

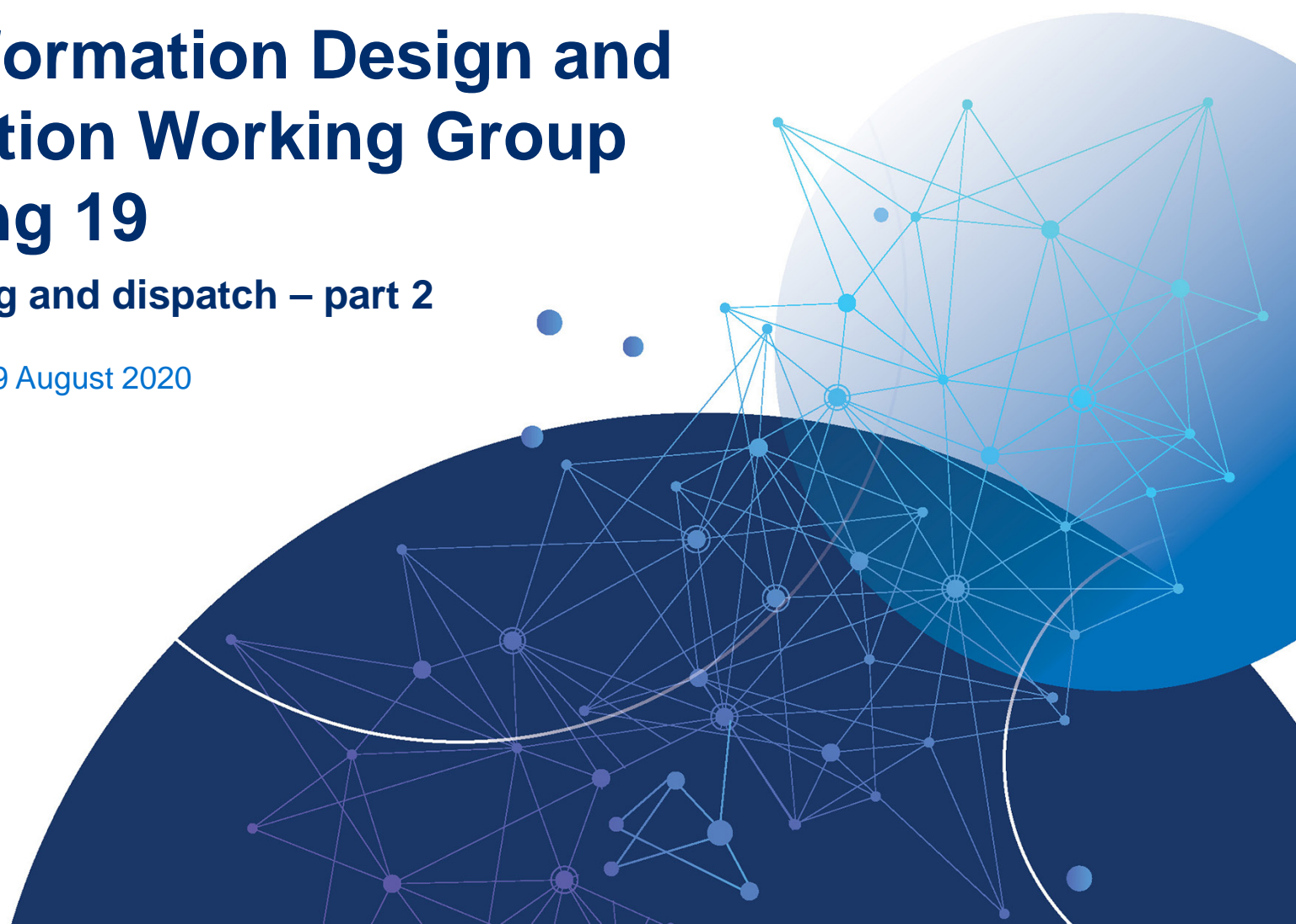


**Energy Transformation
Implementation Unit**

Transformation Design and Operation Working Group Meeting 19

Scheduling and dispatch – part 2

Wednesday 19 August 2020



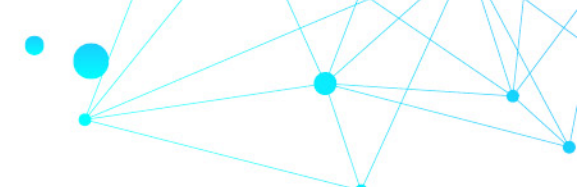


Ground rules and virtual meeting protocols

- Please place your microphone on mute, unless you are asking a question or making a comment.
- Please keep questions relevant to the agenda item being discussed.
- If there is not a break in discussion and you would like to say something, you can 'raise your hand' by typing 'question' or 'comment' in the meeting chat. Questions and comments can also be emailed to TDOWG@energy.wa.gov.au
- The meeting will be recorded. However no minutes will be issued.
- Please state your name and organisation when you ask a question to assist with meeting minutes.
- If there are multiple people dialling in through a single profile, please email TDOWG@energy.wa.gov.au with the names of the attendees to be recorded in the minutes
- If you are having connection/bandwidth issues, you may want to disable the incoming and/or outgoing video.

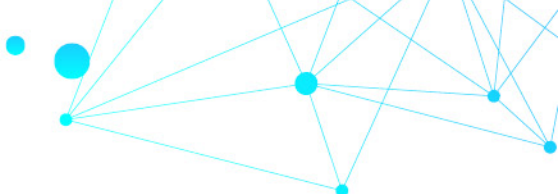


How to provide feedback

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- By email, written submission or face-to-face
 - Preference is to receive feedback on rule sections rather than the entire package
 - Where feedback refers to specific clauses, please provide in table format
 - Please provide alternative drafting suggestions where possible
 - Consultation on Tranche-1 closes **cob 28 August**



Agenda

- Dispatch Algorithm
 - Network constraints (7.5.1 – 7.5.4)
 - ESS constraints (7.5.5 – 7.5.8)
 - Storage constraints (7.5.9 – 7.5.10)
 - Dynamic parameters (7.5.11 – 7.5.14)
 - Central dispatch
 - Dispatch Instructions (7.6.1 – 7.6.12, 7.6.16 – 7.6.22)
 - DSP Dispatch (7.6.13 – 7.6.17)
 - Tiebreaking (7.6.23 – 7.6.27)
 - AEMO control of facilities (7.6.28 – 7.6.30)
 - Dispatch Inflexibilities (7.6.31 – 7.6.32)
 - Scarcity and intervention (7.7)
 - Market Schedules (7.8)
 - Commitment (7.9)
 - Dispatch Compliance (7.10)
 - Market Advisories (7.11)
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Cooptimisation – The Basics

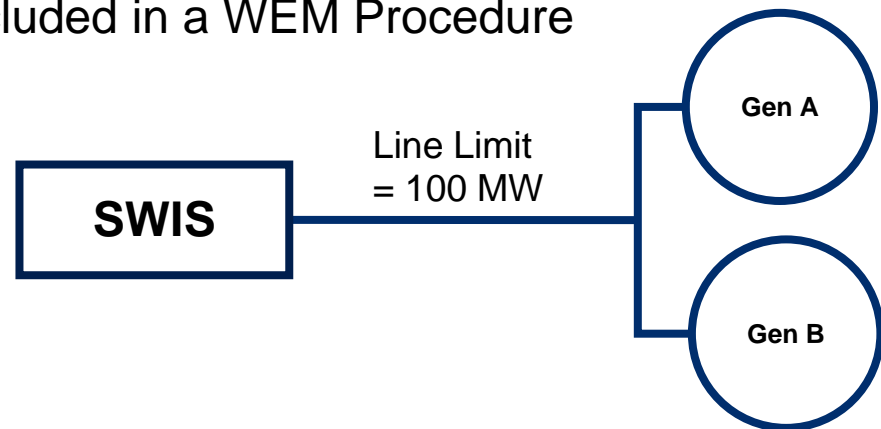


- Maximise the value (or minimise the cost) of dispatch, subject to all relevant constraints.
- Relevant constraints include:
 - The total non-scheduled demand to be met
 - The limitations in the network
 - » Thermal, stability, and other limits
 - Physical limitations of generation/load facilities:
 - » Maximum capabilities, ramp rates
 - The required quantity of each ESS to be procured
 - Trade-offs between the provision of one or more services (e.g. Energy and one or more ESS)

Dispatch Algorithm – Network Constraints

Clauses 7.5.1 – 7.5.4

- AEMO must select Constraint Equations or Constraint Sets to be used in the Dispatch Algorithm to reflect relevant Network Constraints for that interval
 - Constraint equations may be updated in near real-time to deal with operational issues
- Generally, selected equations will be in fully co-optimisable form, where the clearing engine can see all parameters which contribute to the Network Constraint, and consider these when determining optimal dispatch
- Process for selection to be included in a WEM Procedure
- Example: $Gen_A + Gen_B \leq 100$





Dispatch Algorithm – ESS Constraints 1

Clauses 7.5.5 – 7.5.8

- The Dispatch Algorithm will incorporate ESS standards through Constraint Equations for ESS quantities:
 - Regulation Raise, Regulation Lower, and Contingency Reserve Lower set outside dispatch algorithm
 - Contingency Reserve Raise and RoCoF Control Service requirements determined as part of the dispatch algorithm
- AEMO will include constraints to respect enablement minima/maxima:
 - If a facility is not operating between its enablement limits, its RTM Submissions for that ESS will not be included in the dispatch algorithm
 - If a facility is operating between its enablement limits:
 - » its RTM Submissions for that ESS will be included in the dispatch algorithm
 - » AEMO will include constraint equations to ensure that the facility is dispatched for energy between those limits, even if not dispatched for ESS
- AEMO will include constraints that prevent the same capacity being used simultaneously for Regulation Raise and Contingency Reserve Raise (or Regulation Lower and Contingency Reserve Lower)

Dispatch Algorithm – ESS Constraint example

Contingency Raise

Max capacity (Energy): 100 MW

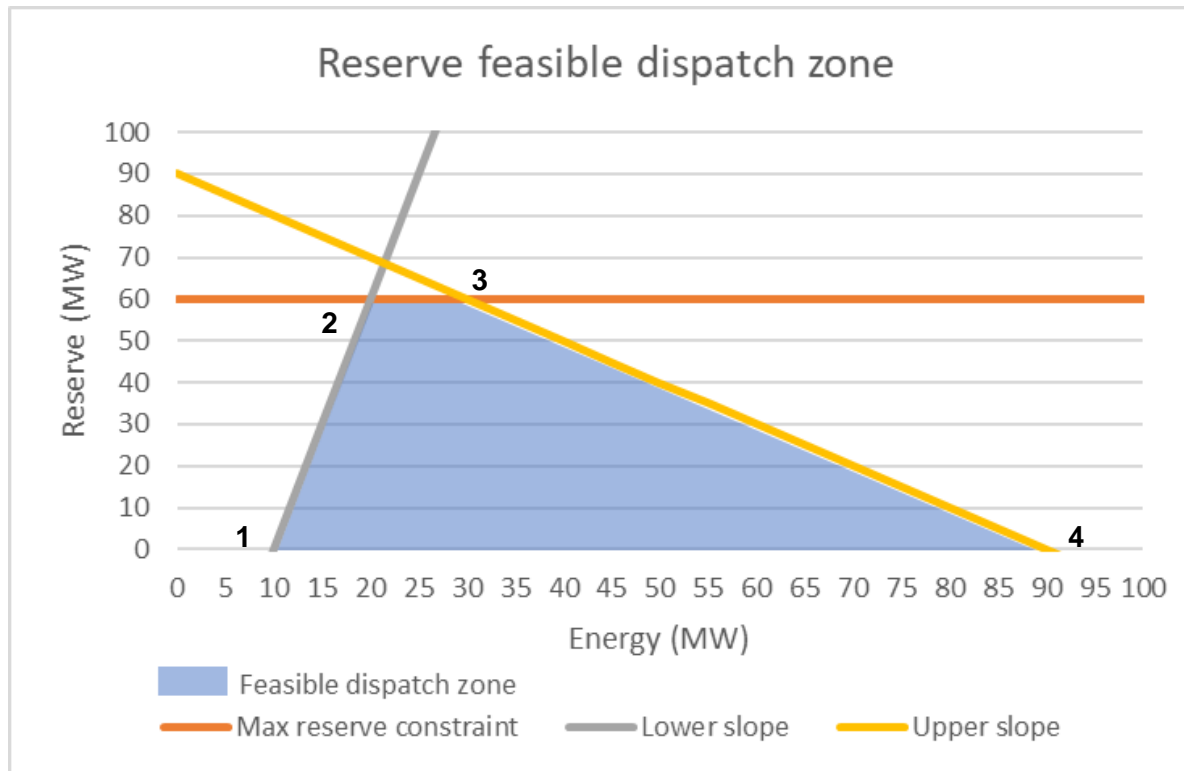
Max ESS Capability: 60MW

Enablement min: 10MW (1)

Low breakpoint: 20MW (2)

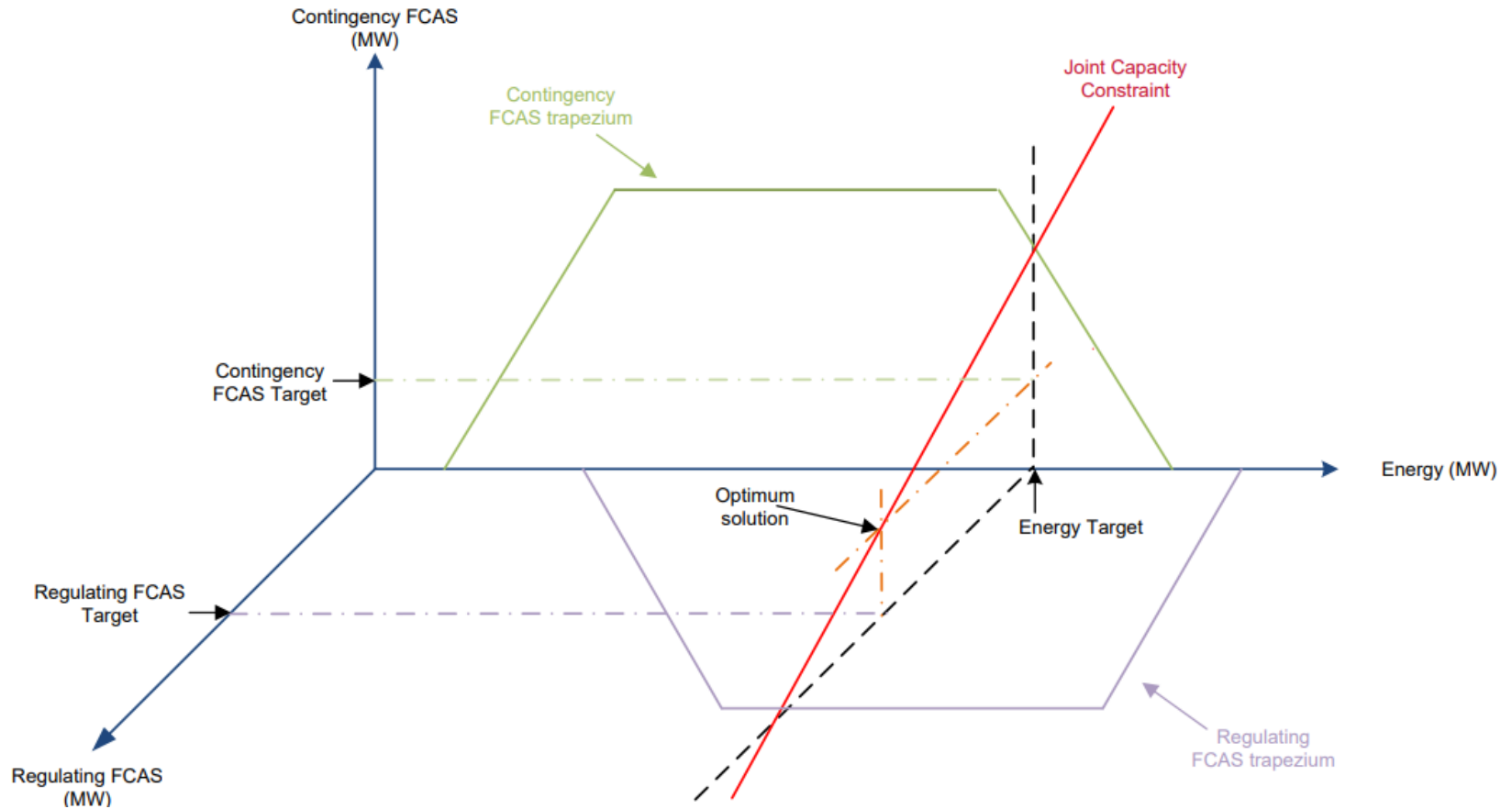
High breakpoint: 30MW (3)

Enablement max: 90MW (4)



Joint Capacity Constraint Example

Figure 13: Joint capacity constraint in 3D



Dispatch Algorithm – Storage Constraints

Clauses 7.5.9 – 7.5.10

- AEMO may include constraints to ensure that energy storage facilities receive a feasible dispatch, by considering the quantity of energy stored
- Participants may also request that storage constraints are included for Facilities that do not solely consist of storage resources.
- In either case, these constraints will be opt-in.

Example:

Injection capability: 100MW, Storage capacity: 100MWh, Charge level: 5MWh

- Dispatch Algorithm considers both MW and MWh limits:
 - Energy \leq 60MW (inject 5MWh)
 - Energy \geq -100MW (store 8.3MWh)
 - Regulation lower \leq 100MW (store 8.3MWh)
 - Regulation raise \leq 60MW (inject 5MWh)
 - Contingency reserve lower \leq 100MW (store 25MWh)
 - Contingency reserve raise \leq 20MW (inject 5MWh)

$$\frac{5}{60} \times energy_f + \frac{5}{60} \times regulationRaise_f + \frac{15}{60} \times contingencyReserveRaise_f \leq storedEnergy_f$$

Dispatch Algorithm – Dynamic parameters

Clauses 7.5.11 – 7.5.14

- Some dispatch algorithm parameters depend on system conditions and dispatch outputs:
 - Contingency Raise/Lower Factors – the proportion of the largest risk that must be covered
 - Facility Performance Factors – the contribution that 1MW of reserve from the facility makes towards the reserve requirement
 - Minimum RoCoF Control Requirement – the level of RoCoF Control Service required to ensure the RoCoF Safe Limit is met
 - RoCoF Control Requirement – the level of RoCoF Control Service that minimises overall costs
- AEMO must determine these as part of the Dispatch Algorithm, and the methodology must be covered in the relevant WEM Procedure.
- The intended approach for new market start is that Facility Performance Factors for Contingency Raise will be dynamic, but Facility Performance Factors for Contingency Lower will be held constant at one.

Central Dispatch – Dispatch Instructions

Clauses 7.6.1 – 7.6.12, 7.6.16 – 7.6.22

- AEMO must use the Dispatch Algorithm to set Dispatch Targets, Dispatch Caps and ESS quantities for each Registered Facility in each Dispatch Interval
- WEM procedure to cover Dispatch process, including approach where Dispatch Algorithm can't be run (e.g. forecast schedules or offline runs).
- For energy, AEMO will issue either a Dispatch Target or a Dispatch Cap. These relate to the end-of-interval MW quantity, not to individual AGC movements within the interval.
- Scheduled Facilities get a Dispatch Target, Semi-Scheduled Facilities get a Dispatch Cap unless cleared for ESS (pending further work), Non-Scheduled Facilities don't get either – just reiterate their forecast.
- When issuing DIs, AEMO must record certain information and make available to a participant.
- All DIs will be calculated sent-out, but may also be provided as-generated quantities where participant has opted for that approach. Methodology covered in WEM procedure.



Central Dispatch – DSP Dispatch

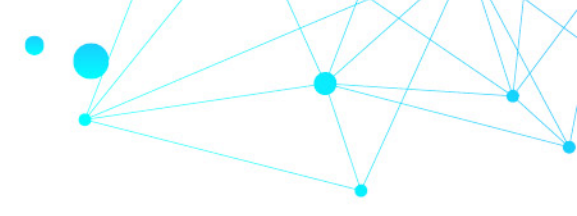
Clauses 7.6.13 – 7.6.17

- DSPs bid to consume RCOQ
- DSP Dispatch instruction relates to a reduction in demand from the relevant demand (part of which the facility may already be delivering)
- DSP dispatch based on Pre-Dispatch outcomes (Reference Scenario)
- Once dispatched, DSP is deemed inflexible for clearing engine purposes until receiving a zero dispatch instruction (ie delivered reduction is deemed fixed, per the inflexibility profile)
- If any Interruptible Load has same Associated Load as a dispatched DSP, it must update RTM submissions



Central Dispatch – Tiebreaking

Clauses 7.6.23 – 7.6.27

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- A degenerate solution is where more than one combination of dispatch targets would deliver the same overall cost or value. This can be managed inside and outside the clearing engine, with priority to:
 1. Deliver feasible dispatch
 2. Maintain consistency between intervals
 3. Preserve flexibility when at the top of the stack (DSPs ahead of other facilities, and preference to retain interruptible load capability)
 4. Pro-rata dispatch of tied pairs
 - Oscillation control constraint equations allow a mechanism to avoid large swings between facilities between intervals. If using such constraints AEMO would have to publish impacts
 - AEMO will need to document the implementation and thresholds for these constraints in a procedure



Central Dispatch – AEMO control of facilities

Clauses 7.6.28 – 7.6.30

- As now, AEMO may have direct control of facilities:
 - Regulation provision will be controlled via AGC
 - For energy where participants opt-in
 - During System Restart
- Dispatch instructions must still be recorded
- AEMO must operate the facility in accordance with recorded instructions, but participant also retains responsibility for dispatch compliance.



Central Dispatch – Dispatch inflexibilities

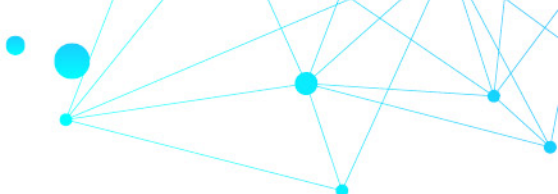
Clauses 7.6.31 – 7.6.32

- These clauses cover the situation where a facility cannot respond to an instruction from AEMO, and can only deliver a specific quantity of output.
- Participant must update RTM submissions accordingly and submit any outages required.
- AEMO must use reasonable endeavours to respect the inflexibility (whether flagged in a submission or via a Dispatch Inflexibility Profile)



Scarcity and intervention

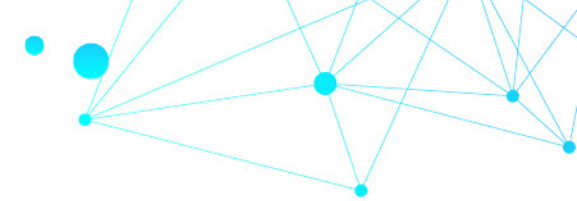
Section 7.7

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- PASA will forecast issues with power system reliability and security. Those situations may require intervention to resolve. This section provides for specific powers to be linked to declarations published to the market:
 - Directing ESS accredited facilities to offer
 - Cancelling and recalling outages
 - Directing facilities with an RCOQ to offer In-Service (i.e. plan to commit and synchronise)
 - Directing ESS accredited facilities to synchronise to provide ESS
 - Use of supplementary capacity contracts is to be in line with the terms of those contracts.
 - Directions are to be implemented as amendments to Dispatch Algorithm inputs where possible (e.g. adjusting constraint sets), must be recorded, and must respect facility data (including minimum response times)
 - Following a Contingency Event, AEMO may adjust ESS requirements.



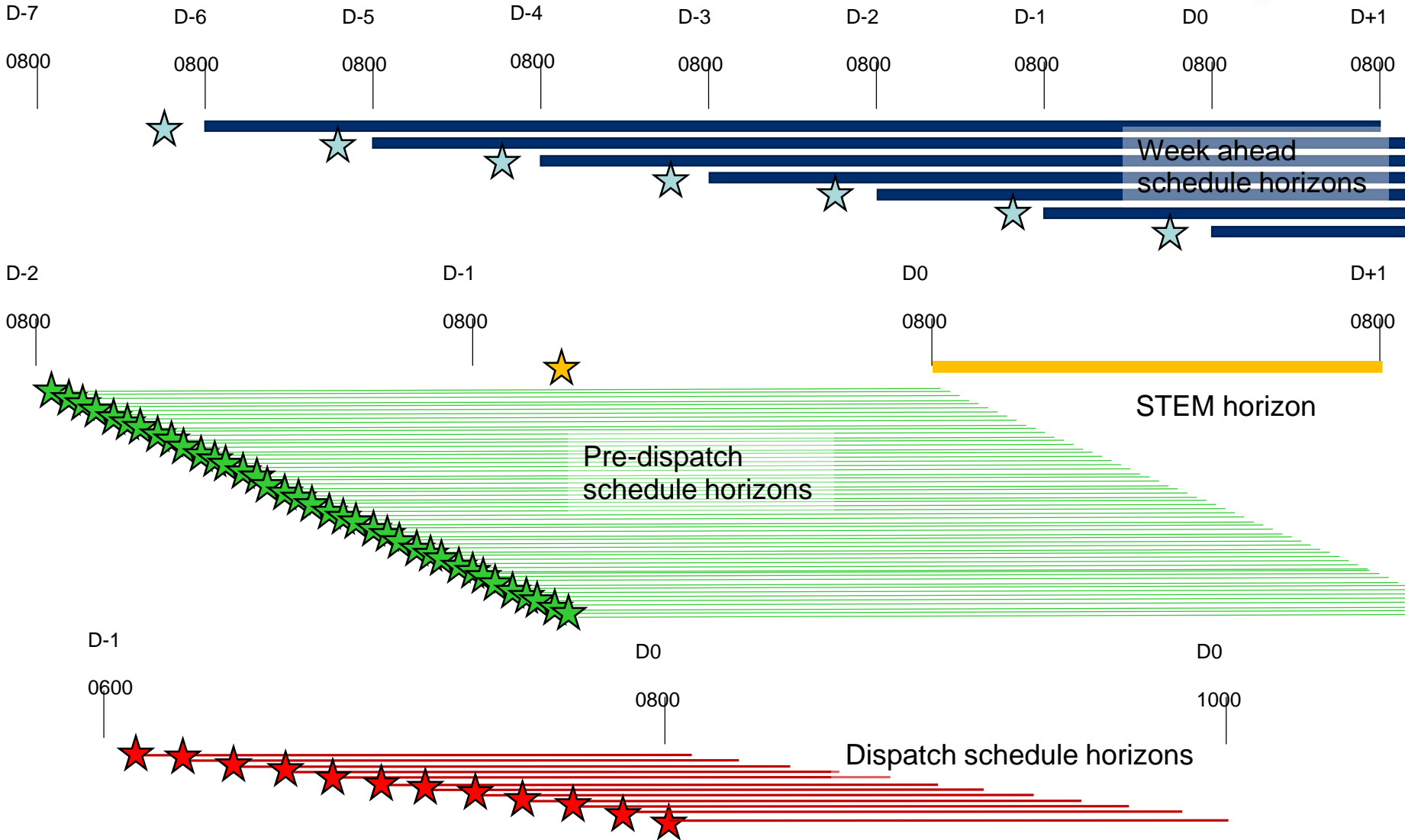
Market Schedules

Section 7.8



- AEMO will publish:
 - Week-Ahead Schedule (now + 7 days)
 - Pre-Dispatch Schedule (now + 2 days)
 - Dispatch Schedule (now + 2 hours)
- Schedules will have multiple Scenarios, one of which will be Reference Scenario.
- Reference scenario:
 - represents AEMO's best estimate of future market outcomes
 - excludes capacity offered as Available Capacity which is before the relevant startup time
- All input data to be retained.
- Processes to be in a WEM Procedure (including number and types of scenarios, and approach to storage)

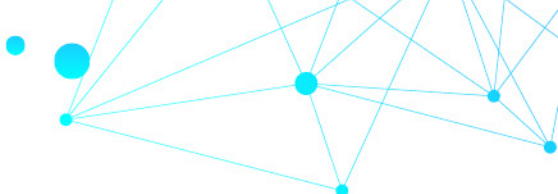
MARKET SCHEDULE TIMELINES





Commitment

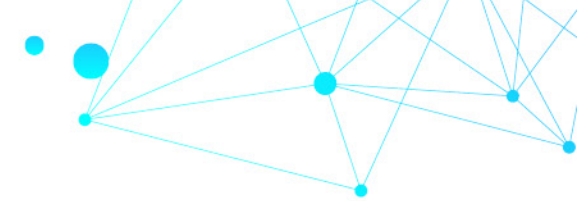
Section 7.9

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- Fast Start Facilities with a Dispatch Inflexibility Profile can be committed by AEMO regardless of whether the facility has offered as In-Service or Available.
 - Facilities without a Dispatch Inflexibility Profile must manage their own commitment, by offering as In-Service
 - Where commitment intentions are not visible through RTM submissions (embedded generators for Intermittent Loads), participants must advise AEMO.
 - If commitment or decommitment would endanger power system security or reliability, AEMO may direct participants to maintain their current status.
 - Interruptible Loads which have been triggered following a contingency event must have AEMO approval before restoring load, and must provide a restoration profile so that the effects can be incorporated into the load forecast.



Dispatch Compliance

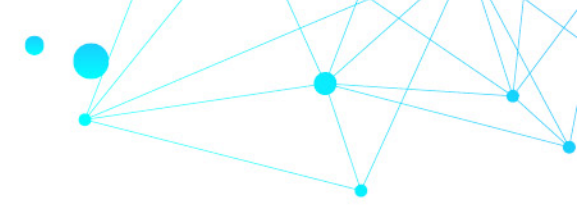
Section 7.10

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- Participants must comply with issued Dispatch Caps, Dispatch Targets, ESS quantities and ramp rates, except where:
 - Compliance would endanger safety, damage equipment or be illegal
 - Deviation is within the dispatch tolerance range
 - It suffered a forced outage, and lodges an outage that reflects the remaining available capacity of the facility
 - It has exemption from complying with linear ramp rate but otherwise complies
 - Facilities will only be exempted from linear ramping compliance if the facility can only ramp at a fixed rate.
 - Consistently operating at the limits of tolerance range is not permitted
 - Semi-Scheduled facilities must not exercise any control they have to increase variation from Dispatch Forecast (unless providing ESS or responding per GPS)
 - Processes for ramp rate exemptions and assessing non-compliance to be recorded in a WEM procedure



Market Advisories

Section 7.11

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- Section merges previous Dispatch Advisories and Market Advisories.
 - With new Pre-Dispatch, Outage and PASA processes, the need for Market Advisories will be significantly reduced, as relevant information will be regularly published.
 - Market Advisories will only be issued where the situation has not already been notified through other planning processes:
 - Any separate PASA Low Reserve Condition notices
 - Pre-Dispatch Schedule
 - Outage information publication



Meeting close

- Questions or feedback can be emailed to TDOWG@energy.wa.gov.au
- Next TDOWG on 26 August on SCED part 3