

## MEETING OUTCOMES – REAL TIME MARKET FORUM

MEETING: WAMRP Wholesale Real Time Market Forum 2  
 DATE: Tuesday, 22 November 2016  
 TIME: 10.00 am – 3.00 pm  
 LOCATION: AEMO Boardroom – Level 17, 197 St Georges Terrace, Perth

### ATTENDEES:

NAME	COMPANY
William Street	Alinta
Siyang You	Blair Fox
Adam Stephen	Bluewaters
Ignatius Chin	Bluewaters
Gemma O'Reilly	Collgar Wind Farms
Steve Gould	Community Electricity
Todd Gordon	EDL
Adrian Theseira	ERA
Jake Flynn	ERA
Wendy Ng	ERM Power
Denise Ooi	Kleenheat
John Nguyen	Perth Energy
Patrick Peake	Perth Energy
Jenny Laidlaw	PUO
John Rhodes	PUO
Laura Koziol	PUO
Lex Lanyon	PUO
Matthew Fairclough	PUO
Andrew Everett	Synergy
Brad Huppatz	Synergy
Jacinda Papps	Synergy
Peter Huxtable	Water Corp
Basilisa Choi	AEMO
Brian Nelson	AEMO
Chris Muffett	AEMO
Chris Stewart	AEMO
Chris Wilson	AEMO
Greg Ruthven	AEMO
Jacquie Miller	AEMO
Kerri Ball	AEMO
Michael Sanders	AEMO
Mike Hales	AEMO
Phil Hayes	AEMO
Steven Disano	AEMO

### 1. Welcome

## 2. Recap on actions from previous meeting

Meeting outcomes from Forum No. 1 have been distributed and will be published to the AEMO website. Slide packs from Forum No. 1 and No. 2 have been published.

## 3. Presentations

### Introduction to Optimisation and Constraints

- Question – What is the RRN?

Answer – RRN = Regional Reference Node. Every region has a RRN that should be a major load centre within that region. In WA this is likely to be Southern Terminal. Prices in a region are set at the RRN.

- Question – In the electricity market is the objective function the sum of all bids for the generators?

Answer – The objective function is cost of supplying energy, being enabled for FCAS, plus any constraint violation terms. Typically, this is the sum of all energy and FCAS bids that are used.

- Question – How is the price calculated in the electricity market?

Answer – The Rules define the spot price as the cost of supplying an increment of demand at the RRN. The spot price is calculated as the marginal value of the regional energy balance equation, which requires that the energy being consumed at the RRN equals the generation entering the RRN.

- Question – Explain more about the marginal value, is it a derivative?

Answer – Yes. The marginal value is the partial derivative of the change in the objective function with respect to a change in demand in the regional energy balance equation.

- Question – Does the dispatch engine use only linear constraints?

Answer – There are two major distinctions when choosing the best technique for solving a constrained optimisation:

- Whether the constraints are linear or non-linear
- Whether the variables are continuous or non-continuous

Constrained optimisations with linear constraints and continuous variables are the most easily solved: solution is fast, and guaranteed to yield the global optimum.

- Non-linear effects must be linearised in this approach – this can cause corollary issues, but may not be relevant in WA because there are no interconnected regions.
- Non-continuous variables can be managed using mixed integer programming (MIP) which allows non-continuous variables to assume integer values, and solves to find the best integer solution. The non-continuous variables are then converted to continuous variables with their value fixed at the optimal integer result, so the constrained optimisation can be rerun as a linear continuous problem. MIP may not be relevant in WA as there are no interconnected regions. The NEM started with linear programming (LP) but now uses MIP.

### Introduction to Ancillary Services

- Question – How will the governor response be incorporated into the market?

Answer - In the current market, capability is defined under terms of connection agreements. Frequency response is enabled via FCAS.

- Question – When someone provides services under an ancillary services agreement, what kind of participant or what type of registration are they providing it?

Answer – Contract ancillary services are called non-market ancillary services, which are commercial agreements between either AEMO or the TNSP and the service provider. In the NEM, these are for system restart and network control. There is no requirement that service providers are market participants.

- Question – Does NEMDE constrain generating units to provide reactive power (MVar)?

Answer – No, it's not part of the NEMDE optimisation at the moment. Generating units that contribute to reactive reserve are taken into account in determining the technical envelope if required. There is a separate process for reactive power (MVar) assessment and dispatch in the NEM. AEMO is currently trialling an automatic system for the reactive power dispatch (i.e. VAr dispatch scheduler) in the NEM.

- Question – Is the VAr dispatch scheduler something that is intended to be used on the WEM?

Answer – No, not at this stage. It's something that we may look at in the future if it's practical and useful to do so.

- The current likelihood is that the ERA will set the frequency standard with the assistance of a Reliability Advisory Committee.

- Question – Do you have to be registered to provide FCAS?

Answer - Yes, the NEM design does not oblige you to provide all services. There is a registration called the market ancillary service generating unit. You go through an accreditation process when you register. Refer to AEMO's Market Ancillary Service Specification (MASS) - <http://www.aemo.com.au/-/media/Files/PDF/01600136pdf.pdf>

- Question – Does the contingency raise service need to sustain until the frequency comes up?

Answer – The different services (fast, slow, delayed) have different response time/duration requirements that are specified in the MASS.

- Question – Should the FCAS Supply Band capacity be reduced based on ramp rates?

Answer – No, participants do not need to reduce the FCAS offer band capacity to incorporate ramp rates. Ramp rates are submitted as separate parameters in offers and NEMDE applies additional constraints to represent the ramp rates.

- Question – If you have offered FCAS but you cannot provide FCAS, are there penalties?

Answer – There are no penalties applied by AEMO. There is no issue if FCAS availability is reduced due to Energy dispatch as long as you are operating within the technical limitations that you have provided for the service. In this case, NEMDE would consider the technical limitations and reduce the FCAS dispatch accordingly. If you have been dispatched and paid for FCAS but did not provide the service during a frequency event, it may become a subject to investigation by a regulator.

- Question – Is there a requirement for price bands to reflect costs?

Answer – The NEM rules do not specify how to determine prices in bids. However, dispatch outcomes may be distorted if prices for energy and FCAS are also distorted

- Question – Could generators put multiple prices / bands for FCAS provision?

Answer – Yes, the NEM central dispatch system allows up to 10 price bands for all 8 FCAS and energy. This design is intended to be flexible enough to allow generators to use the price

bands to reflect their cost structures. In practice, participants generally use less than 5 price bands for a given dispatch interval.

- Question – Do ancillary service loads also submit FCAS trapeziums?

Answer – Yes, a trapezium must be submitted for each ancillary service for scheduled loads. If the load is not scheduled for energy, then the trapezium does not apply.

- Question – Are we going to have to bid to provide the governor control that is current prescribed under the Technical Rules?

Answer – The PUO does not currently intend to remove the mandatory governor control requirement. It should be noted that the mandatory governor requirement is for a lesser service than the NEM's fast contingency services (10-second response duration versus 60-second response duration).

### Constraints in Dispatch

- Generator minimum loads are typically priced at the market floor price, so they will be dispatched before any more expensive generation. If they are caught behind a constraint they would expect to be dispatched at their minimum load, unless there is more generation priced at the market floor price than the constraint allows. In this case they would be dispatched on a pro rata basis.<sup>1</sup>

**ACTION: AEMO to provide further information (potentially at subsequent Forums) on how generators in the NEM manage minimum loading.**

- Question – With the network regulation reform bills not proceeding, will constrained-off payments be retained?

Answer – This will be considered by the PUO at a later date.

- Question – How does NEMDE prioritise which constraints to breach and/or relax first?

Answer – If we are unable to satisfy all dispatch constraints the solution is called “infeasible”. In this case we relax constraints in increasing order of their constraint violation penalty factors (CVPs) and rerun the optimisation.

The use of penalty factors in the objective function is designed to ensure that constraints are violated in the correct order. A schedule of constraint violation penalty factors used in the NEM is available at [http://www.aemo.com.au/-/media/Files/Electricity/NEM/Security\\_and\\_Reliability/Congestion-Information/Schedule-of-Constraint-Violation-Penalty-Factors-v20.pdf](http://www.aemo.com.au/-/media/Files/Electricity/NEM/Security_and_Reliability/Congestion-Information/Schedule-of-Constraint-Violation-Penalty-Factors-v20.pdf)

It is likely that industry input will be sought before establishing an analogous schedule of CVPs for WA.

**ACTION: AEMO to provide further information on how CVP factors are determined.**

ACTION: AEMO to distribute a link to the Congestion Information Resource (complete – see link below)

A comprehensive source of information on the formulation and operation of constraints in the NEM is available at <http://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Security-and-reliability/Congestion-information>

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<sup>1</sup> Update – in the NEM, the arrangement is for generators to self-dispatch to their minimum load and submit a ramp down rate of 0 MW/min. The arrangement for WA to be clarified.

## Ancillary Services in Dispatch

- Question – Is energy prioritised over FCAS?

Answer – Under normal conditions, NEMDE can find a solution that satisfies both energy and FCAS requirements and does not need to prioritise energy dispatch over FCAS dispatch. If it is not feasible to satisfy all energy and FCAS requirements, NEMDE would prioritise constraints with high CVPs. Network constraints generally have a higher CVPs and will tend to take priority over FCAS constraints if the constraints conflict with each other.

- Question – Does AEMO assess FCAS requirements online?

Answer – There are ongoing assessments for FCAS requirements. For contingency services, the requirements are dynamically calculated based on the largest risks online. For regulation services, the requirements are static and reviewed regularly. The regulation service requirements in the NEM were reduced from 250MW to 130MW/120MW for raise/lower services over the years. Regulation service requirements are linked to time error and may increase temporarily if time error increases.

- Question – Does that mean the markets generally have the same price if the requirements are not changing for regulation FCAS?

Answer – If the requirement and supply remain unchanged, prices are expected to remain unchanged. However, because FCAS availability depends on the energy dispatch targets for units providing both energy and FCAS, FCAS supply curve can change without any changes to the FCAS offers and this can impact the pricing outcome.

- Question – If your ramp rate is 2 MW/min (that is, 10 MW in 5 minutes), could you expect to be controlled up to 20 MW above your initial MW to provide 10MW of energy increase and 10MW raise FCAS?

Answer – This depends on the services dispatched – regulation or contingency. Regulation dispatch is controlled centrally and the signal is sent via automatic generation control (AGC). The combined energy and regulation FCAS increase via AGC cannot be above the SCADA ramp up rate. In this case, it will not be above the 2 MW/min ramp rate. Hence, AGC will control the unit up to 10MW above its initial MW, not 20MW for the combined energy and regulation raise FCAS. For contingency FCAS, the combined contingency raise service and energy increase can be more than the SCADA ramp rate. However, NEMDE applies a joint capacity constraint for the combined energy/regulation/contingency capacity to ensure that the combined capacity is within the technical envelop specified by the relevant contingency FCAS trapezium. The FCAS trapezium may restrict the combined generation increase to be less than 20MW.

- Question – If a generating unit has responded to a frequency deviation and provided more generation than its energy dispatch target, would it potentially move the energy spot price?

Answer – The energy dispatch price is determined at the start of the dispatch interval. However, the price may be influenced by contingencies in the next dispatch interval.

- Question – Does that mean we are solving the energy first before we get to the optimisation

Answer – No, energy and FCAS dispatch is solved and priced concurrently.

- Question – How do we physically use regulation to meet the contingency requirement?

Answer – Regulation services can substitute for delayed contingency services but not vice versa. Regulation services cannot substitute for fast or slow contingency services. Delayed

contingency service requires a 5-minute response time. As Regulation is provided within 5-minutes, it can reduce the delayed contingency service requirement.

### Approach to Registration

- When completing the application for registration you will declare which facilities you are the financially responsible market participant for and which facilities someone else is being nominated as the financially responsible market participant. Under the law you have to be either registered or exempt. The registration process is designed to be flexible enough to not have multiple registrations and also be compliant with the requirements of the law.
- There is only one financially responsible market participant for any particular point.
- Intermediary arrangements will require discussions between AEMO and market participants to ensure multiple companies aren't registered or a participant ends up with more registrations than required.
- An intermediary takes on all the responsibilities and liabilities of the registered participant in the rules.
- You are registered in respect of each of your facilities.
- WEM and NEM registrations will be separate, with two sets of invoices, two sets of prudentials, two sets of bank guarantees, etc.
- Performance standards provide documentation of the capabilities of facilities and are set during establishment/renewal of a connection agreement.
- Participants that are already registered in the WEM will not be required to register again and will not be charged registration fees. Registration will be 'deemed', though AEMO will work with each market participant through a due diligence process which will look and feel like a registration process.
- AEMO plans to release an online sandpit to participants to allow testing of bid submissions.
- Question – What is the registration handout that has been referred to?

Answer – AEMO distributed a handout at the first Forum, which provided an early indication of the mapping of existing WEM generators into the proposed registration model. Stakeholders were encouraged to review this, and provide feedback on the proposed classifications. However as some stakeholders did not receive this, AEMO will consider distributing this via email.

**ACTION: AEMO to consider distributing the handout electronically.**

### Next meeting

- The next Real Time Market Forum is scheduled for 13 December 2016. AEMO is working on the Forum schedule for 2017. Topics for consideration at future Forums should be emailed to [WAMRPWholesale@aemo.com.au](mailto:WAMRPWholesale@aemo.com.au).