Government of **Western Australia**
Department of **Mines, Industry Regulation and Safety**
Energy Policy WA

Demand Side Response Review Working Group

Meeting 1

10 May 2023

Working together for a **brighter** energy future.

Scope of this review

Project Scope

The objective of this review is to:

- **identify the different ways Loads/Demand Side Response can participate across the different WEM components;**
- **Identify and remove any disincentives or barriers to Loads / Demand Side Response participating across all of the different WEM components; and**
- **identify any potential for over- or under compensation of Loads/Demand Side Response (including as part of "hybrid" facilities") as a result of their participation in the various market mechanisms and provision of Network Services.**

The following aspects related to the participation of Loads are out of scope for this review:

- **certification and dispatch baseline for DSPs; and**
- **treatment of IRCR.**

Guiding Principles

1. **Meet the Wholesale Market Objectives.**
2. **Enable the orderly transition to a low greenhouse gas emissions energy system.**
3. **Be cost-effective, simple, flexible and sustainable.**
4. **Allocate risks to those who can manage them best.**
5. **Provide investment signals and technical capability signals that support the reliable and secure operation of the power system.**
6. **Ensure that the value of Demand Side Response can be maximised for the benefit of those who provide it and the WEM as a whole.**
7. **Ensure that Loads are not under- or over compensated for their participation and treatment in any of the WEM components.**

Project stages

Stage 1

- High level assessment of the participation of Loads/Demand Side Response across all WEM components based on:
  - Jurisdictional review seeking to identify problems they're facing or are expected to face, and whether/how these arrangements relate to the WEM.
  - Outcome of the system stress analysis from stage 1 of the RCM Review.
  - Identification of typical flexible loads in the WEM that aren't participating in the WEM.
  - Assessment of possibilities for over- or under compensation for DSR

Stage 2

- A gap analysis identifying any barriers and disincentives identified under Step 1, including in:
  - the registration framework;
  - the Real Time Market;
  - the ESS market, including Non-Co-Optimised ESS; and
  - the RCM.

Stage 3

- Formulations of recommendations for further action, if any, and development of Rule changes, if necessary

Introduction to Demand Response

Demand response

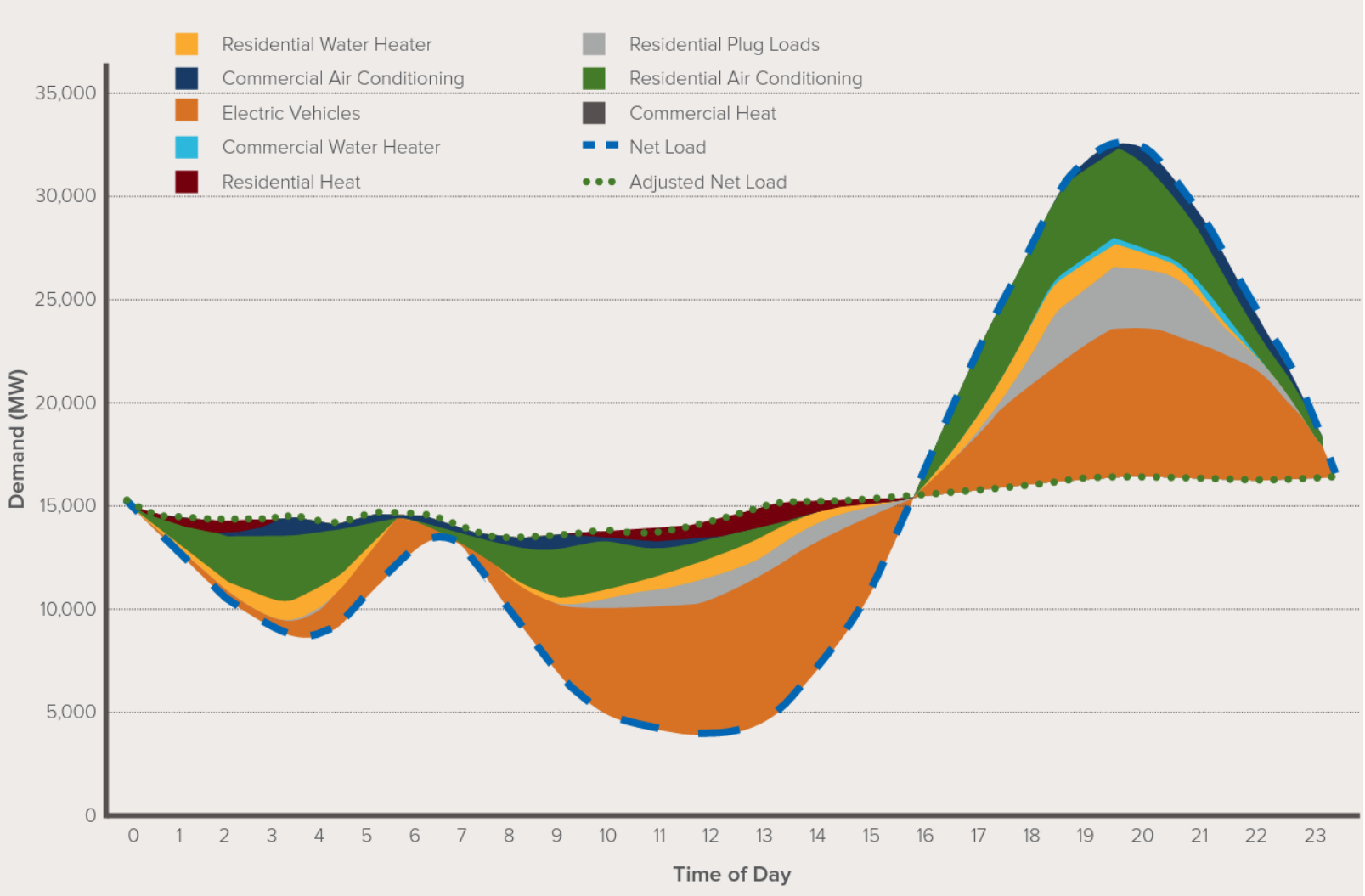
Has the potential to

- **Flexibly support system stability & reliability (contributing to ancillary services)**
- **Enhance efficiency**
- defer investment in transmission and generation
- shift usage away from peak periods (improve capital resource utilisation)
- reduce system and market costs through larger competitive pool (demand and supply side competing among and with each other)

Demand response takes many traditional forms

- Demand side bidding and forecasting – requirement for consumption side of the market to forecast and bid in their requirements in order to improve system demand accuracy,
- Dispatchable demand – incentive to use less electricity when prices are higher and more when prices are lower (subject to elasticity). Sometimes called Energy Arbitrage.
- Interruptible load – demand competing with spinning reserve for varying reserve products (defined by immediacy of response and sustainability)
- Demand reduction – call option given to grid owner or distribution company in order to manage outages and maintenance or to defer investment. Also can be provided to retailer to mitigate high price periods when under hedged.
- Ripple Control – relinquishing some control over consumption to supply companies and/or the grid operator (direct load control). AMI metering expanding these possibilities.
- Real-time response – control given to distribution company, grid operator (or sometimes aggregator) for demand to respond to Frequency (regulation) control. A discounted tariff will typically be given for this.
- Load shedding – when system supply insufficient to meet demand

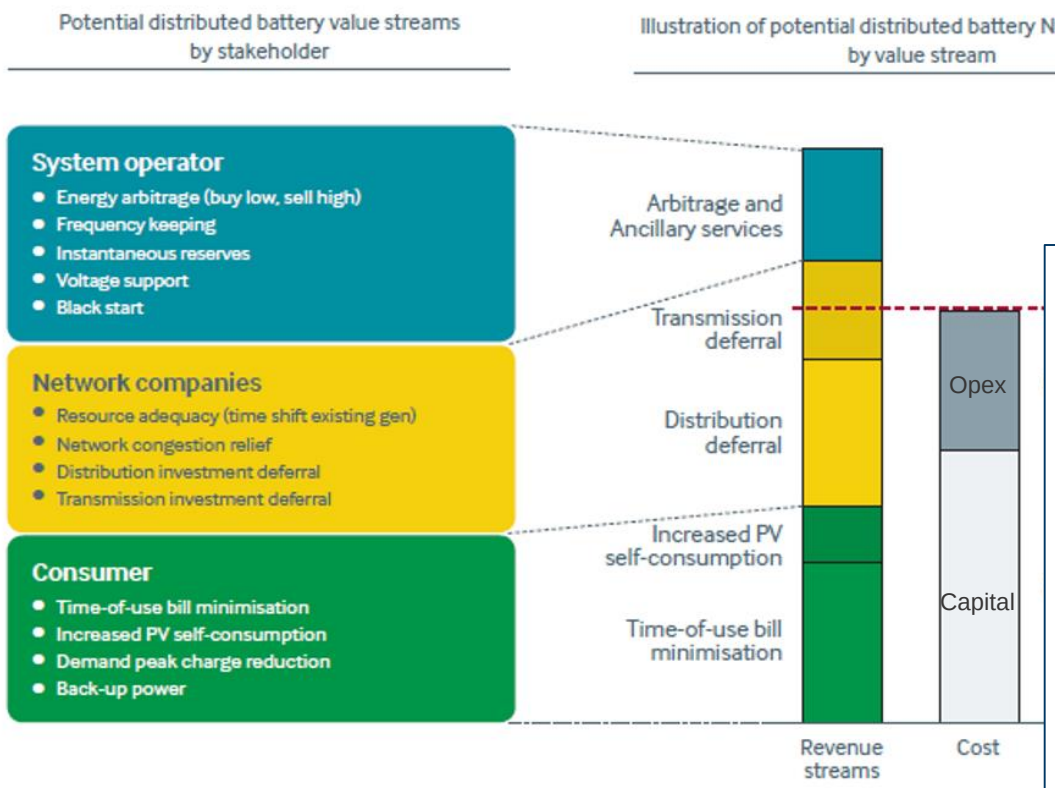
Value of Demand Flexibility (load shifting)



- **DSR has the potential to provide a wide range of flexibility and dramatic load shifting opportunities.**
- **DSR is situationally responsive demand.**
- The situation can be a price signal.
- Or it might be a direction, technical requirement, or constraint (condition-based) (e.g., security).
- **Participation can be by the resource owner or by a resource operator who contracts with the resource owner.**

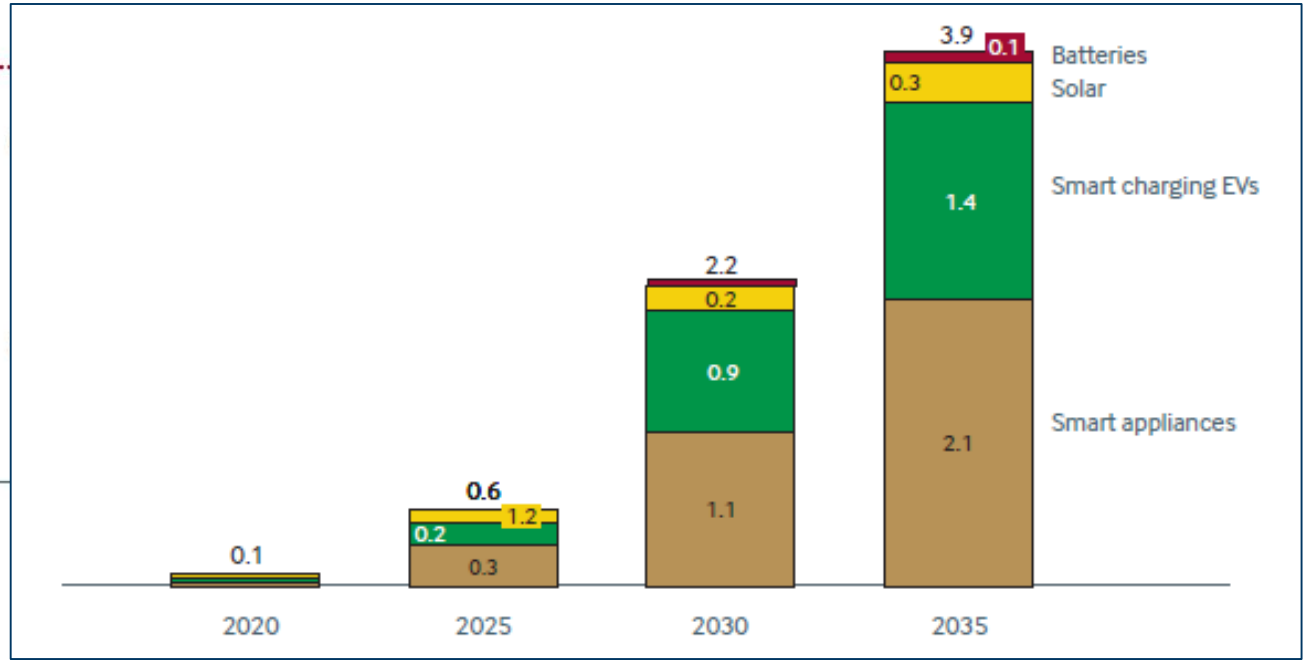
Source: Using a hypothetical 2050 generation mix in ERCOT. Demand Flexibility – The key to enabling a low-cost, low-carbon grid. Rocky Mountain Institute, February 2018

Looking forward most project an increasing mix of DERs and an increasingly complicated set of value propositions



Source: Based on The Economics of Battery Energy Storage, Rocky Mountain Institute

Distributed energy resources by type (millions)



Source: Empowering our Energy Future – Transpower (New Zealand), March 2020

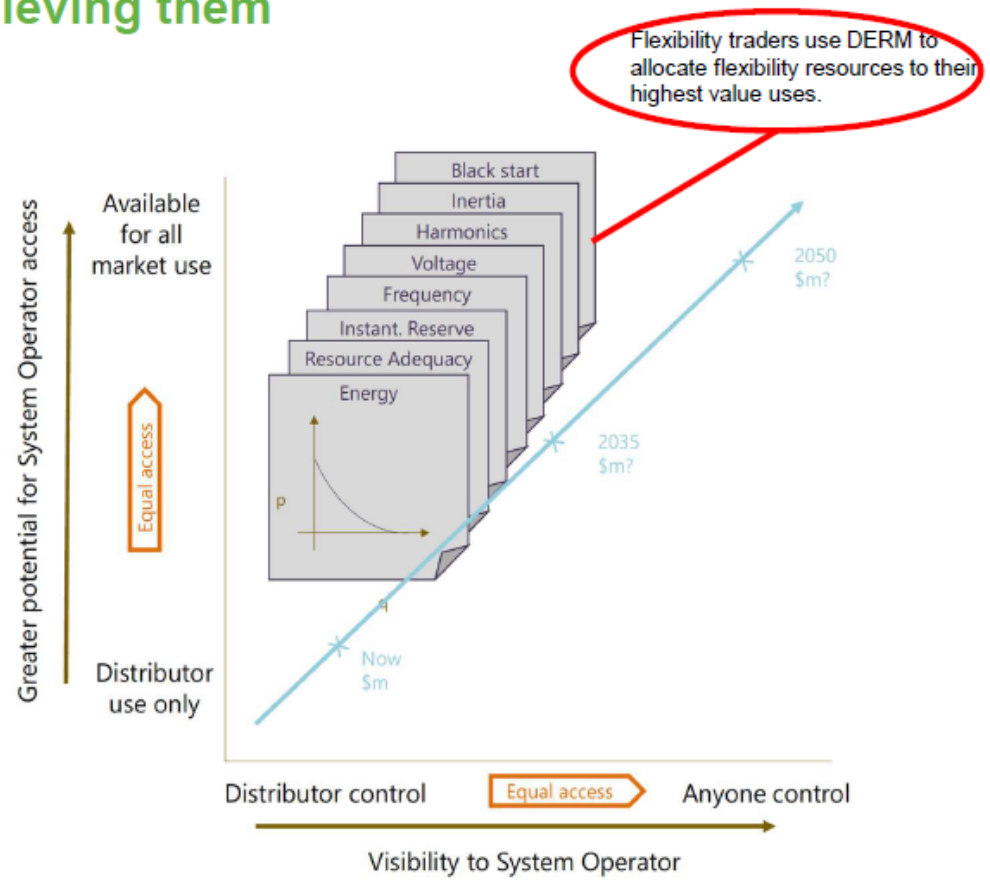
Taming the Beast that lives on the Demand Side

DER have Jekyll and Hyde characteristics – both creating problems and relieving them

Embedded DER supply (particularly solar) provides energy but potentially congests distribution and transmission and exacerbates need for market peaking and firming

Resource adequacy is the use of DER (particularly dispatchable demand and embedded battery storage) to defer or avoid investment in distribution, transmission and peaking generation

Some ancillary services can also be provided by DER



Source: *Distributed Energy Resources – Understanding the potential*, Sapere for the System Operator, July 2020

- DER Resources can operate individually, or in aggregation, or in coordination.
- **Individually** means that maybe something is going up when something else is going down, wasting opportunities.
- **Aggregation** might be someone trying to make money by getting *more* things to work together in a *particular* way.
- **Coordination** might be mandating or directing *everything* to operate in a *systematic* way.

How can we tell if we have achieved our objectives?

Consider a possible “conceptual test”

Such as:

1. **Have we identified the relevant sources of value?**
2. **Is it possible for DSR to map its capabilities to those sources of value?**
3. **If not, have we identified the potential barriers and removed them?**
4. **Are these “enablers” and the outcomes economically efficient?**

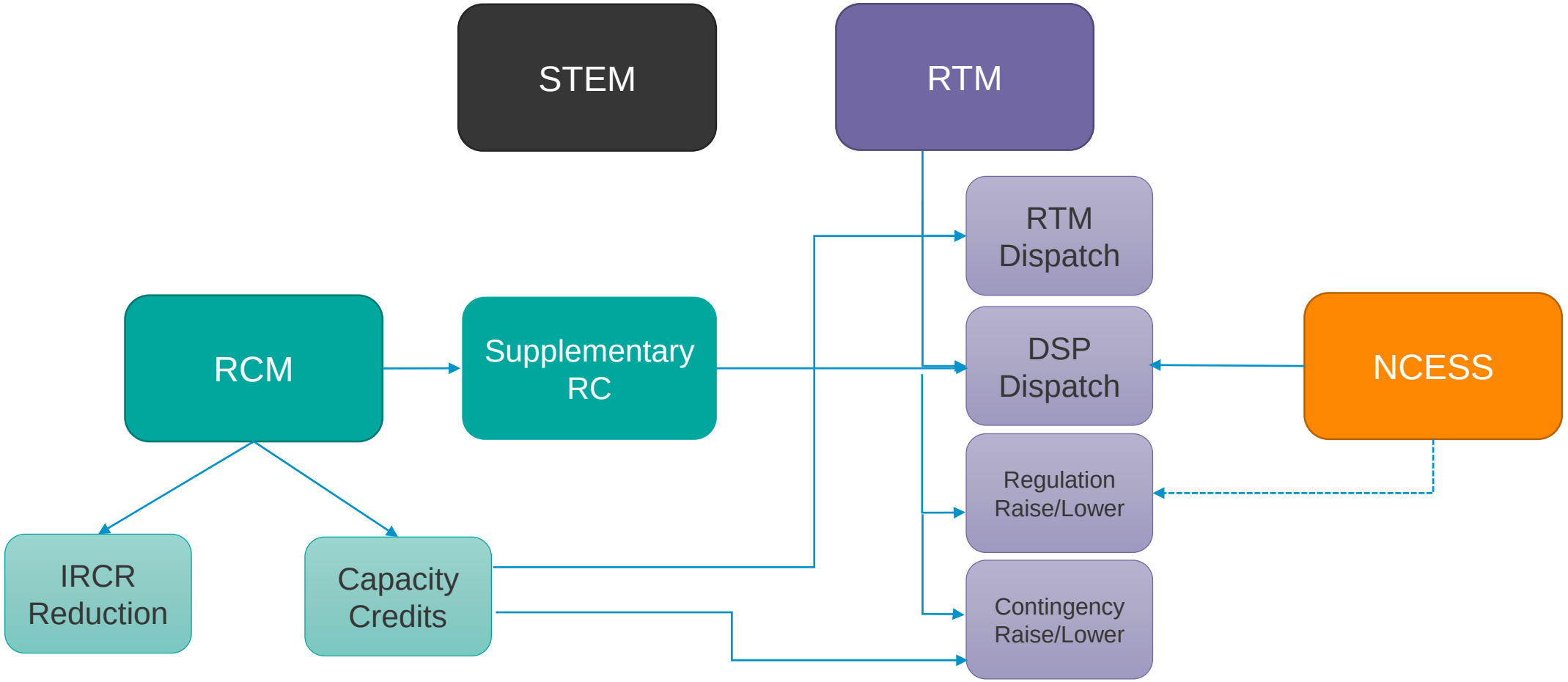
DSR Participations options

High-level exploration of the ways Loads and Demand Side Response can participation in the WEM

DSR Participations options

- In the following slides we explore the options for Loads and DSR to participate under the new market rules.
- For this meeting we've approached mapping the options at a high-level to showcase the changes under the new rules and to start discussion.
- Over coming meetings we will focus on particular areas and dive into more detail.

DSR Participation in the WEM Flow Chart



Options for DSR registration

DSR eligible to register as only one of the following:

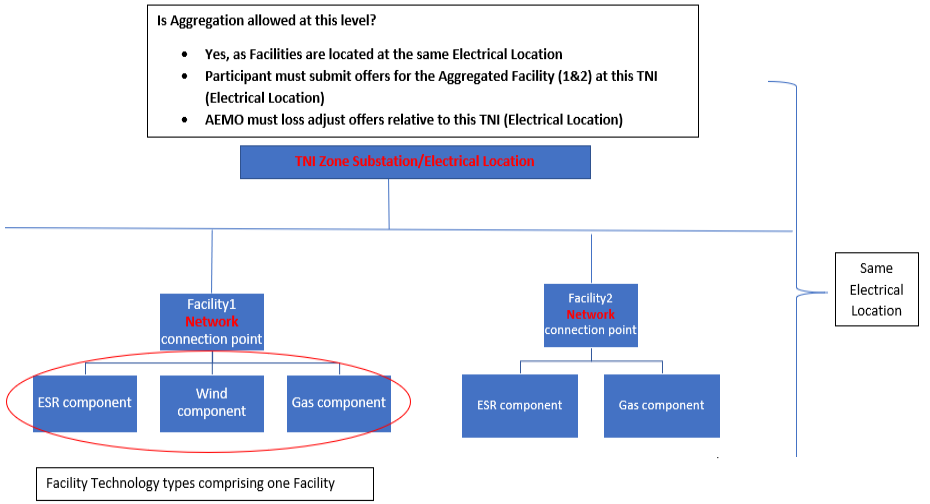
- **A Scheduled Facility with a Load**
- **A Semi-scheduled Facility with a Load**
- **A Non-Scheduled Facility with a Load**
- **An Interruptible Load with a Load**
- **An Interruptible Load with Non-Dispatchable Load(s)**
- **A Demand Side Programme with a Load**
- **A Demand Side Programme with Non-Dispatchable Load(s)**

Load: One or more electricity consuming resources or devices, other than Electric Storage Resources, located behind a single network connection point or electrically connected behind two or more shared network connection points.

Note: a non registered load by default is a Non-Dispatchable Load

DSR registration continued

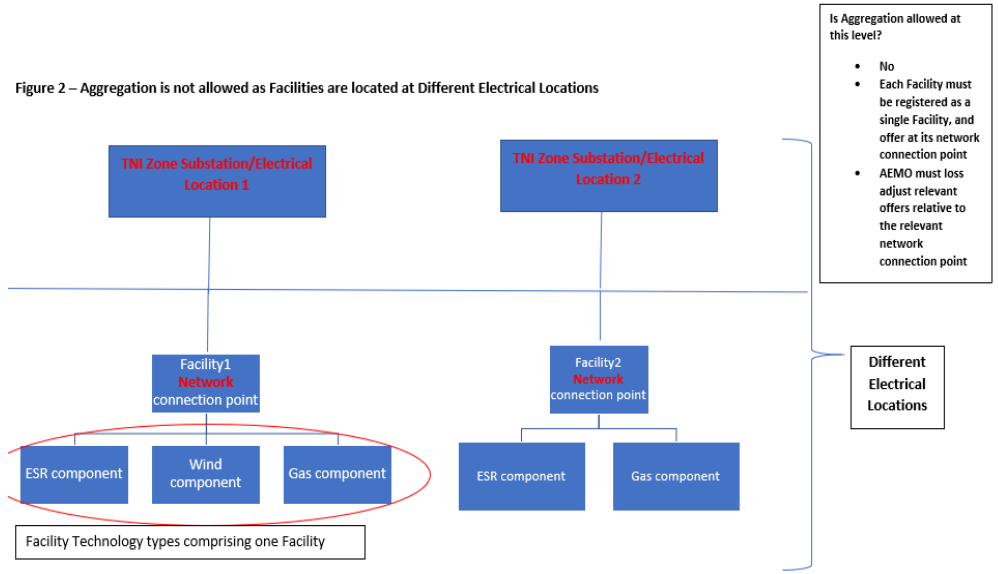
A load can be aggregated with another Facility Technology Type provided they share a common connection point and then register as a Scheduled Facility, Semi-Scheduled Facility or a Non-Scheduled Facility



Aggregation is allowed as Facilities are located at the same Electrical Location

Aggregation is not allowed as Facilities are located at Different Electrical Locations

Figure 2 – Aggregation is not allowed as Facilities are located at Different Electrical Locations



RCM – DSR Participation

The RCM is mostly out of scope of this review – however

- **The RCM Review flagged three areas of consideration for this project:**
    1. AEMO's ongoing procurement of Non Co-optimised Essential System Services (NCESS) for minimum demand services highlights that minimum demand remains an ongoing concern.
    2. Rules will be needed to ensure that a Capability Class 2 facility with collocated load and storage cannot self-discharge its storage so as to reduce its IRCR exposure while also receiving capacity credits for that capability.
    3. RCMRWG discussions on DSP dispatch arrangements raised the minimum availability of 200 hours per year as a barrier to participation for some loads which could curtail but are concerned about the impact on their operations.
- **We also consider that the implementation of the dynamic baseline is an important element relevant to DSR participation**

RCM – DSR Participation Discussion

Discussion Questions

- **How could DSR be used to provide minimum load services?**
- **What are the alternative options for considering the minimum availability hours for DSR?**
- **The dynamic baseline design can assist with DSR participation however, there could be some challenges with double counting?**

Supplementary Reserve Capacity (SRC) – DSR Participation

- **Six months before the start of a Capacity Year AEMO can seek SRC if AEMO considers that inadequate Reserve Capacity will be available in the SWIS.**
- **Loads and DSPs are eligible to participate – excluding the reductions provided by a DSP that does not satisfy its Reserve Capacity Obligations during the current Capacity Year or a previous Capacity Year.**
- **Loads or DSPs can only participate if they:**
    1. Do not hold Capacity Credits in the current Capacity Year; and
    2. Have not held Capacity Credits in the current Capacity Year or a previous Capacity Year; and
    3. Hold Capacity Credits in a subsequent Capacity Year, or
    4. Provide evidence satisfactory to AEMO, prior to a Supplementary Capacity Contract taking effect, that
        - costs have been incurred to enable the provision of the capacity through the installation of physical equipment; and
        - the capacity is in addition to the sent out capacity of the Energy Producing Systems, or the maximum amount of load that can be curtailed, that existed prior to the installation of the physical equipment.
- **AEMO dispatches SRC in line with the terms of the contract.**

STEM – DSR Participation

- **DSR is not currently able to participate in the STEM.**
- **DSR participation is not prohibited, rather, DSR is not able to comply with STEM requirements in a few ways:**
  - Market Participants can only sell energy and must identify the contracted Market Participant purchasing the energy through a bilateral contract.
  - Bilateral Contract: A contract formed between any two persons for the sale of electricity by one of those persons to the other.
- **A Market Participant must not specify quantities in a Bilateral Submission or a Standing Bilateral Submission which exceed the quantity of energy that the Market Participant is contracted to supply to the relevant Market Participant.**

STEM – DSR Participation

STEM Continued

6.7.4. A Market Participant must not significantly over-state its consumption as indicated by its Net Contract Position with a regularity that cannot be explained by a reasonable allowance for forecast uncertainty or the impact of Loss Factors.

6.9.13. The Net Contract Position for Market Participant p in Trading Interval t is:

(a) the Net Bilateral Position for Market Participant p in Trading Interval t; minus,

(b) the amount of energy purchased by the Market Participant from AEMO through the STEM at the STEM Clearing Price, which is the total quantity associated with Price-Quantity Pairs for Market Participant p scheduled by AEMO under clause 6.9.9 or 6.9.10 for Trading Interval t where this energy purchased is represented as a positive value; plus

(c) the amount of energy sold by the Market Participant to AEMO through the STEM at the STEM Clearing Price, which is the total quantity associated with Price-Quantity Pairs for Market Participant scheduled by AEMO under clause 6.9.11 or 6.9.12 for Trading Interval t where this energy sold is represented as a positive value.

STEM – DSR Participation Discussion

- **Is allowing DSR participation in the STEM worth exploring further?**
  - Could it increase competition and/or liquidity?
  - Could DSR participation in STEM provide a new ‘product’ to manage short-term outages?
  - Can DSR be considered as supply?
  - Can DSR be considered as an element of consumption?
- **If the STEM rules preventing DSR participation were removed do other barriers remain?**
  - Is the STEM design fundamentally not suitable or attractive to DSR?

Real-Time Market (RTM) – DSR Participation

Scheduled, Semi-Scheduled & Non-Scheduled Facilities and Interruptible Facilities Continued

- **Scheduled Facilities, Semi – Scheduled Facilities and Interruptible Facilities can bid Withdrawal quantities into the RTM**
- **Non-Scheduled Facilities are required to make submissions based on their reasonable expectations for Withdrawal and its Unconstrained Withdrawal Forecast**
- **AEMO centrally dispatches based on RTM Bids and RTM Offers using the Dispatch Algorithm**
- **Under clause 7.2.4 – the Dispatch Algorithm must seek to maximise the value of RTM trading by maximising:**
  - (a) the value of dispatched Load based on RTM Bids; less
  - (b) the cost of dispatched energy and Frequency Co-optimised Essential System Services based on RTM Offers.
- **The Dispatch Algorithm will determine:**
  - For a Scheduled Facility a Dispatch Target
  - For a Semi-Scheduled Facility a Dispatch Cap
  - For an Interruptible Facility a Essential System Service Enablement Quantities
  - No Dispatch Instruction for a Non-Scheduled Facility

Real-Time Market – DSR Participation

Discussion Questions

- **Are there currently any incentives for loads to register in any of these categories in the RTM?**
- **What are the barriers?**

Real-Time Market – DSR Participation

Demand Side Programmes (DSP)

- **DSPs comprise one or more Non-Dispatchable Loads that can be curtailed on request by AEMO.**
- **A DSP can participate in the RTM however, is not dispatched using the Dispatch Algorithm. DSPs must submit:**
  - DSP Unconstrained Withdrawal Quantity, which is the Market Participant's estimate of the average MW consumption of its Demand Side Programme in the Dispatch Interval assuming that the Demand Side Programme is not affected by any Dispatch Instruction or Reserve Capacity Test; and
  - DSP Constrained Withdrawal Quantity, which the DSP Unconstrained Withdrawal Quantity adjusted to take into account the impact of any impending dispatch or Reserve Capacity Tests about which the Market Participant has been advised.
- **AEMO may issue Dispatch Instructions to a Demand Side Programme where AEMO reasonably considers that the dispatch of a Demand Side Programme is required to restore or maintain Power System Security or Power System Reliability (clause 7.6.5A)**

Real-Time Market – DSR Participation

DSPs Continued

7.6.5B. AEMO must issue Dispatch Instructions to Demand Side Programmes in accordance with the following principles:

(a) AEMO must not issue Dispatch Instructions to a Demand Side Programme that restrict the absolute value of Withdrawal below the Facility's Relevant Level by more than the Facility's Reserve Capacity Obligation Quantity in a Dispatch Interval, except with the prior agreement of the Market Participant; and

(b) when selecting Demand Side Programmes for dispatch to meet a potential energy shortfall, AEMO must:

i. take into account Market Schedules and any information provided by Market Participants in response to a Market Advisory issued under clause 7.11.5(gA) for the relevant period;

ii. avoid the dispatch of Demand Side Programmes beyond the extent that AEMO considers may reasonably be necessary to restore or maintain Power System Security and Power System Reliability;

iii. where a Demand Side Programme has an Associated Load which is also an Associated Load of an Interruptible Load, and that Interruptible Load is expected to provide an Essential System Service during the relevant period, prefer dispatch of other Demand Side Programmes; and

iv. only discriminate between Demand Side Programmes based on response time and availability, except where required under clause 7.6.5B(b)(iii).

Real-Time Market – DSR Participation

DSPs Continued

Clause 7.6.11A reflects the differences between Dispatch Instructions for Demand Side Programmes and the Dispatch Instructions that are issued by the Dispatch Algorithm for other Facility Classes. These include the following:

- **Dispatch Instructions for Demand Side Programmes are issued in accordance with the required notice period for the Facility (usually two hours);**
- **a Dispatch Instruction is usually only issued to a Demand Side Programme when a change is required to its consumption, whereas Dispatch Instructions are issued to other Facilities every five minutes;**
- **the start time for a Demand Side Programme (i.e. the time from which the Dispatch Instruction applies) must fall on a Trading Interval boundary, to support the relevant settlement calculations;**
- **the meaning of a Dispatch Instruction is different for Demand Side Programmes:**
- a non-zero MW quantity means that the consumption of the Demand Side Programme must be curtailed to less than or equal to the specified level by the start time shown in the Dispatch Instruction; and
- the Market Participant is expected to maintain at least this level of curtailment until the start time of the next Dispatch Instruction it receives for the Demand Side Programme; and
- a zero MW quantity means that the consumption of the Demand Side Programme no longer needs to be curtailed from the start time shown in that Dispatch Instruction; and

DSP when dispatched must be at or below the required level by the start time of the Dispatch Instruction, and must remain at or below the required level until the start time of the next Dispatch Instruction, which may either be to increase or decrease curtailment, or return to uncurtailed levels.

Real-Time Market – DSR Participation

Discussion Questions

- **Will the RTM facilitate participation as DSPs?**
- **Do the relevant WEM Rules present barriers that will reduce possible DSP participation?**

ESS – DSR Participation

ESS – Regulation Raise and Regulation Lower

- **Regulation Raise and Regulation Lower services are provided by Facilities responding to controls from AEMO's energy management system via the Automatic Generator Control (AGC) scheme**
    - Thus, Scheduled facilities with a load and Semi- Scheduled facilities with a load are eligible to apply
- All Facilities providing Regulation Raise or Regulation Lower must be capable of continuously receiving and responding to a control signals in a manner that meets the requirements of AEMO's AGC scheme, to increase or **decrease** Injection or **Withdrawal** (as applicable), within the enabled Regulation Raise or Regulation Lower range for that Facility.

ESS – DSR Participation

ESS – Contingency Reserve Raise and Contingency Reserve Lower

- **All Facilities providing Contingency Reserve Raise must be capable of automatically responding to downward excursions of Local Frequency by one or more of decreasing Withdrawal in proportion to a frequency deviation, or by a specified quantity for a Block Response**
    - Thus, Scheduled facilities with a load and Semi- Scheduled facilities with a load are eligible to apply
- **All Facilities providing Contingency Reserve Lower must be capable of automatically responding to upward excursions of Local Frequency by one or more of increasing Withdrawal in proportion to a frequency deviation**
    - Thus, Scheduled facilities with a load and Semi- Scheduled facilities with a load are eligible to apply
- **Interruptible Loads can only provide Contingency Reserve Raise**

ESS – DSR Participation

ESS – RoCoF Control Service

- **Cannot be provided by a Facility with a Load**
- **However – loads can potentially reduce the overall requirement (?)**

ESS – DSR Participation

Discussion Questions

- **Will the ESS markets facilitate the participation of DSR?**
- **Do the relevant WEM Rules present any barriers to the participation of DSR?**

NCESS – DSR Participation

Non-Co-Optimised Essential System Service

- **AEMO or Western Power can request the Coordinator of Energy to trigger the procurement of NCESS if either party considers there's insufficient ESS**
- **The Coordinator of Energy may also trigger NCESS procurement subject to the occurrence of one of more market events.**
- **Details of the NCESS procurement are published by the Coordinator of Energy and the terms are bespoke to the specific system requirements**
    - Loads and DSR may participate if they satisfy the requirements
- **All Facilities eligible to participate in the procurement of NCESS subject to the requirements**
- **If entering a NCESS contract the Facility must apply for Capacity Credits if the Facility type is eligible for Capacity Credits**
    - Where contracted entered with AEMO or Western Power, contracting party must reduce the contract payment less RCM payments
- **AEMO dispatches NCESS contracts inline with the contract terms**

RTM – DSR Participation

RTM - Intermittent Loads

- **Facilities with co-located load and generation behind the same meter are eligible to be an Intermittent Load**
    - Under the new rules an Intermittent Load Facility is considered a Load Technology Type
- **Intermittent Loads can register as either a Semi-Scheduled or Non-Scheduled Facility and thus can participate in the RTM where applicable**
- **Facilities with an Intermittent Load are not required to make submissions to Withdraw but must bid Injection**