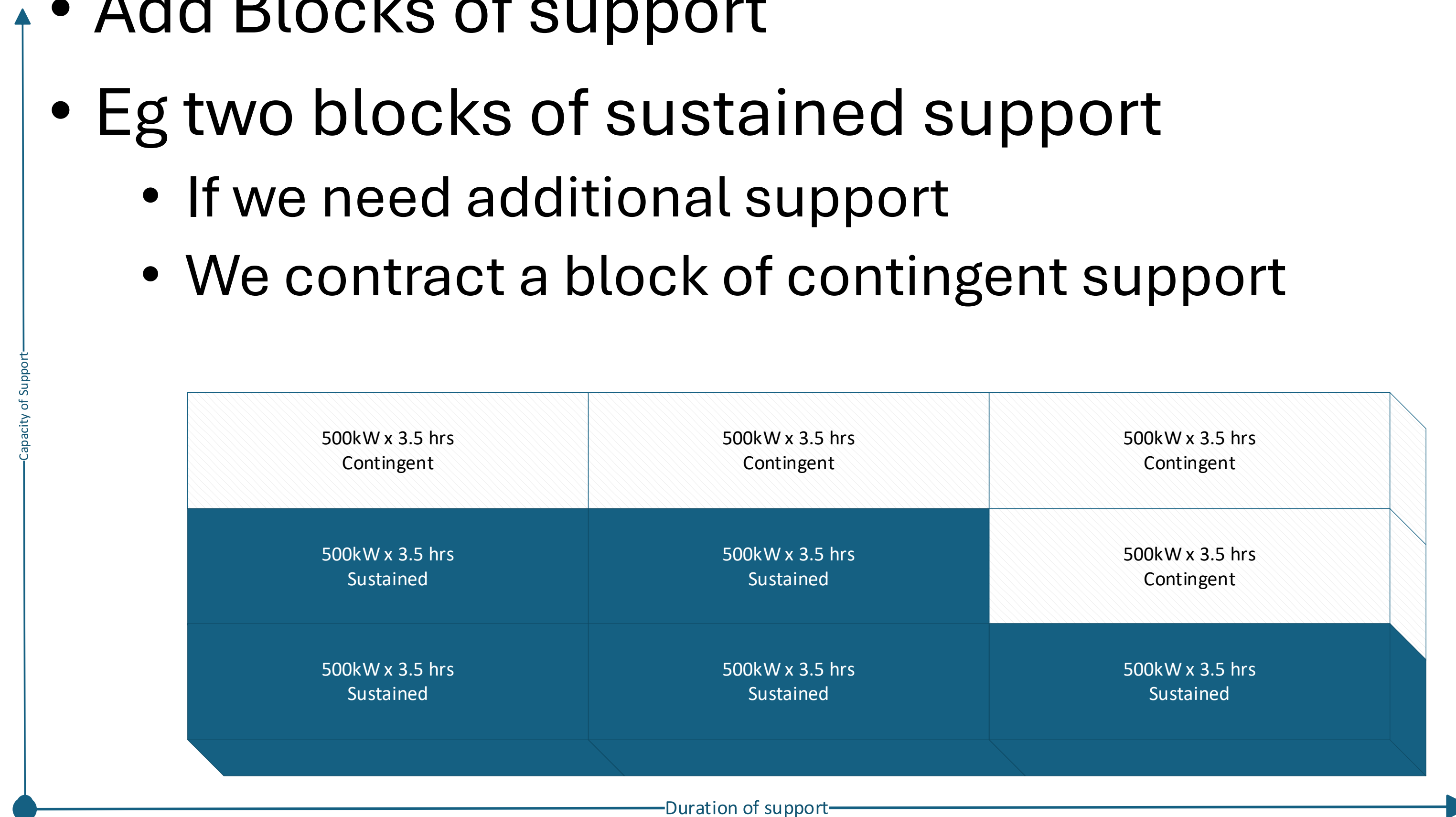
- 500kW of support
- Available for 3.5 hours
 - Sustained support (*is always present*)
 - Contingent support (*only when we call it*)



A longer network need

- Add Blocks of support
- Eg two blocks of sustained support
 - If we need additional support
 - We contract a block of contingent support

- ❑ Blocks may be positioned according to value and potential use
- ❑ Relative value allow needs to be met
- ✓ Flex suppliers costs
- ✓ Network needs met
- ✓ Dispatch order

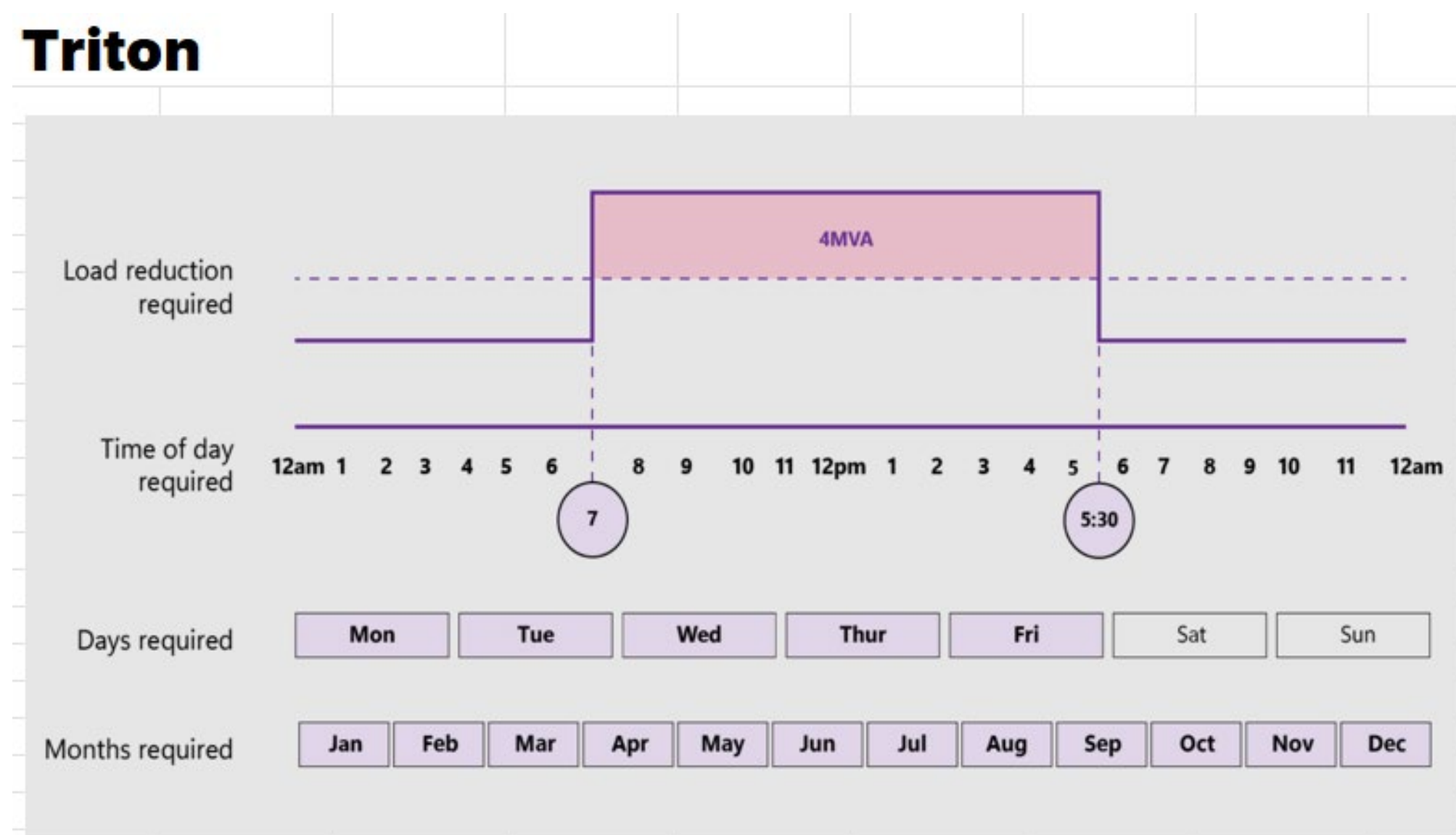


Load block methodology

Making it palatable – Powerco as a Macro-Aggregator

- Example – Triton – 10.5 hours sought – too much for some!
- Mix of Sustained vs Contingent

Triton



Go to market - learnings

Key take aways - EOI, NBIO, LOI

- ✅ High market interest, but ongoing market education is essential
- ⚠️ Flex demand currently exceeds available supply
- ⚠️ Misalignment exists between FSP contract expectations and EDB needs
- ❓ Price discovery remains challenging in an immature market
- ✅ Indicative pricing ranges through NBIOs improved market transparency

Evaluate the offers

(Posited 2024)

Award *(we have executed agreements)*

Implement

Manage

Repeat

We now have a range of tools we can use to interact with FSPs

- FSPs are keen to engage and help develop a shared approach
- EDBs are collaborating to evolve NZ methodologies

International learning is important, but context is critical to ensure a fit with New Zealand's unique market structures

Powerco will continue to seek flex support in order to grow a Flexibility Services Market - Cadence will be important





Electricity Engineers'
Association

Objective 4: Connections and Pricing

Building the foundations for future DSO capability

Dr Stuart Johnston, Principal Analyst, Electricity Authority

Objective 4

Connections and Pricing

Building the foundations for future DSO capability

“From static connections to flexible, system-aware network access.”

Dr Stuart Johnston | Electricity Authority

EEA2026 Conference • Auckland • 22 September 2026

Why connections need to change

Connections are becoming an active part of how the distribution system is managed.

Traditional network

- Connect → reinforce if necessary
- Largely passive customer
- Static assumptions and limits

Emerging system

- More solar, batteries, EVs and flexible demand
- Capacity varies by location and time
- More diversity and uncertainty

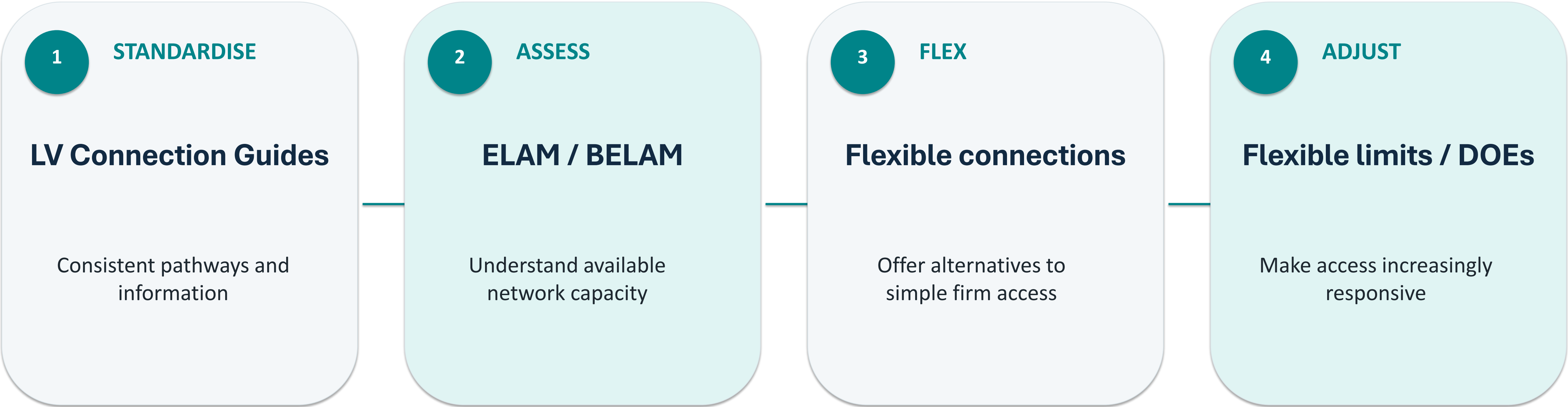
Future DSO capability

- Connect efficiently
- Understand available capacity
- Communicate limits
- Enable flexibility and coordination

The question is shifting from “Can you connect?” to “How can you connect — and under what operating conditions?”

We are already building the enabling pieces

Not four separate projects — a pathway toward more capable, flexible distribution operation.



Standardise → Assess → Connect flexibly → Observe → Adjust

Together, these are enabling capabilities for a future DSO.

ELAM / BELAM: making network access more transparent and repeatable

A common engineering basis for understanding and communicating available export capacity.

ELAM

- Repeatable assessment approach
- Common engineering methodology
- Supports greater transparency about available export capacity

BELAM

- Application-specific assessment
- More detailed analysis where scale or network conditions require it
- A structured pathway for more complex connections

WHY THIS MATTERS FOR DSO CAPABILITY

Consistent capacity assessment

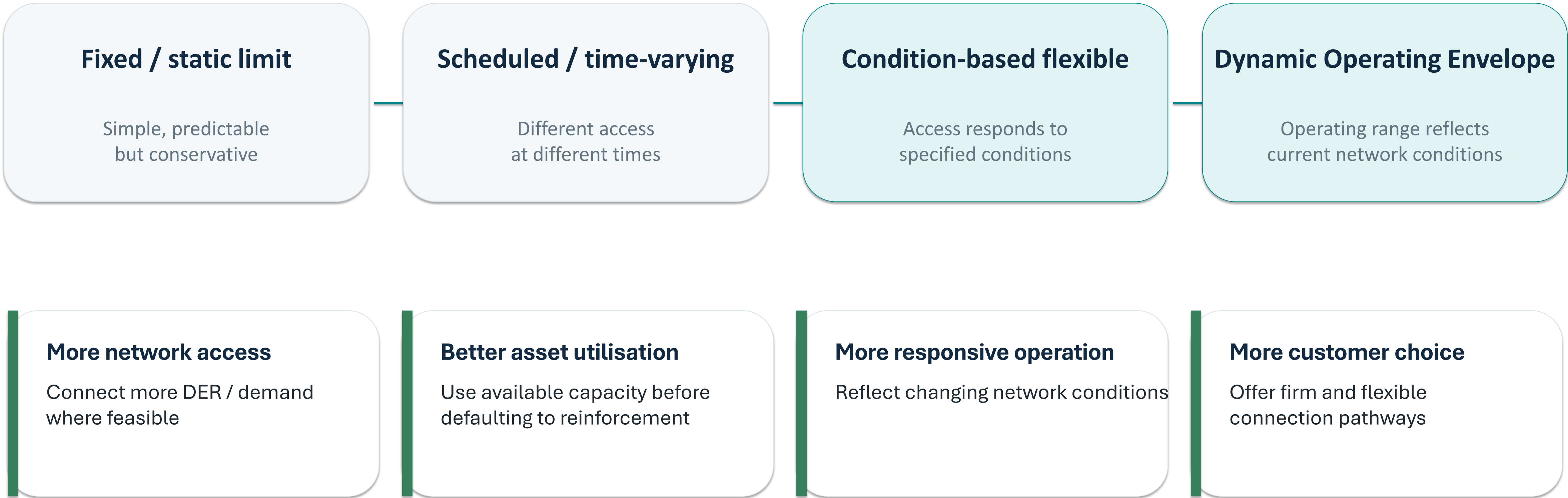
Better visibility of constraints

Clearer connection decisions

Foundation for more dynamic access

From static limits to flexible connections

A maturity pathway — not every connection needs to move to the right.



Flexibility complements network investment — it does not remove the need for efficient reinforcement.

Where connections start meeting pricing

A future DSO needs technical, price and flexibility signals to work together.

Connection signals

- What capacity is available?
- What limits apply?
- Can access be flexible?

Price signals

- When and where does network use impose cost or provide value?
- Import / export and time-varying signals

Flexibility signals

- Can customers / DER respond?
- Is flexibility efficient?
- How is response valued or procured?

Technical capability alone is not enough — customers also need clear, predictable incentives.

What does this mean for the DSO Roadmap?

The transition is evolutionary — but the capabilities need to build on one another.

NOW

- Consistent connection processes
- Common engineering methodologies
- Better information and transparency
- Clear flexible-connection pathways

NEXT

- Greater network visibility
- Flexible import / export limits
- Interoperability and data exchange
- Stronger pricing / flexibility signals

LONGER TERM

- Dynamic network access
- DOEs at scale where justified
- Coordinated DER and flexibility
- Closer DSO–SO interaction

Each initiative solves an immediate problem — together they build a more dynamic distribution system.

SLIDO: What is the biggest gap between today's connection arrangements and genuinely flexible network access?



FSR@EA.GOV.T.NZ

Objective 5: Consumers

Case study: **Customers enable Distribution System Operations**

Evie Trolove, Head of Market and Customer Innovation, Orion

Customers enable Distribution System Operations

Evie Trolove

Head of Market and Customer Innovation

Orion

EEA Conference 2026

Customers enable distribution system operation today

85MW

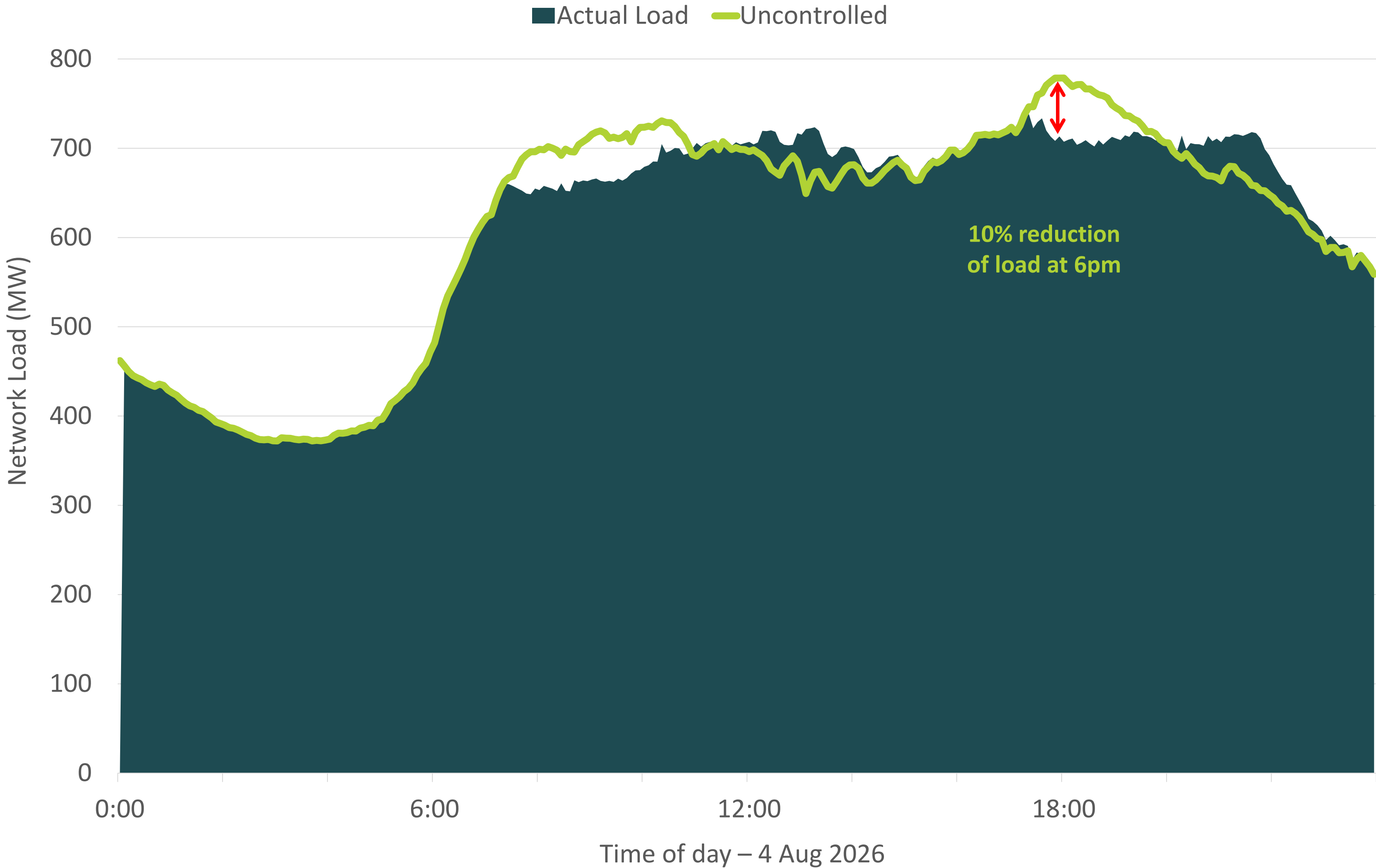
peak reduction from hot water and dynamic pricing response

85%

Of residential customers are on an optional controlled tariff (100k responding)

15,000

Customers value stacking hot water with shared control across 5+ retailers



- **Residential**

Commercial & Industrial

Community Energy

Residential flexibility

EARLY ENGAGEMENT

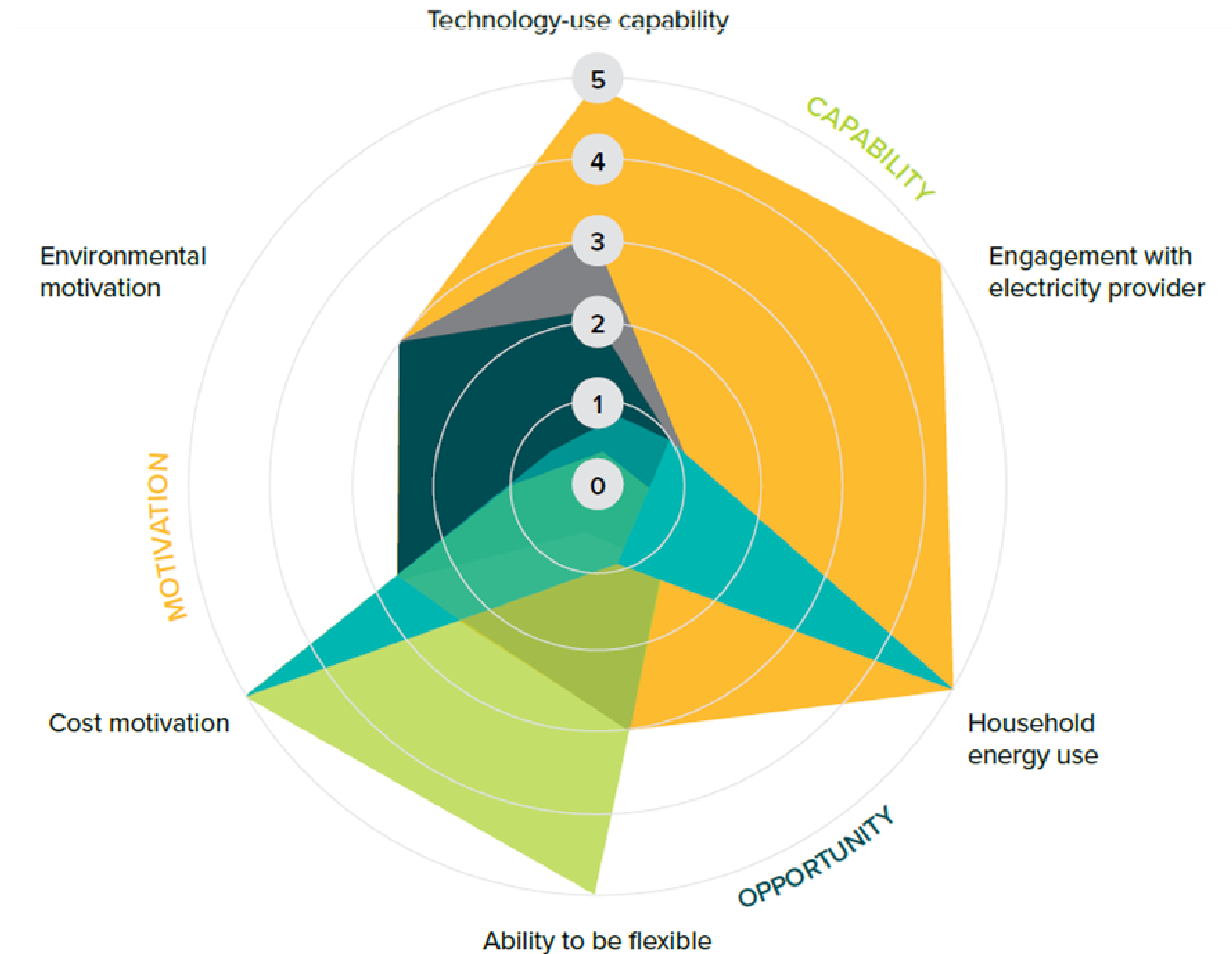
The customer journey is complex
and touches many stakeholders

Customers are diverse
with different willingness and ability to participate

Cost in the primary driver
and value is mainly accessible through retailers



Orion



Residential flexibility

OUR APPROACH

300+

customers participated across three Resi-flex trials in partnership with Octopus Energy and Ecotricity

97%

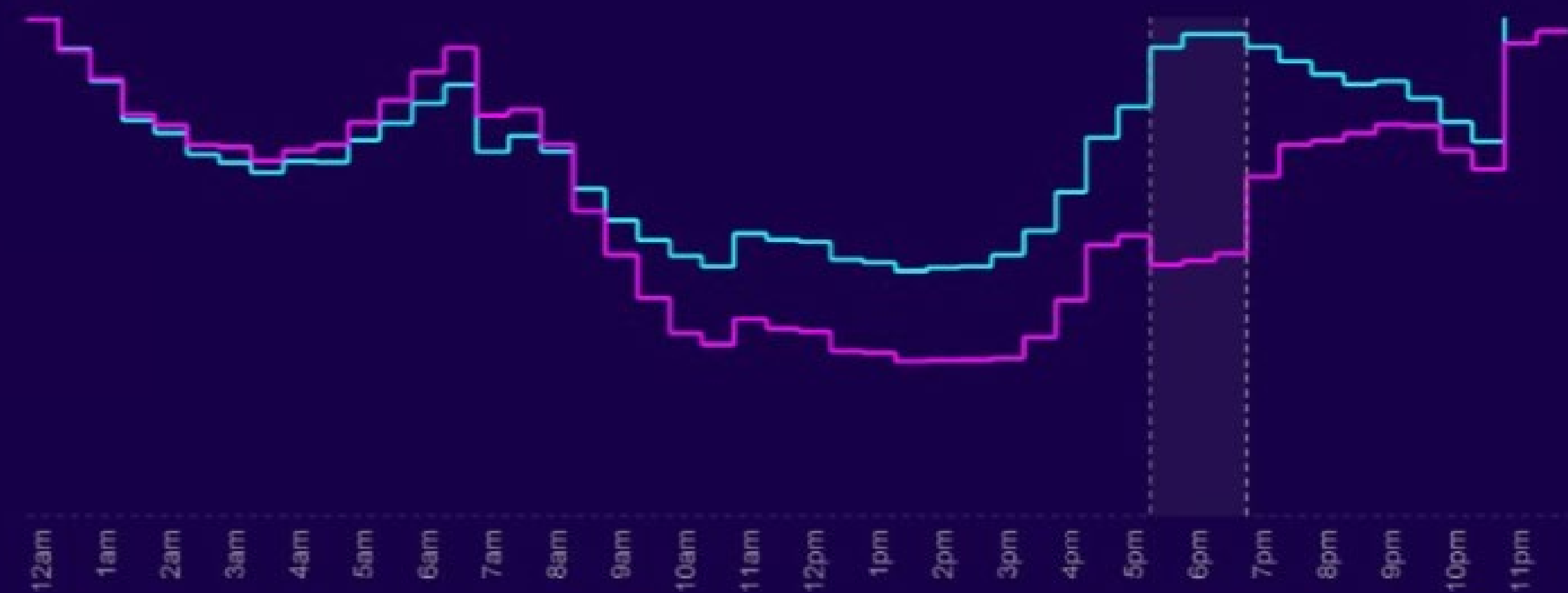
of EV charging done off-peak in the Octopus Energy trial

Next

Halswell Flex builds on learnings to test locational dynamic pricing at scale

Octopus Energy Saving Sessions

50% average reduction in load
0.84 kW for evening sessions and 0.71 kW in the morning





\$2 / kWh

\$1 / kWh

Orion

Wellington Electricity | we*



Residential flexibility

SCALABLE INSIGHT

Clear rewards benefit networks

Customers change behaviour when the reward is clear with potential for significant network benefit

Customer choice is important

Virtual power plants (VPPs) are effective, but not all customers will be willing to adopt these

Retailer capability sets the pace

Willing and capable retailers are required for the benefits to scale, and create access to the whole flexibility value stack



Residential

- **Commercial & Industrial**

Community Energy

Commercial & Industrial

EARLY ENGAGEMENT



Head of
finance

CPD is our single
biggest energy
cost.

I think I've heard of CPD,
but I have no idea how it
works



Facility
manager



Commercial & Industrial

OUR APPROACH

\$156,000

per reduced MVA a year is what Control Period Demand (CPD) is worth to customers at current pricing

55 of 419

Only 55 major customers respond regularly, and around 85% of that response is from backup diesel

>2 MW

new non-diesel flexibility unlocked through pilot flexibility assessments and a forecast for CPD periods



Commercial & Industrial

SCALABLE INSIGHT

Understanding unlocks flexibility

Once the right teams understand the incentives, they are equipped and ready to identify flexibility opportunities

Customers need notice

Customers need notice to prepare for operational response and the duration matters as much as timing

Long-term signals enable investment

Long-term pricing signals are needed for customers to have the confidence to invest in flexibility



Residential

Commercial & Industrial

- **Community Energy**

Community Energy

EARLY ENGAGEMENT

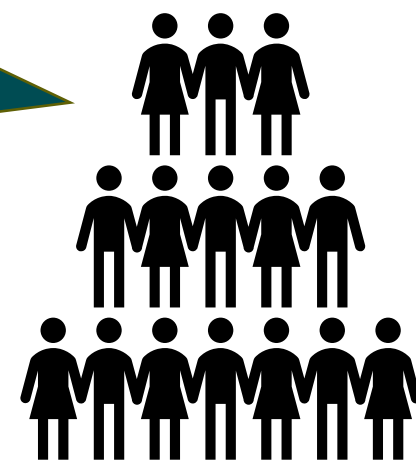


Youth
centre

We have parts of our community
that can't afford to pay their
power bills, often we work with
Rangatahi from those homes.

We don't know what it looks like
but we have roofs and buildings
and are keen to explore.

90% of respondents were
prepared to invest in a
community energy scheme.



Castle Hill
Village Survey



Community Energy

OUR APPROACH

8 communities

Finished the Community Energy Activator, a 12-week programme in 2024

3 projects

are underway at Castle Hill Village, Lyttelton and Taumutu Marae

Next

developing concepts where community and network interests intersect

COMMUNITY ENERGY ACTIVATOR PLUGGING IN OUR PEOPLE



Orion

Ara
AKE



Community Energy

SCALABLE INSIGHT

Start early

Trust, capability and community buy-in take longer to establish than network planning timeframes

Benefits beyond the asset

Community energy initiatives can improve resilience, literacy, equity, trust and participation

Design for diversity

Communities have different motivations, resources and barriers. One model will not work for everyone



Photo credit: Peanut Productions Photography

Help your customers enable distribution system operation

1

Start with customers

Design Thinking can help us navigate the space between customer and system needs. Invest in people with the right skills to join the dots.

2

Co-design with partners

EDBs are only one part of the system. Co-design solutions with partners to make them simple and attractive for customers.

3

Factor in desirability

Technically feasible and commercially viable is not enough for solutions to land. Participation should feel like an option, not an obligation.

Mā tini, mā mano, ka rapa te whai | By many, by thousands, the work will be accomplished

Questions / Pātai



Electricity Engineers'
Association

Workshop: Implementation Priorities and Challenges

Testing the DSO Roadmap

From roadmap to action

Geoff Parr and Dr Stuart Johnston | Electricity Authority

EEA2026 Conference • Auckland • 22 September 2026

Testing the DSO Roadmap

The opening session set out the Roadmap. The rest of today has given us evidence to test it.

1 Roadmap

Vision, purpose, five workstream groupings and possible critical-path enablers.

2 Experience

International lessons, NZ case studies and consumer perspectives.

3 Test & prioritise

Are we on track? What is missing? What matters first? Who needs to act?

SLIDO | Having heard today's presentations, how confident are you that NZ is on the right path for DSO development? 1 = low | 5 = high



Having heard today's presentations, how confident are you that NZ is on the right path for DSO development? (1 = Low confidence; 5 = High confidence)

How we will work: build on what you have already captured

The A3 sheets have been on your tables throughout the workshop. Now we will use those observations to test the Roadmap and turn them into priorities.

1 Test the Roadmap

Use what you captured while listening.

Where are we making progress – and where are the biggest gaps?

Use your existing notes

2 Identify the Critical Path

Prioritise the enablers and sequence what needs to happen.

Focus on dependencies – not just a wish

Challenge assumptions

3 Turn it into Action

Identify who needs to lead and where EA can make the greatest difference.

Report only the strongest messages.

Be specific

Exercise 1 - How are we tracking against the Roadmap?

Use the same five workstream groupings introduced during the earlier presentations.





Which Roadmap workstream needs the greatest additional attention?

ROADMAP PULSE

Where is the biggest gap?

Use the Slido result as a room-wide heat map, then hear one biggest gap from each table – preferably something not already said.

Design & delivery of one or more DSOs	Strong	Mixed	Gap
Driving efficiencies	Strong	Mixed	Gap
Accelerating flexibility	Strong	Mixed	Gap
Distribution network connection & pricing	Strong	Mixed	Gap
Prioritising consumers	Strong	Mixed	Gap

Facilitator probe

What is behind the gap? Is it a capability gap, regulatory gap, coordination gap, evidence gap - or something else? What would materially move it forward?

Exercise 2 - What is really on the critical path – and what needs to happen when?

Choose the enablers that really matter, identify dependencies, then sequence the actions. Do not assume everything belongs in the “now”.



TABLE TASK

1. Choose your TOP 3. 2. Why are they critical? 3. What depends on what? 4. Sequence actions: NOW 0–2 | NEXT 2–5 | LONGER 5+ years. Circle the ONE action that cannot wait..

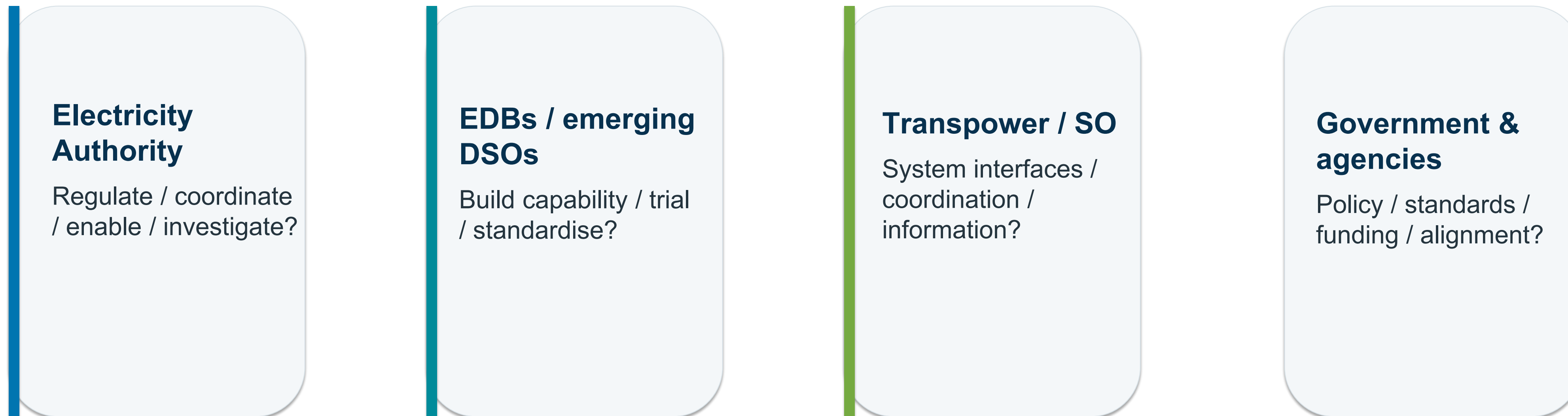
SLIDO | What is the single most important action to progress in the next 2 years?



What is the single most important action to progress in the next 2 years?

Exercise 3 - Who needs to lead - and what is the Authority's role?

Take your TWO or THREE highest-priority actions: identify the lead, key partners, EA role and first practical next step.



KEY TEST

Where is regulation genuinely needed - and where is coordination, industry action or experimentation enough?

SLIDO | Select the THREE areas where EA action could make the greatest difference over the next 2–3 years.?



Where could Electricity Authority action make the greatest difference over the next 2–3 years? (up to THREE selections)

A3 CANVAS 6 - What should we take away?

Agree the messages your table wants carried forward. The detailed canvases will also be collected.

1 Strongest finding

What did today confirm or reveal?

2 Biggest gap / risk

What most threatens progress?

3 Priority action

What should happen first - and why?

4 Ownership / EA role

Who leads - and what should EA do?

SLIDO | What is the ONE thing we should not leave this workshop without acting on?



What is the ONE thing we should not leave this workshop without acting on?

Close: What happens to the material?

The value of the session is in the combined record - not just the report-back.

Slido results

A room-wide view of relative priorities and areas of agreement / difference.

A3 canvases

Evidence, examples, dependencies, minority views and suggested actions from each table.

EA synthesis

Use the combined material to test Roadmap priorities and inform subsequent work planning.

Please leave all completed A3 canvases on your table



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Electricity Engineers'
Association

Group Playback and Closing Comments

Thank you

Ka kite anō