

MINUTES

MEETING: National Electricity Market Operating Committee (NEMOC)
 MEETING NUMBER: 11
 DATE: Tuesday, 6 March 2018
 TIME: 09:30am – 3:00pm
 LOCATION: Powerlink Queensland
 33 Harold Street
 Virginia QLD 4014
 CONTACT: Lenard Bayne – Lenard.Bayne@aemo.com.au

ATTENDEES:

NAME	COMPANY / DEPARTMENT
Christian Schaefer <i>(Chair) (F2F)</i>	AEMO
Dean Sharafi <i>(F2F) – Observer</i>	AEMO
Lenard Bayne <i>(Secretariat) (F2F)</i>	AEMO
Tim Lloyd <i>(Dial In)</i>	AusNet Services
Ben Skinner <i>(Dial In)</i>	Australian Energy Council
Naresh David <i>(F2F)</i>	Australian Energy Council
Kate Summers <i>(F2F)</i>	Clean Energy Council
Lillian Patterson <i>(Dial In)</i>	Clean Energy Council
Verity Watson <i>(Dial In)</i>	Energy Networks Australia
Ron Barbagallo <i>(F2F) – Proxy Blake Harvey</i>	Energy Networks Australia
Garry Edwards <i>(F2F)</i>	PowerLink QLD
Mike Paine <i>(F2F)</i>	TasNetworks
Andrew Kingsmill <i>(F2F)</i>	Transgrid

IN ATTENDANCE:

NAME	COMPANY / DEPARTMENT
James Lindley <i>(Item 7.3)</i>	AEMO
Mike Davidson <i>(Item 9.3)</i>	AEMO

APOLOGIES:

NAME	COMPANY / DEPARTMENT
Rainer Korte	ElectraNet
Blake Harvey	Energy Networks Australia

1. Welcome & Introductions

The Chair opened the meeting and welcomed all attendees and noted those attendees that were dialling in and apologies. In addition, the chair noted those attendees who were attending as a proxy. The chair briefed the members about the structure of the today's agenda and outlined the objectives for this meeting and proposed outcomes.

2. Previous Meeting Minutes

Minor changes were required. Those changes will be reissued to the NEMOC members via email to obtain their acceptance.

3. NEMOC Membership

The Chair noted recent changes to the NEMOC membership. The current representation of each organisation are outlined below.

REPRESENTATIVE	ORGANISATION
Christian Schaefer (<i>Chair</i>)	AEMO
Lenard Bayne (<i>Secretariat</i>)	AEMO
Tim Lloyd	AUSNET SERVICES
Ben Skinner	AUSTRALIAN ENERGY COUNCIL
Naresh David	AUSTRALIAN ENERGY COUNCIL
Kate Summers	CLEAN ENERGY COUNCIL
Lilian Patterson	CLEAN ENERGY COUNCIL
Verity Watson	ENERGY NETWORKS AUSTRALIA
Blake Harvey	ENERGY NETWORKS AUSTRALIA
Garry Edwards	POWERLINK QLD
Mike Paine	TASNETWORKS
Andrew Kingsmill	TRANSGRID

The Chair requested new members to provide an overview of their background to the committee.

Dean Sharafi (AEMO WA) was invited as an observer. This was an opportunity to leverage from Dean's expertise in the WA markets and draw on the combined knowledge of the NEMOC members.

4. Actions Register

The secretariat provided the status on those action items that had been completed. It was noted that those action items that were open would be discussed as an agenda items at this meeting.

5. Governance

The Chair opened the discussion by asking the group if they were in acceptance of the recent changes made to the NEMOC Terms of Reference (ToR). There was no objections and all ToR's included working groups, were deemed final. The group agreed that the ToR's was appropriate to publish on AEMO's website.

5.1. WG ToR (NER Compliance)

AusNet Services provided comment in relations to the ToR and raised the question relating to the overlapping of some working group's ToR and identify areas that could be streamlined. AEMO agreed with AusNet Services comments and added that there was overlapping items within the OPWG and FCWG ToR. AEMO added that there is a need for the NEMOC members to review and realign all working groups' purpose. The objective of this review will set clear expectations from the NEMOC.

AEMO opened the question to the members to ascertain areas that required changes. The following comment was made.

- OPWG ToR
 - CEC provided comments relating to the OPWG ToR under the objectives section dot point 3 (*Develop and maintain procedures for maintaining system frequency control*). CEC explained that there are 3 industry technical working groups working on frequency control. These industry working groups were identified as;
 - Frequency Control Frameworks Review (FCFR)
 - (which looks at the market frameworks)
 - Frequency Control Technical Working Group (FCTWG)
 - (primarily working with synchronous machines)
 - Ancillary Services Technical Advisory Group (ASTAG)
 - (more regulatory & market based)

CEC raised the concern that there is a need for better coordination in relation to the NEMOC, OPWG, FCTWG & ASTAG groups, CEC had the view that there wasn't sufficient governance to maintain system frequency control. CEC recommended that the NEMOC should put forward tighter guidance on the OPWG's objectives.

AEMO reminded the group that the OPWG have representatives from Network Service Providers (NSP), which coordinate under frequency load shedding and schemes requirements. AEMO noted that the OPWG were proactive in establishing requirements and monitoring this throughout all state regions. AEMO suggested that the NEMOC members provide feedback to change and articulate the above dot point, to be clearer and more aligned.

ENA suggested that the ToR should be changed to "Make recommendations on the application and suitability of the rules when relating to an operational manner in order to maintain system security". AEMO added that due to the diversity of the NEMOC's representation, the committee does not propose rules changes. AEC reminded the group that the process for rule change, was best suited to a technical working group, due to vested interest.

AEMO advised the members that AEMO will consult with the OPWG members regarding the above discussion and report feedback at the next meeting. AEMO requested that the NEMOC members provide any feedback to AEMO on changes to the ToR, by 30 June.

- PSMRG ToR
 - Powerlink QLD commented that the ToR didn't provide a clear objective and scope of the working group. The NEMOC chair provided an overview of the group's functions and membership. NEMOC members asked to review the ToR and provide their recommended changes before the next NEMOC meeting.

6. NEM Operations Matters

6.1. Line Switching for voltage control

The Chair welcomed Sujeewa Rajapakse who dialled into the meeting and provided the members an overview of the agenda item.

The paper had been requested by the committee for Operations Planning Working Group (OPWG) together with Power System Security Working Group (PSSWG) to prepare a discussion paper that reported on:

- NEM Jurisdictional practices and policies for switching of EHV transmission lines; (275/330/500 kV) to manage over-voltages in their networks.
- Frequency of EHV line switching for voltage control in the NEM regions.
- Any present issues or concerns experienced during line switching.
- Projected frequency and expected issues with HV line switching for voltage management e.g. security risks, planned outage management etc.
- Any practices and policy advice on international practices of line switching to manage over-voltages in transmission networks.
- Any other relevant advice on these matters and experiences.

The paper outlined reviews for switching EHV lines for voltage control by Transmission Network Service Providers (TNSPs) in Australia as well as a number of international Independent System Operators (ISOs) and presented relevant operational information. All TNSPs and ISOs reviews, considered EHV line switching to be a viable option for managing over-voltage conditions

- All TNSPs and ISOs reviews, used EHV line switching as an option after all other available options had been exhausted, with the exception of one ISO where they used it ahead of instructing to increase load (e.g. starting pump load).
- Inherent risk of EHV line switching option is recognised by all TNSPs and ISOs. Some ISOs require complete power system security checks before switching a line for voltage management.
- It is prudent to identify EHV lines suitable for this purpose by conducting adequate power system security studies as well as relevant risk assessments and documenting in operating procedures as an option for managing high voltage after other options have been utilised.

The work done by TransGrid was seen to be useful and highlighted the risk of switching lines for Voltage control without doing too much detailed analytics. For example the associated risk of restriking, insulation failures or flash overs had the potential to cause multiple line trips, bus faults and line losses throughout the transmission system.

The OPWG recommended that if switching lines was unavoidable and required, that there is a need to quickly identify low risk lines that would be useful, rather than leaving this for the control room to conduct a power flow study and then make a decision. It was noted that there would be a need to update procedures to reflect any operational changes relating to line switching.

ENA raised a question on whether or not line switching had an effect on embedded generators in terms of stability and would this have a consequential impact on renewables stability? AEMO responded that one of the cost associated with line switching is that there was a need to study the impacts on the generation and impacts on transfer limits etc. When line switching has the potential to have a market impact, the control room would require to identify which lines would be suitable and taking into account lines that would have less impact on the transmission system. It was noted by OPWG that the system would be vulnerable to multiple contingencies.

The NEMOC member's acknowledge that this report was useful and had highlighted the need to implement an end to end voltage control strategy rather than reactive planning.

6.2. Summer Readiness Plan 2017/18

Damien Sanford, Executive General Manager, Operations at AEMO joined the meeting to provide the members with a facilitated discussion of the summer readiness 2017/18 review and was taken as read.

Highlights.

- Increasing generator capacity.
- Collaboration with generators to ensure that their assets were in their best condition.
- Returning moth ball fleets back into the market.
- Reserve levels.
- Maximising the availability of the transmission network.
- Fuel availability.

Operational improvements

- Short term forecasting.
- Forecasting of available
- Reserve management & forecast uncertainty measures.
- Implement further training for our control room operators.
- Weekly meetings taking place every 7 days with industry and jurisdictions.
- Conducted a joint NEM and Gas weekly meeting.
- Bidding of the forecasting availability for the generation suite

Key learnings

- Strong collaboration across industry and government
- Movement of generator outages outside of the summer period
- Network preparation
- RERT requirements

During the summer period it was noted that there was only one major network event that occurred on the 18th of January during a high demand period. Overall this did not compromise the security and reliability of the system. Damien also mentioned that RERT was activated twice during this period and reports published and available on AEMO's website.

Damien advised that AEMO is currently planning for the next summer period and meetings are already underway between AEMO and government. Next steps will be to meet with industry to start discussions regarding their preparation plans for next summer.

Damien also provided the group an overview of the recent LoR event which occurred on 7 June 2018.

6.3. Tasmanian Frequency Trial (FCWG)

Andrew Groom joined the group to provide an overview of the recent Tasmanian Frequency Trial with the following points discussed.

- Basslink out of service during May 2018
- Altered Hydro Tasmania governor and AEMO AGC settings
- Assessed impact over periods of several hours on:
 - Tasmania system frequency
 - Generator operation (conformance, governor work / activity)
- Achieved significant improvement in system frequency performance, at the cost of continuous generator effort
- Hydro Tasmania was thanked for their voluntary participation

AEMO provided the group with the results of the test which are outlined below,

- Governor mileage measured as total change in % position / hour
- Increased governor mileage – analysis ongoing.
- Reduction in generator MW conformance, but small.
- Causer pays factors would have been 0.2% higher
 - But as noted, test periods were excluded

In conclusion, what AEMO took from these tests was that it was quite simple to achieve a very substantial improvement in system frequency outcomes with simple control changes in the case with Tasmania. In addition this test was able to be conducted remotely without taking a unit offline. Other findings from the test are outlined below;

- Significant improvement in Tasmanian system frequency under normal conditions was achieved with simple, remotely applied control changes across a number of units.
- Normal frequency control appears to be affected by level of Tasmania wind generation
- Increased work / activity required from generator governors to achieve improved frequency.
- Increased distribution of MW deviations from base MW targets (but small)
- These are outcomes some generation operators may see as undesirable.
- Causer pays impacts would have been minimal (however test periods were relatively small amount of the month)
- Hydro indicated they didn't see significant issues with increased governor activity, but this will be unit and technology specific.

AEMO suggested and advised their recommendations to conduct a similar trial on the mainland. These recommendations are outlined below.

- Suggest there is value in a similar system frequency trial on the mainland.
 - Directly assess required volumes of primary frequency control
 - Directly assess impact on operation of individual generators

- Suggest longer periods for tests, with at least two different test periods.
 - Capture load ramps, generation commitment changes, variations in wind, etc.
- Testing Period
 - 1st test period to include maximum number of generators providing primary control
 - Suggest trialling 2/3 of average NEM fleet
 - Generators to operate with continuously active governor response, with frequency dead-band set ideally to zero, or if not to zero, then to no more than +/- 0.025 Hz.
 - No explicit management of headroom suggested in this trial, or any other governor changes.
- To assess required volumes, 2nd trial period with only half as many generators involved.
 - Desirable to include widest range of technologies in the tests.
 - Hydro, OCGTs, CCGTs and steam turbines
 - Desirable to include batteries, curtailed wind or solar (if possible), and to include Tasmania.

7. NEM Operations Matters

7.1. NSCAS Gap for system strength in SA

Moved to next meeting's agenda.

7.2. NEM Power System Issues

The Chair advised the group that this item was provided by the Power System Security Working Group (PSSWG) and provided a brief introduction. Responses were sought from all TNSP's, however only 2 TNSP's provided input.

The NEMOC observed that this form of reporting was favourable and requested to see more visibility on NEM Power System Issues from the PSSWG. In particular there was general consensus that there were concerns relating to control room resourcing and the aging workforce.

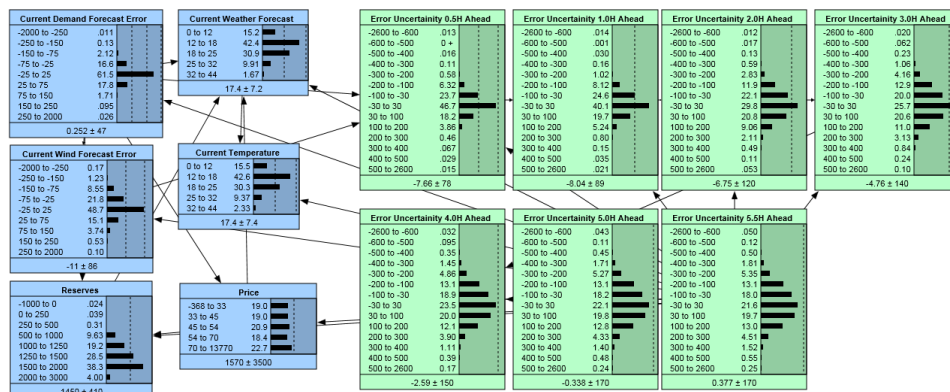
7.3. Probabilistic forecasting and predicting extreme weather events

Mike Davidson joined the meeting to provide an overview of the Probabilistic Forecasting and Extreme Weather Events presentation to the NEMOC group. The following points were discussed,

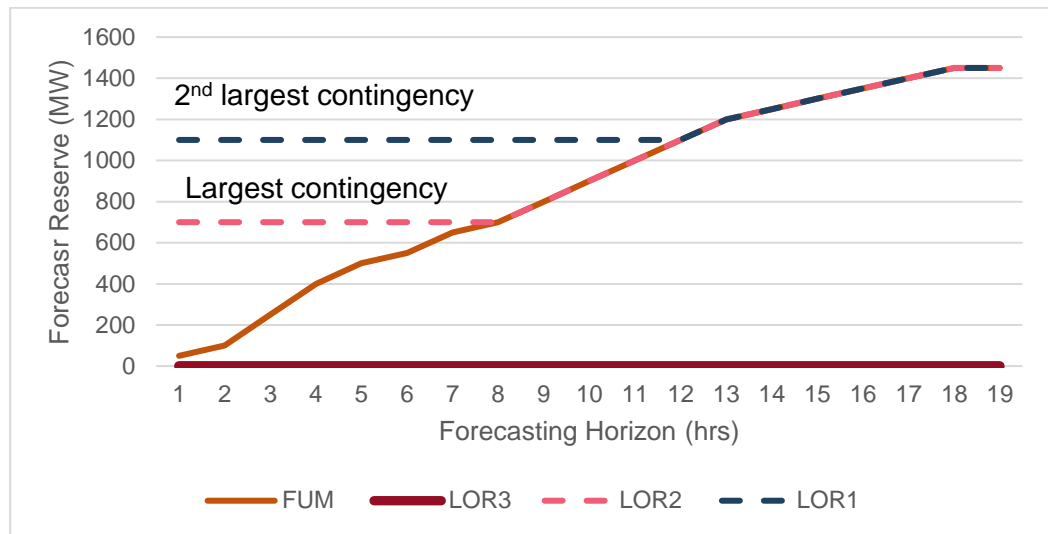
- Electricity is condensed weather
- Weather is chaotic
- The God of weather is capricious
- Risk Management
- Best Forecasting
 - Quantify uncertainty and impact
 - Take Action

Mike Davidson had provided an example of Dynamic Spinning Reserve Method using Bayesian Belief Networks (BBNs) which was outlined in the presentation. These discussion points are outlined below.

- Day-Ahead forecasting uncertainty – Region (2011-2017)
 - NSW: Dominated by low frequency, high materiality errors, with a positive bias for generation error.
 - QLD: No intermittent generation forecasts, and is dominated by low frequency, high materiality errors, with a positive bias for generation error.
 - SA: *In absolute terms has the same size forecasting error for both Intermittent and Scheduled Generation*
 - Tasmania: Generally well controlled and low Generation Error.
 - VIC: Dominated by low frequency, high materiality errors, with a positive bias for generation error.
- Day-Ahead forecasting uncertainty – over time
 - Intermittent Generation uncertainty is increasing over time, caused by increases in installed capacity
 - Scheduled Generation has a positive bias and is consistent over time. Intermittent and Operational Demand have no bias
- Bayesian Belief Network
 - Below is a dynamic Bayesian Belief Network that was trained on the historical forecasting errors and the weather conditions that were present at the time the forecast was produced.
 - Over 1 billion forecasts were used to train the network.
 - BLUE nodes represent inputs into the network
 - GREEN nodes represent the forecasting error in MW for each 30 minute forecasting interval



- Using the Forecasting Uncertainty Measure (FUM) to dynamically set reserve level
 - The FUM from the Bayesian Belief Network is used to dynamically update the required reserve level, given the forecast of conditions.



- Other potential applications of Bayesian Belief Networks
 - **Forecast Over-rides.** Similar day analysis to determine historic forecasting error distribution and then use error distribution to assess need for override of model forecast
 - **Ensemble Weather Forecasts.** Merging multiple weather forecast providers to create a dynamically updating ensemble weather forecast based on historical weather forecast provider accuracy
 - **Price Forecasting.** Day-ahead price forecast error distribution to improve price forecasting

8. Discussion and Decision

The Chair opened the discussion by setting out the objective and proposed outcomes. The committee were asked to;

- Consider and confirm the suitability of the present structure and objectives of the technical working groups and if the scope of the working groups need to change or if some should be stood down.
- Determine critical NEMOC directives for 2018/19 and direct existing - or establish new working groups.
- Agree on communication strategies to provide guidance and share information with the industry, jurisdictions and regulatory bodies.

8.1. NEMOC 12 Month Work Focus Plan

The following discussions took place.

AEMO raised, “what is the suitability of the present structure and objectives of the technical working groups”?

- **AusNet Services Response:**
 - It is hard to see clearly what the roles and responsibilities are for the groups. Suggestion would be for all the working group leaders to come together as a one off to discuss the areas that are overlapping and to identify the long term challenges that the industry has. Is there any gaps in the current structure that

won't be addressing or won't be analysing or critiquing with the current challenges we have.

- **Powerlink Response:**

- Are the working groups reflective & forward looking?

- **CEC Response:**

- Should there be forecasting uncertainties and availability captured in OPWG & PSMRG objective (refer to point 2 working Group). In addition there should be future thinking i.e. Redefine their objectives to include lag indicators in areas that are emerging in the power system.

Recommendation from CEC is for all working groups to cross pollination by design.

Should the working groups have in place “working plans” for the year by request from the NEMOC?

Should the OPWG work with industry planning teams to leverage ideas and current network issues?

- **TasNetworks Response:**

- How do we get the NEMOC governance right to get visibility across all working groups? In addition, all working groups should provide out of cycle updates as those updates become available i.e. Tasmanian Frequency Trial (Item 7.3)

- **AEMO Response:**

- Should the NEMOC seek from the working groups, important topics and/or studies to be presented at NEMOC meetings and in addition report on these matters once a year as a minimum?

8.2. External Communications Strategy

It was noted that the current platform for external communication is the AEMO website. The committee suggested that the ESB Board as platform to communicate out program of works and what implementations NEMOC recommends.

8.3. NEMOC Meeting Schedule

The chair opened the discussion by seeking the committee’s approval for the suggested dates below and each organisation agreed to host a NEMOC meeting at their office. (See below).

National Electricity Market Operations Committee Forward Plan

	Location	Hosting Organisation
Thursday 6 September 2018	Canberra	TransGrid
Thursday 6 December 2018	Hobart	TasNetworks
Thursday 7 March 2019	Adelaide	TBA
Thursday 6 June 2019	Brisbane	Powerlink QLD

Thursday 5 September 2019	TBA	TBA
Thursday 5 December 2019	TBA	TBA

9. Noting

The below noting items were not discussed and where considered read prior to this meeting.

9.1. Working Group Updates

9.1.1. Power System Security Working Group (PSSWG)

Risk of Trip Protocol

PSSWG 2018 High Level Priorities

9.1.2. Operations Planning Working Group (OPWG)

9.1.3. Frequency Control Working Group (FCWG)

9.1.4. Power System Modelling Reference Group (PSMRG)

10. Other Business

11. Meeting Close

Meeting concluded at 3.00pm