

Meeting Date: 24 October 2024

## OPPORTUNITIES FOR THE USE OF RIPPLE AND SMART-METER CONTROLLED CIRCUITS FOR MANAGING PEAKS

## SECURITY AND RELIABILITY COUNCIL

This is a joint presentation by Powerco and Vector. It offers distributor perspectives on how changes in use of these technologies could allow more flexible demand in the power system, notes learnings from recent trials and where recent uses have benefitted security and reliability.

**Note:** This paper has been prepared for the purpose of the Security and Reliability Council (SRC). Content should not be interpreted as representing the views or policy of the Electricity Authority except where specifically noted.

# Opportunities for the use of ripple and smart-meter controlled circuits for managing peaks

## 1. Introduction

- 1.1. This paper introduces a presentation from Powerco and Vector on opportunities for the use of ripple and smart-meter controlled circuits for managing peaks.
- 1.2. At the SRC's August meeting, members discussed risks and future topics for inclusion in the work programme. Karen and André offered to put together a presentation on distributor perspectives on the roadblocks to (now 'opportunities for') greater use of ripple control and Advanced Metering Infrastructure (AMI) to support peak management.
- 1.3. John Hancock (Powerco) and James Tipping (Vector) will join the meeting, as presenters and be available for questions.
- 1.4. The presentation is attached as **Appendix A**.

## 2. Questions for the SRC to consider

The SRC is asked to consider the following general questions.

- Q1. What further information, if any, does the SRC wish to have provided to it to maximise understanding of these technologies and how they can be used?
- Q2. What updates does the SRC think are needed to its risk radar, or forward work programme, in light of the presentation?
- Q3. What advice, if any, does the SRC wish to provide to the Authority?

## Appendix A: Powerco and Vector joint presentation

# Opportunities for the use of ripple and smart meter-controlled circuits for managing peaks

EDB experience and recent trials

Karen Frew and André Botha for the SRC | October 2024



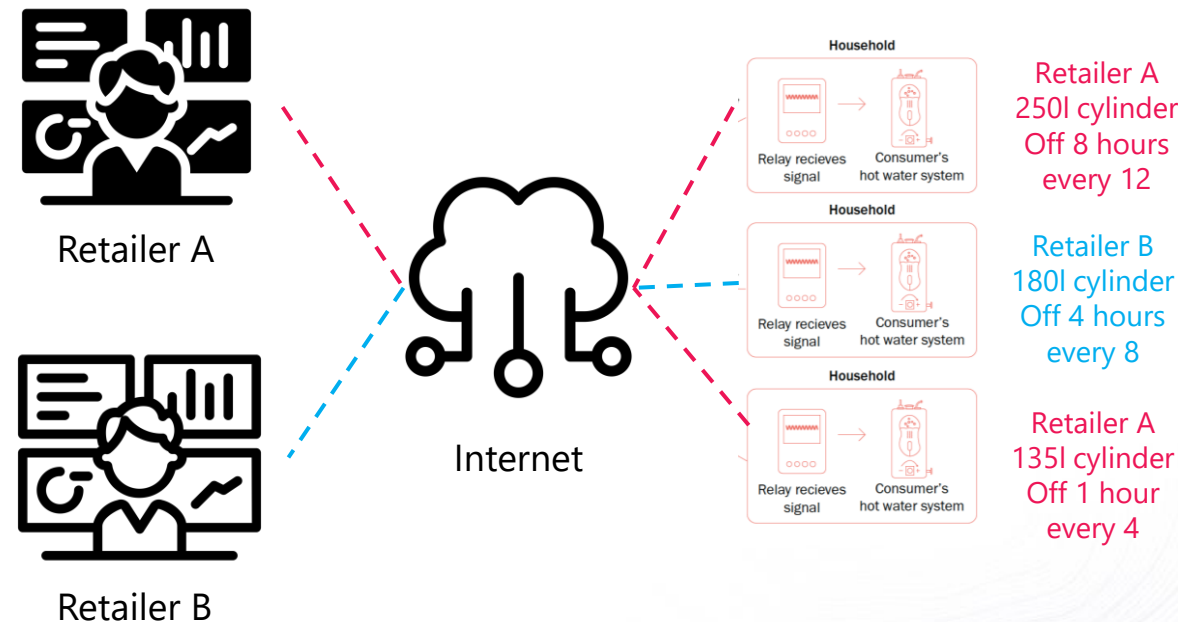
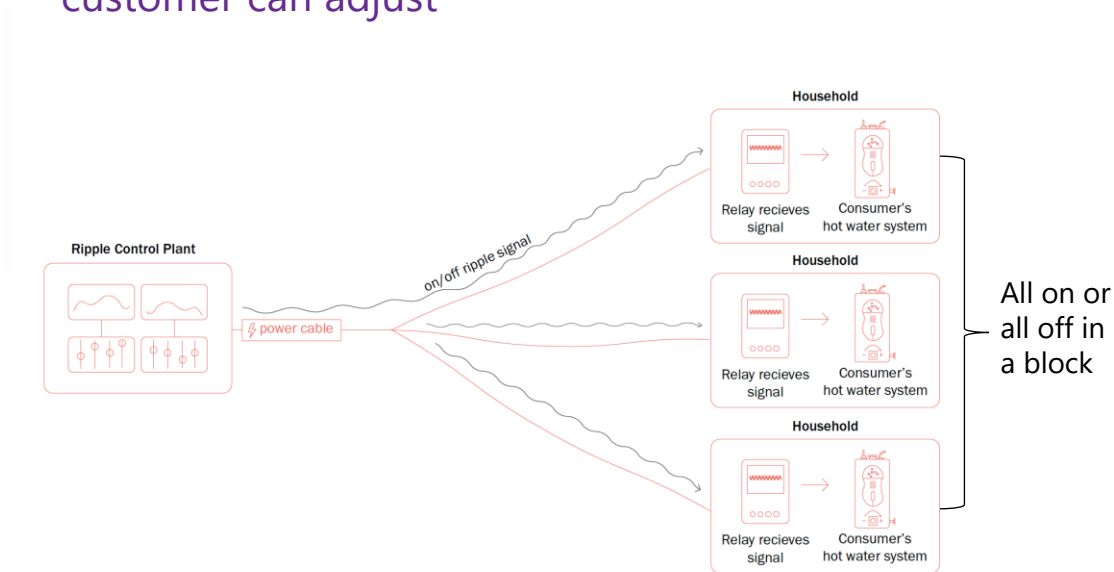
# Retailer control of hot water heating using smart meters could reduce national peak demand by hundreds of MW

Changes in use of ripple control and smart meter capability for individual ICP control could allow more flexible demand to compete with generation in the spot market than has historically been the case

- Powerco's experience with retailers controlling hot water through smart meters is that
  - Spot market peaks (currently) coincide with transmission and distribution network peaks so retailers managing to minimise demand during high spot prices currently relieves network congestion at peak – but may delink with more intermittent supply
  - ICP-level control allows individual operating protocols which reflect that modern hot water cylinders are much bigger than old ones and customers have different preferences about how much water needs to be hot when – with retail competition, customers see the benefit of this in prices and service levels
  - This allows more load to be deferred for longer than is possible with ripple control as currently configured at very low incremental cost
- RCPD used to provide a peak signal that some EDBs used to respond to with ripple control (even though transmission costs are a passthrough).
  - Since RCPD was removed, most EDBs do not use ripple control to respond to GXP peaks consistently but many still use it to manage peaks on their own networks
  - Some EDBs also offer ripple control into the national instantaneous reserve market – during which periods it is not available to as "discretionary demand" in grid and system emergencies
- Approximately 20% of Powerco's control circuits are currently being managed by retailers. We will be encouraging all retailers to maximise their use of this resource next year
- Because our CPP investments addressed acute congestion on Powerco's networks, we may rely on ripple less than most other EDBs for congestion management on our own networks
- Most EDBs could accommodate some retailer control alongside their own use of ripple for network management – it's the future!

# Smart meters allow individual controlled (hot water) circuits to be managed with more precision than ripple

ICP-specific control means retailers can agree different operational protocols with each customer, depending on the size of their hot water cylinder, how much hot water they need and when they need it, which the customer can adjust



Pros	Cons
<ul style="list-style-type: none"><li>• Very reliable (analogue)</li><li>• Independent of 3<sup>rd</sup> party data networks</li><li>• Provides redundancy for emergencies</li><li>• Near 100% signal coverage of ICPs including remote areas</li><li>• Low cost option for streetlight control</li></ul>	<ul style="list-style-type: none"><li>• Not targeted (large blocks of customers) – unlike competitive retail</li><li>• Binary (on/off)</li><li>• Single point of failure at injection plant</li><li>• No feedback from consumer meters</li><li>• Limited pool of technical support?</li></ul>

Pros	Cons
<ul style="list-style-type: none"><li>• Encourages retail competition and different price/service options</li><li>• Granular – allows individual operating rules at each ICP</li><li>• Will evolve to device-level “turn up/down” &amp; dynamic operating modes</li><li>• Can measure quantities controlled</li></ul>	<ul style="list-style-type: none"><li>• Depends on smart meter comms</li><li>• Control is fragmented between retailers</li><li>• Not available to all meters in all areas</li><li>• Relies on service evolution by MEPs</li><li>• Needs coordination during load restoration</li></ul>

# Powerco's 2024 winter trial has over 20,000+ ICPs which will rise to 30,000\* by year end

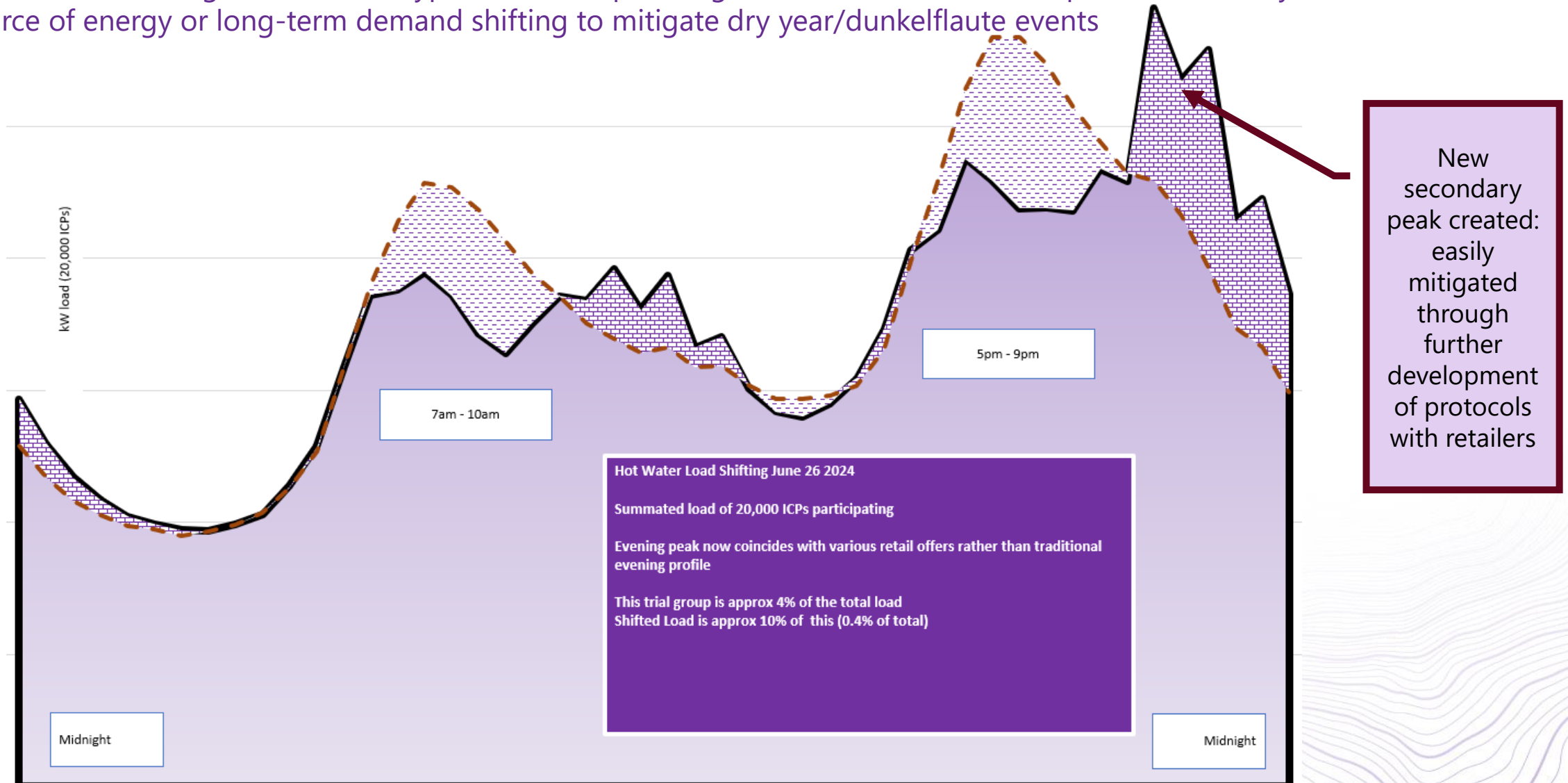
Participating retailers receive permission from Powerco to manage controlled circuits (mainly hot water load) over the internet through smart meters and share data on its use and value outside network control periods

- Retailers get consent from customers – and offer them a deal which reflects the individual operating protocol that they agree with each reflecting longer time off supply and shorter recharge periods for customers with larger cylinders
  - Powerco learns about coincidence of retailer response to spot price peaks with network peaks on Powerco distribution system
  - Under default distribution agreement, Powerco retains control of all discretionary load for managing (national) grid emergencies and system emergency on its own network
  - Under emergency code changes, EDBs make “difference bids” to inform System Operator amount of residual discretionary load that could be controlled in a grid emergency
  - In the trial, retailers are prohibited from changing their load shifting pattern during a system operator event to ensure Powerco retains control in warning and emergency situations, including generation shortfalls and to preserve forecasts in both Powerco and system operator models
- Trial has been very straightforward - no adverse unintended consequences – **everyone is keen to ensure positive customer experience**
  - Retailers observe scarcity prices so have a strong incentive to maximise use of resource at times of system scarcity even if fully hedged or vertically integrated (opportunity cost)
  - Powerco earns a regulated return on ripple control plant – no need for additional payments when used for emergency management
  - EDBs who use ripple actively for managing their own network congestion or participate in interruptible reserve market would need to establish a hierarchy of use to preserve access to the same flexibility offered by discretionary demand while allowing retailers to control load at the ICP – cost reflective distribution pricing is a longer term opportunity
- Has highlighted some areas where roles of parties under DDA in emergencies can be clarified – can be captured in current code change

Sources: \* [Contact eyes control of 10,000 hot-water cylinders | Energy News](#), [Strong frameworks needed for controlled hot water – Octopus | Energy News](#), [Big year for Mercury benefits customers | Energy News](#) \* [Genesis trials hot-water control for new flex service | Energy News](#)

# Trial has been extremely successful

Retailers are shifting load across a typical demand profile: great solution for 1-4 hour peaks. Obviously not a source of energy or long-term demand shifting to mitigate dry year/dunkelflaute events





# Incentives for discretionary demand to respond to peaks

One consequence of the Grid Emergency on 9 August 2022 was the EA's consultation *Driving efficient solutions to promote consumer interests through Winter 2023* with different initiatives around information and incentives

- Information option E was to “Clarify availability and use of ‘discretionary demand’ control (such as ripple control)”
  - Difference bids certainly help but nobody gets paid if the demand reduction offer is dispatched in a grid emergency
  - There's no consequence if EDBs don't meet these bids (or don't offer any) – hence need for incentives
- Incentive option K was to “Procure additional resource outside of spot market” – very similar to a winter peak ancillary service product proposed by the CEO Forum
  - Rejected by the Authority because it wasn't cooptimised with the spot market so would have distorted use of discretionary demand
  - Authority now proposing a new integrated standby ancillary service in the form of a five-minute variability management tool (using MFK) which would provide revenue for discretionary demand
  - Would take several years to implement
  - Like IR, may not be as efficient as value stacking response to spot prices and cost reflective network prices and flexibility payments

# Ripple and hot water on May 10 2024

Good example of how different resources participated during the most recent generation scarcity event

- Was 1 week into Powerco's "retailer hot water control trial" – approx. 7,000 ICPs (over 20,000 today) some of whom turned off load to avoid scarcity prices
- Powerco removed some automatic control of hot water during the event to ensure we could meet the our offered 70MW difference bid – an estimate of load control hot water available for the period – if called
- Opportunity with greater retailer participation for this demand to be reduced at energy peak prior to any system emergency
- System Operator didn't call difference bids – Powerco returned to automatic load control at 8:30am (post-national peak) with some GXPs controlling hot water at that time.
- Nationally, around 140MW offered through difference bids – Powerco was about half of what was offered.
- Several EDBs (covering a large number of ICPs) offered 0MW as they put all their hot water control through the reserves market and are paid for availability even if not called but cannot use the resource for any other purpose unless expressly requested by the SO

Powerco experience with offering controlled load into the IR market is that costs of meeting SO compliance were comparable with the payments we received and ComCom cost allocation rules required us to allocate costs of control plant to unregulated business to match unregulated revenue



## Warning Notice

To: WRN NZ Participants  
Sent: 09-may-2024 10:51  
Ref: 5374984112

From: The System Operator  
Telephone: 0800 488 500  
Email: NMData@transpower.co.nz

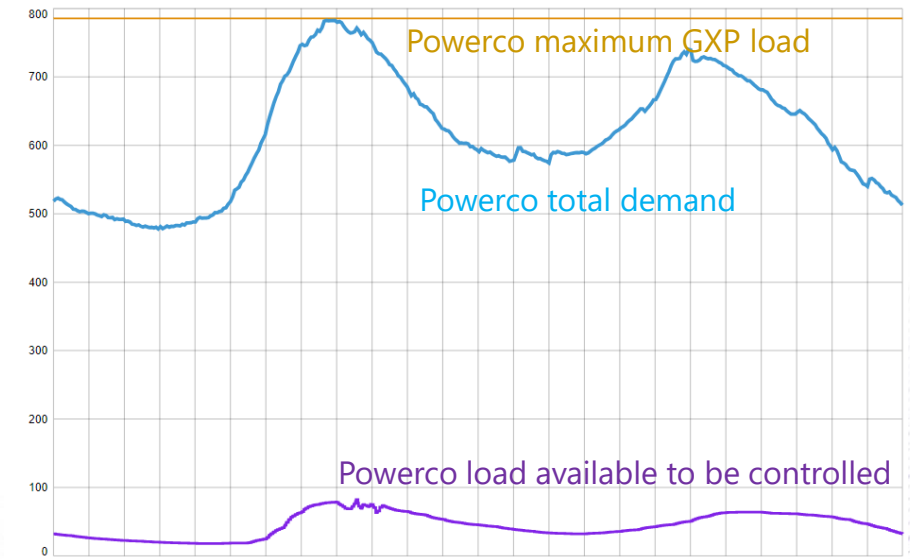
### Revision of:

**Cause:** Insufficient Generation offers to meet demand National  
**Region or GXP affected:** National  
**Starting:** 10-may-2024 07:30  
**Ending:** 10-may-2024 08:30

The System Operator advises there is a risk of insufficient generation and reserve offers to meet demand and provide N-1 security for a contingent event.

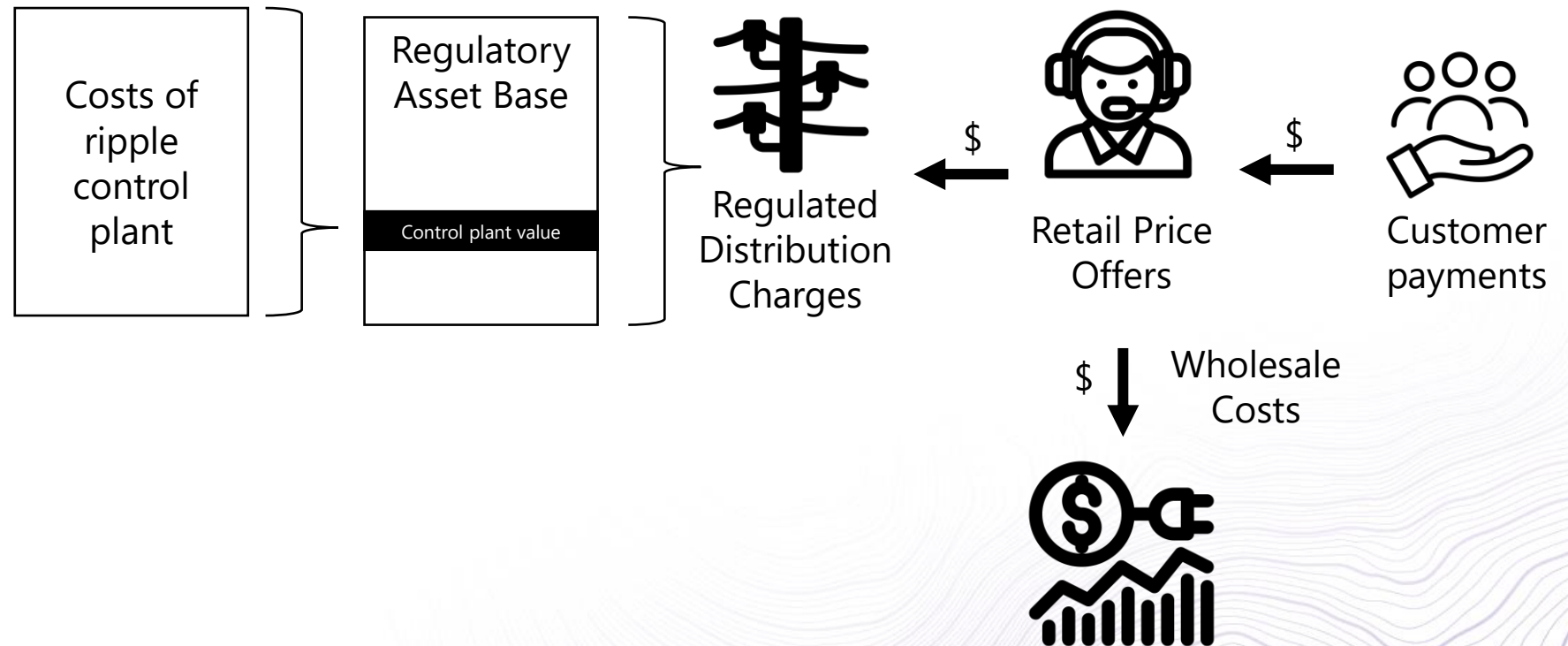
### Consequences on the power system:

Reduced reserves for the CE risk may be dispatched, and/or the system operator may need to manage demand.



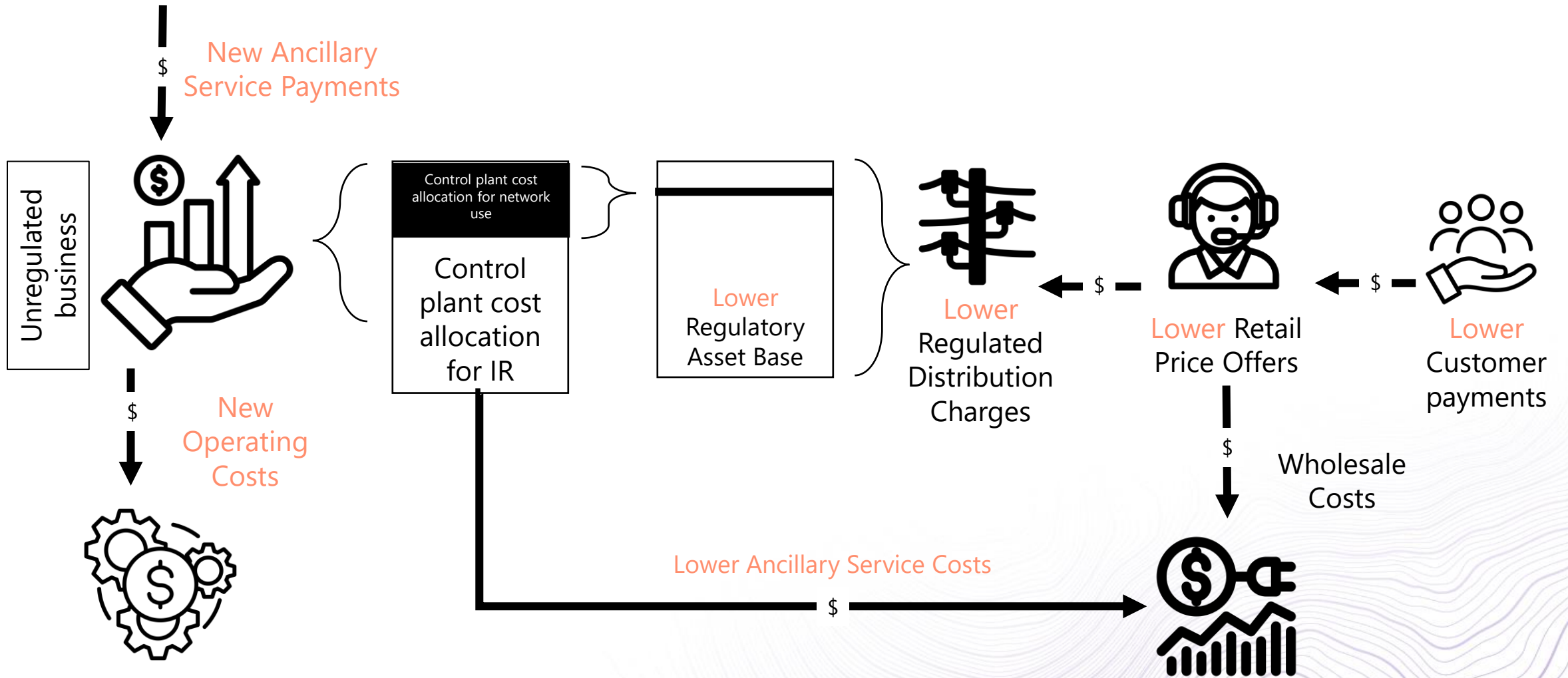
# Currently customers pay for ripple control plant through regulated distribution charges

Payment is for return of and return on capital for assets used to deliver regulated distribution services and passed through by retailers over time as a common input to competitive retail offers



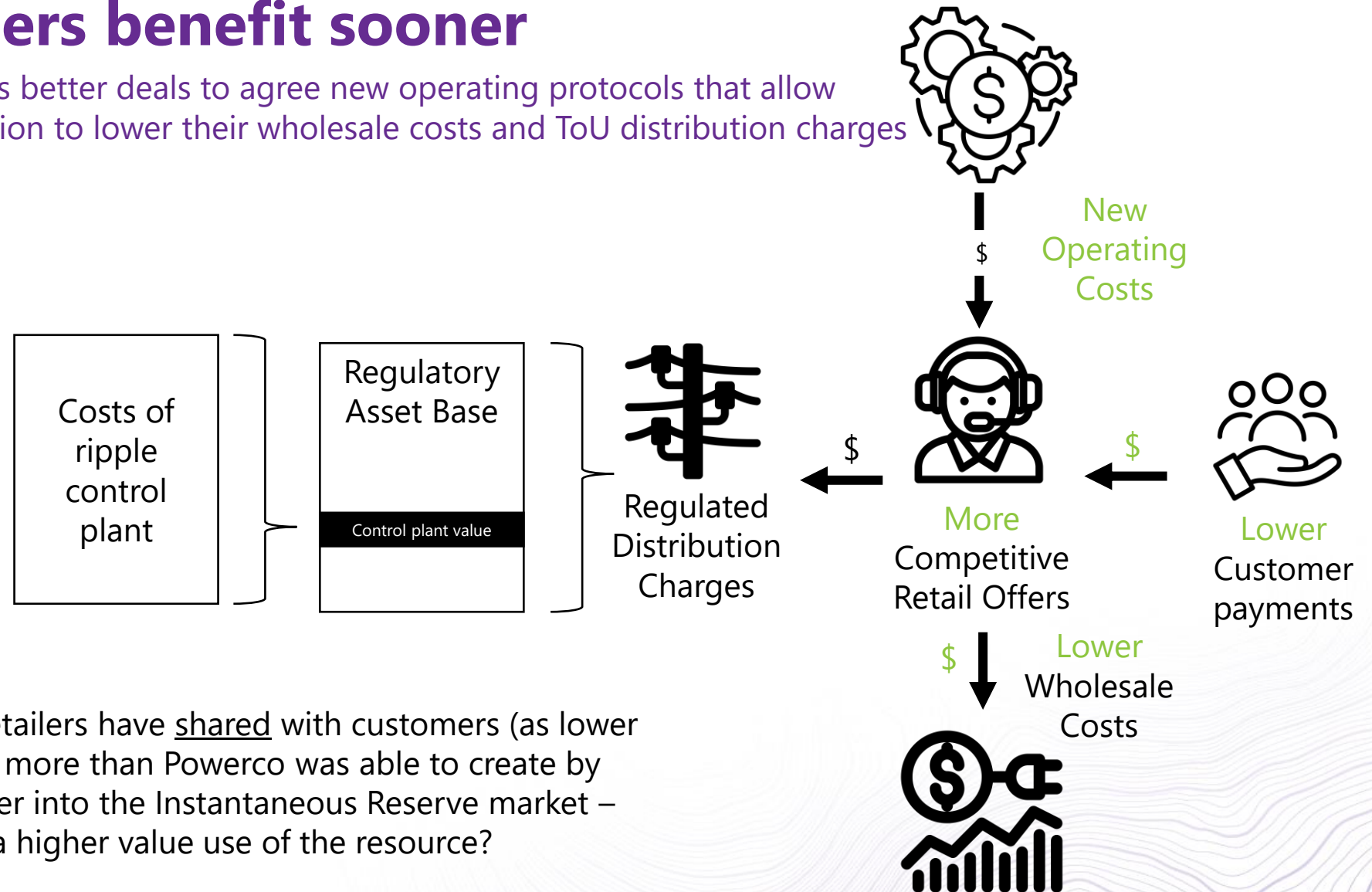
# Using ripple for unregulated activities lowers distribution charges and wholesale market reserve costs

Allocation happens annually for information disclosure but regulated prices reset at the start of each regulatory period and are passed through to consumers over time as retailers compete with one-another



# Where retailers negotiate with customers to control hot water, customers benefit sooner

Retailers will offer customers better deals to agree new operating protocols that allow them to use demand reduction to lower their wholesale costs and ToU distribution charges



Anecdotal, the value retailers have shared with customers (as lower prices, free TVs etc) is more than Powerco was able to create by offering ripple hot water into the Instantaneous Reserve market – maybe this is a higher value use of the resource?

# Enabling third party control of hot-water (and EVs) is not as straightforward as it may first appear

While we agree meter-based control of HW is the better tool for the future, our experience suggests the transition away from ripple must be managed carefully

1. Not all consumers can come on the journey immediately, because:
  - a) not all **meter types** may enable these services, particularly in Auckland; and
  - b) not all homes are **wired correctly**; it's not clear how widespread this is
2. Retailers will need to agree operating protocols with their host EDBs, but non-retailer aggregators are **totally invisible** to us (and outside the Code). Is that fair to retailers?
3. Because the resources are not offered, their use is **outside the trading conduct framework** and can't be monitored by the EA. Having the same party manage both demand and supply seems unusual, and stakeholders will need convincing LTBC are being delivered
4. There will have to be a clear value proposition for consumers to opt in:
  - a) this is obvious for consumers on TOU retail plans, but less obvious for consumers who are on flat-rate tariffs
  - b) we assume we are expected to have faith in competitive forces ultimately ensuring savings to consumers are passed through



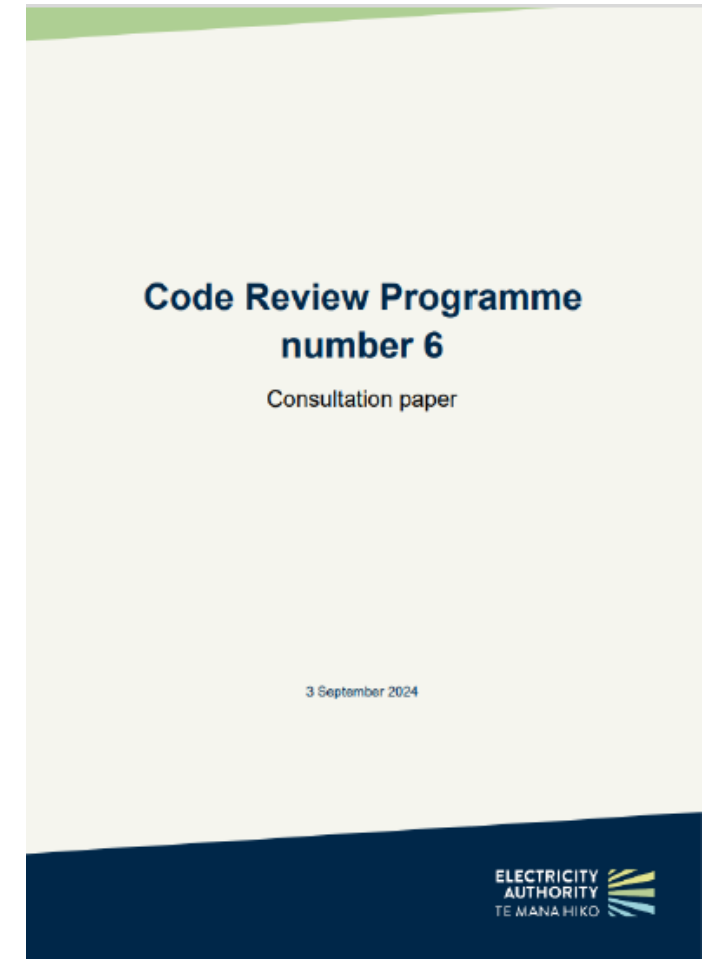
# Hot water can help with energy peaks but we need to anticipate and manage security risks – from local to nationwide

Third-party control of hot water could be efficient and effective, but as an industry we must maintain a hierarchy of control in **local** and **grid** emergencies

- Policy and hierarchy for EDBs offering ripple control into the IR market and giving the SO “difference bid” visibility for Grid Emergencies is now well-established
- Retailer dispatch of load through smart meters is a third option but it is important to develop operating protocols for routine management and emergencies to avoid adverse unintended consequences for system reliability. This includes **restoration of load**, post-emergency.
- Proposal 2 in recent EA Code review programme #6 “Sharing control of load between distributors and others” undersells the provisions for distributed demand management in the Default Distribution Agreement, which describes how load is to be managed when both the distributor and third parties have the ability to control load in different ways.

ENA members have recommended the EA takes the opportunity to clarify the hierarchy of control between multiple parties, and to distinguish between **grid** and **network** emergencies – before third-party control of customer load becomes widespread.

It would have more weight if the SRC supported these suggestions.



# Multiple parties managing devices on EDB networks may be good for customers but creates new security risks

Third-party control of hot water and EV charging could be efficient and effective, but as an industry we must maintain a hierarchy of control in **local** and **grid** emergencies

- As the number of different parties on a network, and the number of signals they respond to increases, balancing these networks will become **increasingly complex**. Network operators on distribution networks will increasingly be required to operate like the System Operator on the transmission grid.
- Part 8** governs how the grid is operated and security (“common quality”) maintained. Transmission limits and security constraints are clearly understood and respected via SPD. All parties must be connected to the SO’s communications system. The processes leading up to, and during, grid emergencies are well established, well understood and well tested.
- The sole equivalent mechanism on distribution networks is an **untested** “load management protocol” to be **negotiated** between a load-managing retailer and their host distributor, under the DDA.

The Code should ensure common quality – the security and safety of the interconnected transmission **and distribution networks** – requiring any load-managing party (whether currently a participant or not) to **respect constraints** and **operating limits** of networks and **immediately execute operator instructions** during emergencies.

Electricity Industry Participation Code 2010	
Part 8	
Common quality	
Contents	
8.1	Contents of this Part
8.1A	<i>(Revoked)</i>
Subpart 1—Performance obligations of the system operator	
8.2	Contents of this subpart
8.3	Recovery of costs from causes of voltage non-compliance
8.4	System operator may rely on information provided
8.5	Restoration
8.6	System operator may contract for higher levels of common quality
8.7	System operator must not contract contrary to this arrangement
Policy statement	
8.8	System operator to comply with policy statement
8.9	<i>(Revoked)</i>
8.10	Incorporation of policy statement by reference
8.10A	Review of policy statement
8.10B	System operator decides not to propose change to the policy statement
8.10C	Authority may require system operator to reconsider
8.11	Content of draft policy statement
8.11A	Changes and variations
8.12	Consultation on draft policy statement
8.12A	Technical and non-controversial changes
8.12B	Authority adopts new policy statement
8.13	<i>(Revoked)</i>
8.14	Departure from policy statement
System security forecast	
8.15	System operator to prepare and review system security forecast
Subpart 2—Asset owner performance obligations and technical standards	
8.16	Contents of this subpart
Asset owner performance obligations and technical standards concerning frequency	
8.17	Contribution by injections to overall frequency management
8.18	Contributions by purchasers to overall frequency management
8.19	Contributions to frequency support in under-frequency events
8.20	Contributions by grid owners to frequency support
8.21	Excluded generating stations
Asset owner performance obligations and technical standards concerning voltage	
8.22	Voltage range AOPOs
8.23	Voltage support AOPOs
8.24	Load shedding obligations to support voltage
8.25	Other asset owner performance obligations and technical standards
8.25A	Fault ride through
8.25B	Reactive current and active power output

3 May 2023



