

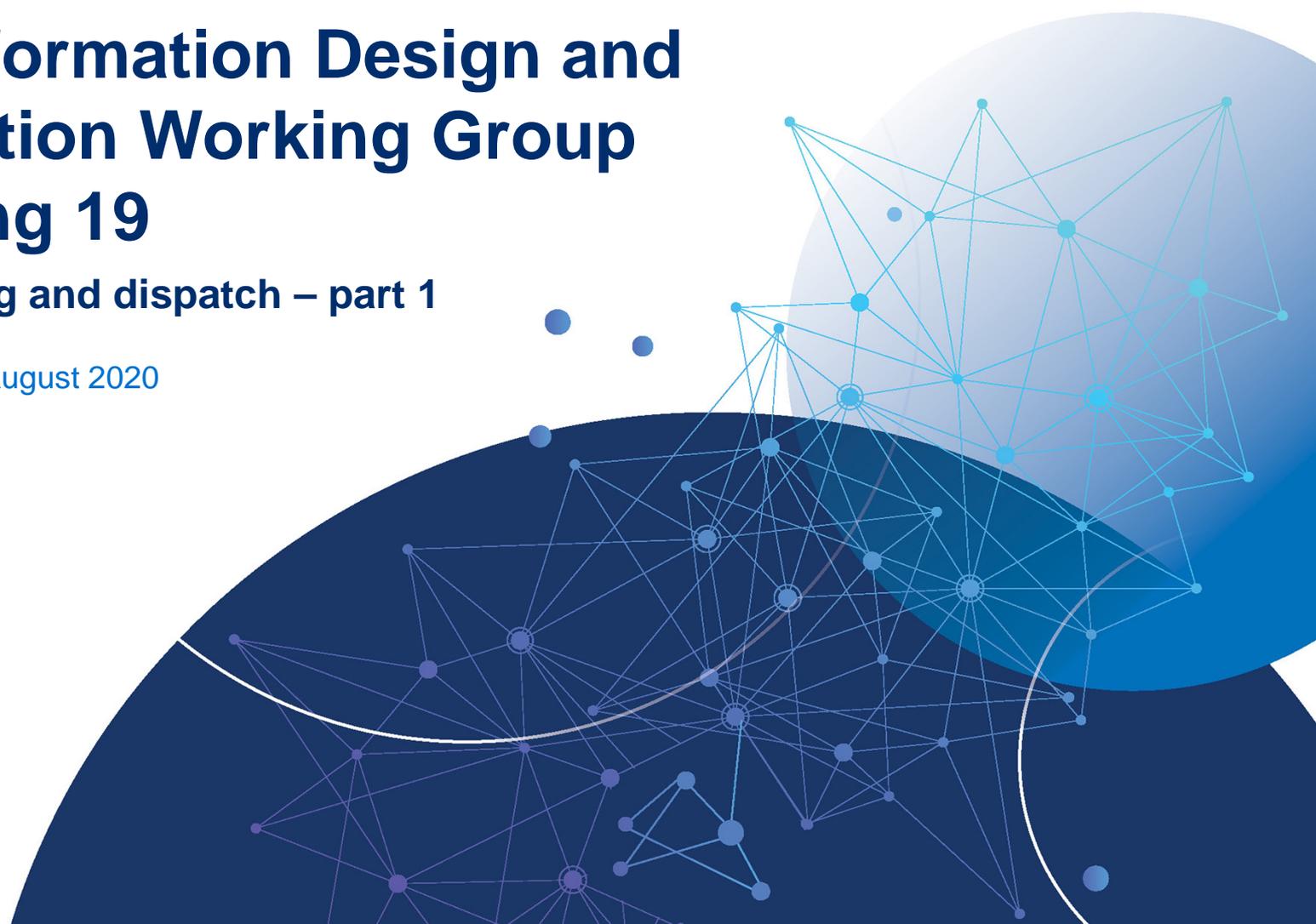


**Energy Transformation
Implementation Unit**

Transformation Design and Operation Working Group Meeting 19

Scheduling and dispatch – part 1

Thursday 13 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

- 
- 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

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- Real-Time Market and Central Dispatch (7.1-7.3)
 - Real Time Market Submissions
 - obligations and meaning (7.4.1 – 7.4.14)
 - timing (7.4.15 – 7.4.30)
 - format and construction (7.4.31 – 7.4.47)
 - validation and processing (7.4.47 – 63)
 - 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)



Real-Time Market and Central Dispatch

Sections 7.1 - 7.3

- Heads of power for new real-time market and central dispatch process
- AEMO must publish real-time market timetable, covering:
 - Submission timelines
 - Schedule publication timelines (with specified minimum frequency)
- AEMO must use the Dispatch Algorithm to determine dispatch targets and dispatch caps
- The Dispatch Algorithm must maximise value of market trading, subject to relevant constraints (incl ramp rates, network constraints, ESS standards)
- AEMO must publish the mathematical formulation of the Dispatch Algorithm
- AEMO may relax constraints to enable a feasible dispatch outcome, and must publish where it does so
- AEMO must determine and publish the Forecast Operational Demand, which represents the expected quantity to be dispatched, not including schedulable loads.



RTM Submissions – obligations & meaning

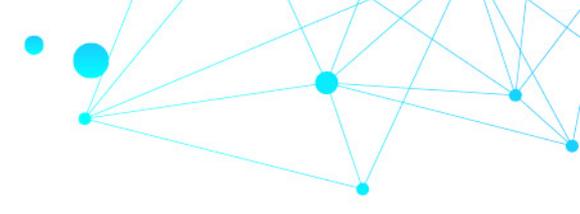
Clauses 7.4.1 – 7.4.14

- Participants must make submissions for each dispatch interval in the Week Ahead Schedule Horizon (now + 7 days)
- Submissions must reflect all information reasonably available to the participant, including forecast market schedules, facility testing, reserve capacity obligations, and planned commitment/decommitment
- Submissions for a facility with a SESSM Award must be in accordance with the award.
- Submissions for Semi-Scheduled and Non-Scheduled Facilities must reflect the participant's best estimate of injection or withdrawal, including accounting for self-curtailment and planned use of storage
- Participants must ensure that a Facility forecast to be cleared for RoCoF Control Service is offered as In-Service in the relevant interval
- Flexible load facilities with components at multiple electrical locations must price at the offer price cap
- Interruptible Load submissions must not include any capability already dispatched as part of a DSP



RTM Submissions – timing

Clauses 7.4.15 – 7.4.30

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- AEMO may specify a start and end for accepting RTM Submissions:
 - Start (Real Time Market Submission Acceptance Horizon) must be at least 4 weeks ahead of real-time
 - End (Gate Closure) must be no more than 15 minutes prior to real-time
 - The setting of Gate Closure must relate to significant and quantifiable risks to power system security, and AEMO must publish those when revising Gate Closure.
 - Participants must not submit after gate closure except to reflect an updated intermittent generation forecast, or if the Facility has suffered a Forced Outage
 - Submissions must include reasons for any technical parameters which differ from standing data, and revisions must include reasons for change
 - AEMO will publish a market procedure giving guidance on submission updates (e.g. intermittent generators should not need to update offers every 5 minutes for intervals a week away)

RTM Submissions – format and construction

Clauses 7.4.31 – 7.4.46

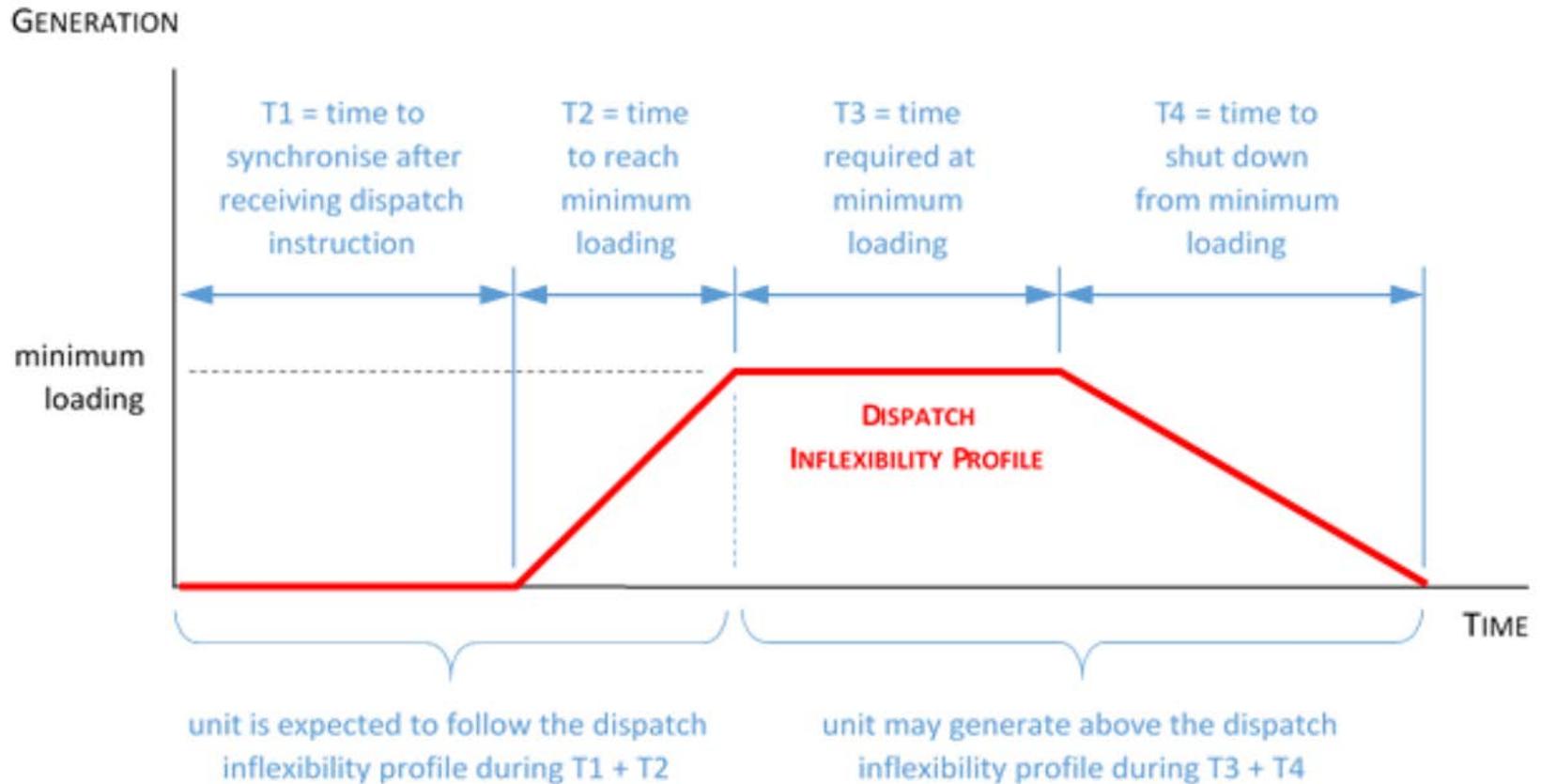
- Each Real Time Market Submission must include specific information, with additional information for energy and each FCESS included in the submission
- Fast Start Facilities (startup and shutdown within 60 minutes) and DSPs can include a Dispatch Inflexibility Profile in their submissions
- Submissions are as at the sent-out point for the facility. For most facilities this is the network connection point, but for aggregated facilities it may be the relevant electrical location (zone substation) or the reference node (for load facilities aggregated across electrical locations)
- Prices can account for startup/shutdown and minimum running costs
- AEMO will calculate and provide ‘Enablement Losses’ for each facility to support participants in constructing submissions

Inflexibility Profiles – Fast Start Facilities

Clauses 7.4.37, 7.4.38, 7.4.40

- Participants can choose to opt-in facilities with startup to min-running time ≤ 30 mins, and startup to min-running to shutdown time ≤ 60 mins
- Opt-in facilities submit a Dispatch Inflexibility Profile:
 - T1: Time to start moving off zero
 - T2: Time to move from zero to min-running
 - T3: Time required at or above min-running before commencing shutdown
 - T4: Time to move from min-running to zero
- Facilities would offer as Available Capacity, and can be dispatched (other facilities only dispatched if offering as In-Service Capacity)
- Clearing engine will dispatch according to required profile until minimum running reached
- Facilities operating within inflexibility profile cannot set price
- Facilities not compensated for losses if market price dips while operating within inflexibility profile.

Fast Start Facilities - Diagram





Inflexibility Profiles – Demand Side Programmes

Clauses 7.4.37, 7.4.39, 7.4.41

- DSPs with a minimum response level may also provide a Dispatch Inflexibility Profile:
 - T1: Time to start reducing demand
 - T2: Time from zero reduction to minimum response level
 - T3: Time required at or above minimum response level
 - T4: Time to move from minimum response level to zero
- T1+T2 must be no more than 2 hours
- T3+T4 must be no more than 2 hours
- DSPs will receive dispatch instructions 2 hours ahead of real-time.
- Clearing engine will use inflexibility profile to reflect DSP response once dispatched



RTM Submissions – validation and processing

Clauses 7.4.47 – 7.4.62

- AEMO will validate that RTM submissions are in the correct format and contain the required parameters
- AEMO is not required to check that an offer meets RCOQ or SESSM offer obligations
- AEMO will convert energy bid and offer prices into loss factor adjusted prices for use in the dispatch algorithm (energy quantities are loss factor adjusted in settlement)
- FCESS offer prices are not loss factor adjusted as those services are provided on a system-wide basis (quantities not adjusted in settlement)
- AEMO may adjust FCESS parameters (enablement min/max, high/low breakpoints) if parameters from the RTM submission are no longer accurate (in the NEM this is used to incorporate real-time SCADA data)
- Standing RTM Submissions may be submitted at any time, and must include an effective date
- AEMO will show participants the submission data as it will be used in Central Dispatch



Co-optimisation – the basics

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- Maximise the value (or minimise the cost) of dispatch, subject to all relevant constraints
 - Relevant constraints include:
 - Meeting non-dispatchable energy demand
 - Meeting ESS requirements
 - The limitations in the network
 - » Thermal, stability, and other limits
 - Physical limitations of generation/load facilities:
 - » Maximum capabilities, ramp rates
 - Trade-offs between the provision of one or more services (e.g. Energy and one or more ESS)
 - The WEM will co-optimize on a Dispatch Interval basis (no day-ahead or similar co-optimisation)
 - Self-commitment (except for previously discussed FSIP)



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): 90MW

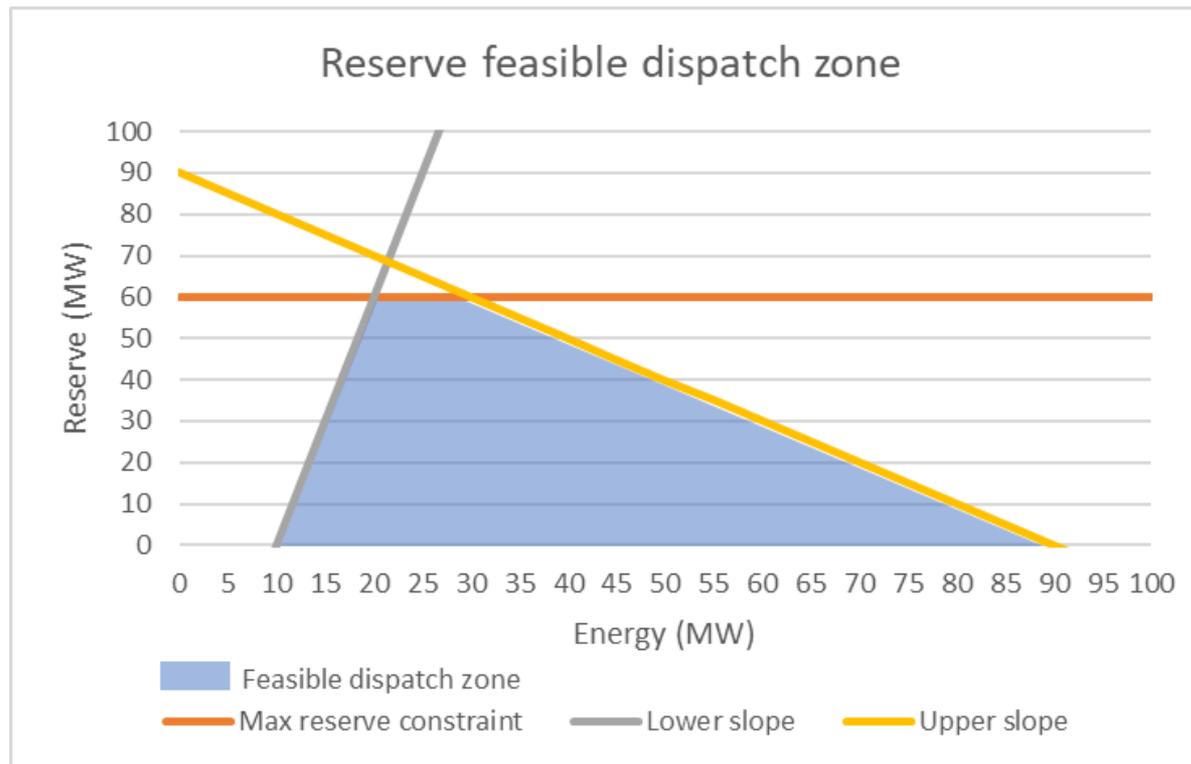
Max Contingency Raise Capability: 60MW

Enablement min: 10MW

Low breakpoint: 20MW

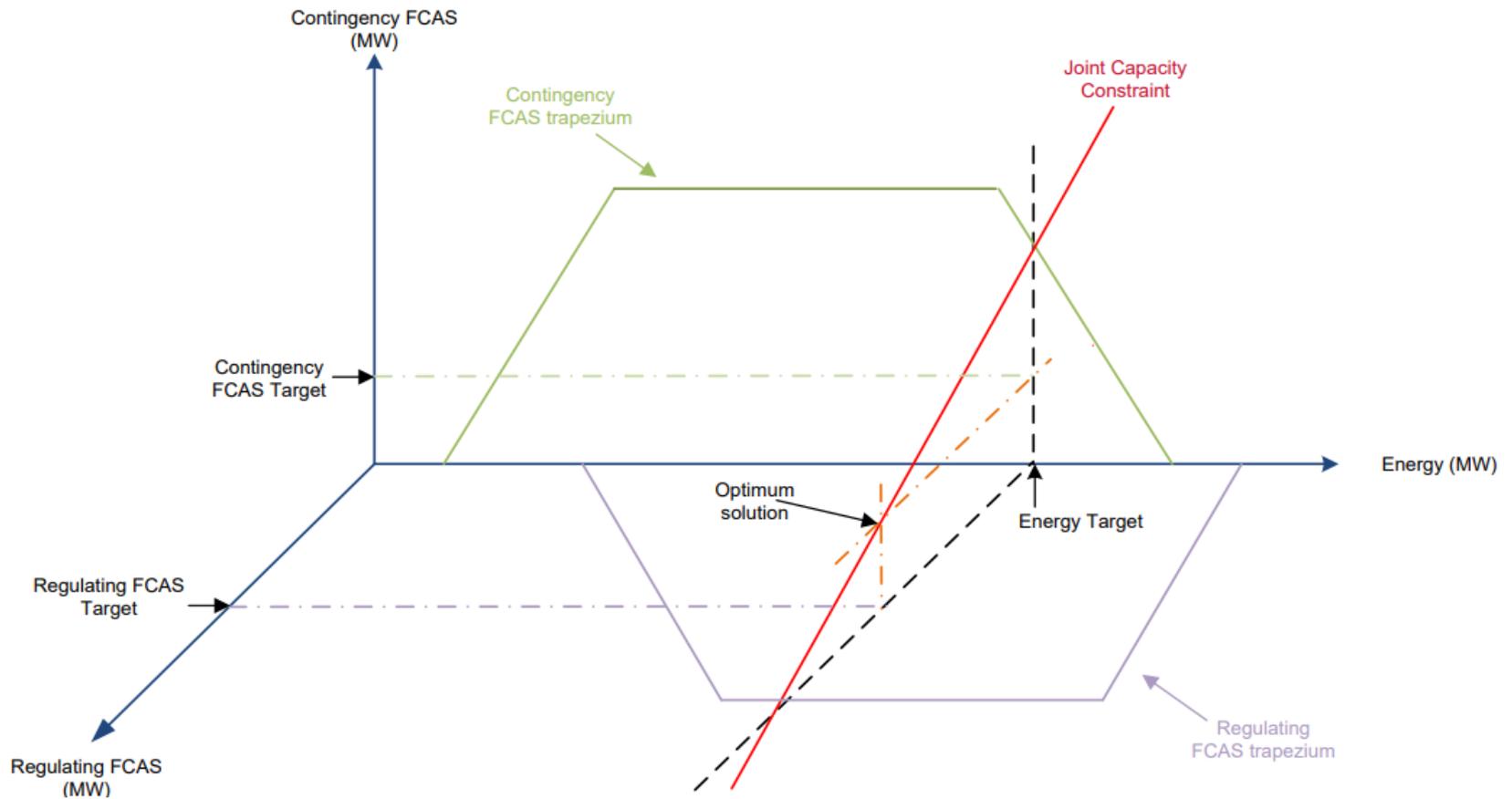
High breakpoint: 30MW

Enablement max: 90MW



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 ≤ 60 MW (inject 5MWh)
 - Energy ≥ -100 MW (store 8.3MWh)
 - Regulation lower ≤ 100 MW (store 8.3MWh)
 - Regulation raise ≤ 60 MW (inject 5MWh)
 - Contingency reserve lower ≤ 100 MW (store 25MWh)
 - Contingency reserve raise ≤ 20 MW (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.



Meeting close

- Questions or feedback can be emailed to TDOWG@energy.wa.gov.au
- Next TDOWG on 19 August on SCED part 2