AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

MLF methodology review 2020

Workshop 2 – 18 June 2020

Agenda

No	TIME	AGENDA ITEM	PRESENTER
1	1:00pm – 1:20pm	Welcome and introduction • Recap from previous workshop • Objectives of this workshop	Chris Muffett
2	1:20pm – 1:30pm	High-level prioritisation	Shantha Ranatunga
3	1:30pm – 3:00pm	Issue discussion • Network data • Load forecast data • Controllable network element flow data • Generator data • Supply demand balance • Publications	Daniel Flynn
5	3:00pm	Closing summary	Chris Muffett

Welcome and introduction

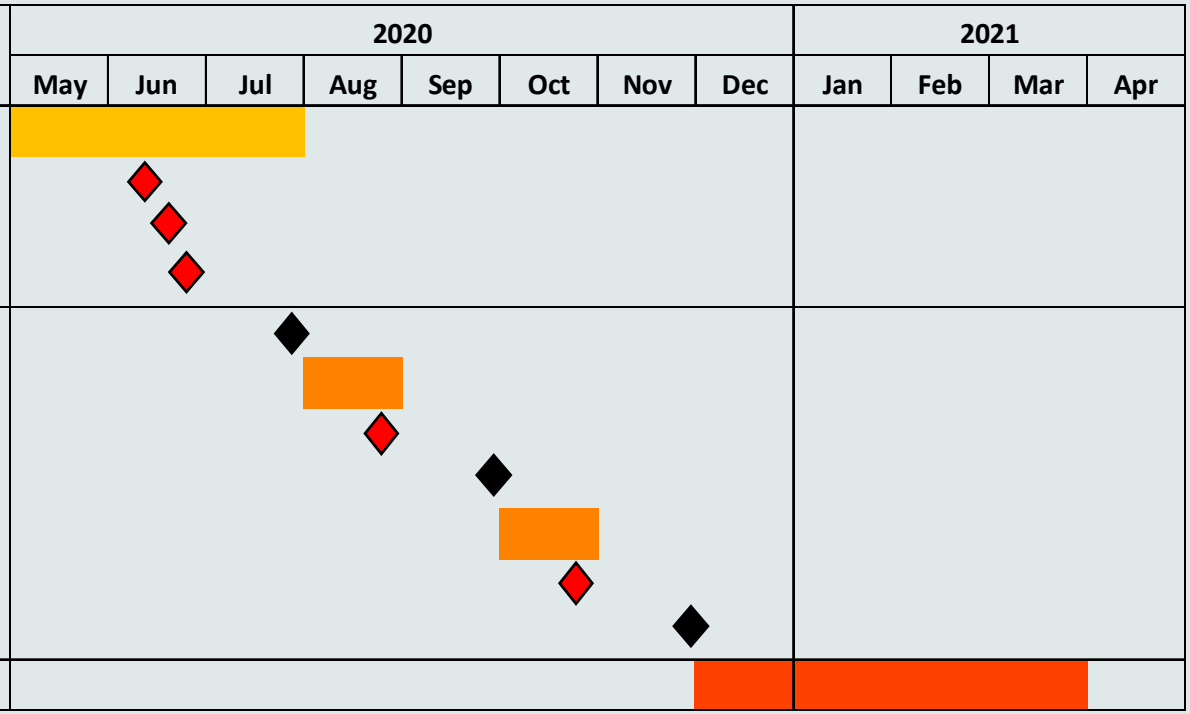
Chris Muffett

Recap from previous workshop

- Purpose of the review is to consider improvements to the Forward Looking Loss Factor (FLLF) methodology
  - Review will be conducted throughout 2020, with the aim to publish a final determination in November 2020
  - Changes to incorporated into the MLF determination for 2021-22
- Workshop 1 held on 5 June – about 35 organisations represented
  - High-level summary of review, including timing and issues being considered
  - Notes have been distributed, and will be published along with the slide pack at: https://aemo.com.au/energy-systems/electricity/national-electricity-market-nem/market-operations/loss-factors-and-regional-boundaries/review-of-marginal-loss-factor-calculation-processes
  - 4 actions for AEMO noted.

Review timeframes

Phase	Task/milestone
Pre-consultation	Planning & stakeholder engagement
	Workshop 1 - high-level
	Workshop 2 - detailed issues 1
	Workshop 3 - detailed issues 2
Formal consultation	Issues paper published
	First round of consultation
	First round consultation workshop
	Draft determination published
	Second round of consultation
	Second round consultation workshop
	Final determination published
Implementation	Incorporate changes into MLF process



Publication timeframes

Stage	FY19-20 application period	FY20-21 application period	FY21-22 application period
Scenario sensitivity study	-	-	Late August 2020
Energy generation forecast study (indicative extrapolation)		November 2019	October 2020
Preliminary report	-	November 2019	November 2020
Draft report	29 March & 1 April 2019	4 March 2020	1 March 2021
Final report	10 May 2019	1 April 2020	1 April 2021
1st revised report	21 June 2019	July 2020	July 2021
2nd revised report	-	October 2020	October 2021
3rd revised report	-	January 2021	January 2022
4th revised report	April 2020	April 2021	April 2022
5th revised report	June 2020	June 2021	June 2022
Historical comparison study	August-December 2020	August-December 2021	August-December 2022

Objectives of this workshop

- Today's workshop will be working through the following issues:
  - 5.1 - Network data
  - 5.2 - Load forecast data
  - 5.3 - Controllable network element flow data
  - 5.4 - Generator data
  - 5.5 - Supply demand balance
  - 5.8 – Publications
- Proposing to time-box each area to avoid getting bogged down in detail with the broader group
- AEMO is happy to discuss these issues (and others) through 1-on-1 sessions

High level prioritisation

Shantha Ranatunga

Prioritisation approach

- Proposing to prioritise addressing issues that can be addressed as part of MLF determination for FY21-22 (prior to April 2021)
  - Incorporate changes for controllable network elements (rule change)
  - Re-align the methodology with current operational practises
  - Consider practical improvements to the methodology
  - Improve documentation
- More significant methodology changes and issues that impact the rules framework may need to be addressed separately
- Seeking input from stakeholders on their priorities – open to engaging 1-on-1 prior to formal consultation

Issue discussion

Daniel Flynn

Methodology review:
5.1 Network data

Issue: Transmission Treatment

There has been some confusion surrounding the treatment of different forms of transmission, in particular unregulated transmission assets and dedicated connection assets (DCAs).

From an MLF perspective, both of these types of transmission are excluded from MLF studies.

DCAs are currently quite simple from an MLF perspective as the connection point must be located at the point of connection to the regulated transmission network.

There is an underlying issue for DCAs where as only a single MLF can be applied, even if there is several different technologies within the DCA (potentially owned by multiple proponents) leading to inefficient dispatch and settlement outcomes (cross-subsidisation of technologies).

Unregulated transmission assets (pre-DCA) are a little more complex as the NSP and the proponent/s can decide on the connection point, which can be within the unregulated transmission assets.

This is problematic, as there is currently no mechanism to account for the transmission losses between the CP and the point of connection to the shared transmission network.

In these rare circumstances AEMO engages with the AER to clarify the treatment of MLFs.

Methodology review:
5.1 Network data

Key Considerations: Transmission Treatment

Requirement: Rule Change / Guideline Update

There is currently a rule change relating to DCAs to allow connection points to be sub-shared transmission network which will in turn will allow for MLFs to be calculated for individual generators within the DCA.

This rule change, if implemented will allow the AEMO to provide more appropriate MLFs to the individual generators.

Further information on the proposed rule change can be found at,

https://www.aemc.gov.au/rule-changes/connection-dedicated-connection-assets

Methodology review:
5.2 Load forecast data

Issue: Reference Data

The currently methodology prescribes that load forecasts (as well as initial generation levels) are to be based on reference year data.

The MLF process occurs over a three year cycle,

- Year 1 – Reference year
- Year 2 – Calculation year
- Year 3 – Target year

Key Considerations: Reference Data

Requirement: Methodology Change

While there is a process for both load and generation that consider historical data outside the reference year utilising additional data (closer to date of publication) as an input to load (and generation) may be of benefit.

However firm meter data is only available some time after real time, and the inclusion of additional data may having timing issues.

Methodology review:
5.3 Controllable network element flow data

Issue: MNSP Rule Change Implementation

The current methodology prescribes that interconnectors that also provide market network service providers (MNSPS) other than energy are to be treated as invariant, this was historically also prescribed by the NER.

When calculating marginal losses all DC lines must be considered invariant (only for loss calculation, not dispatch) since only AC lines are included in the sensitivity matrices.

When calculating the supply-demand balance the MNSP (Basslink) flow was adjusted (from historical values) only in scenarios where Tasmania had a supply shortage.

A recent rule change removed the requirement to treat MNSP as invariant.

This allows more options such as application of the minimal extrapolation process to the entire NEM (Tasmania is currently a separate model).

Key Considerations: MNSP Rule Change Implementation

Requirement: Methodology Change / Engine Change

Currently, there is no process for incorporating a DC interconnector that is not parallel to an AC interconnector into the dispatch process, below is a few options that would allow for a DC interconnector to be incorporated into dispatch.

1. Replace current MLF engine with new engine capable of dispatching DC interconnectors not parallel with an AC interconnector
2. Model Basslink as an AC equivalent line in current dispatch engine
3. Retain existing engine however utilise new engine for dispatch (current engine to calculate MLFs only)

Methodology review:
5.4 Generator Data

Issue: Generator Capacities

Currently the Generation Information summer capacities are based on the following temperatures,

- QLD: 37 degrees Celsius
- NSW: 42 degrees Celsius
- VIC: 41 degrees Celsius
- SA: 43 degrees Celsius
- TAS: 7.7 degrees Celsius

As a result, the summer capacities for generation are often overly pessimistic and unsuitable for application to the entirety of summer (NEM definition) period. This leads to generation operating below a realistic capacity level for the entirety of the summer period.

Methodology review:
5.4 Generator Data

Key Considerations: Generator Capacities

Requirement: Methodology Change

1. Utilise *Typical Summer Capacity*

An additional set of summer capacities to be referred to as *Typical Summer Capacity* will be included in future Generation Information publications. The summer values will be based on the following temperatures in each region,

- QLD: 32 degrees Celsius
- NSW: 32 degrees Celsius
- VIC: 32 degrees Celsius
- SA: 35 degrees Celsius
- TAS: 7.7 degrees Celsius (unchanged)

While still reflecting the summer reductions in capacity, it is expected these capacities will be better suited to MLF studies which apply the capacities for the entirety of the summer (NEM definition) period.

Methodology review:
5.4 Generator Data

Issue: New Generation Profiles / Commissioning Profiles

In section 5.4.2 (New generating units) the current methodology prescribes a process for the production of generation profiles for new generators as a scaled version of a historical profile from an existing generator.

This process is sub-optimal for several reasons,

- Solar generation output is dependant on location, tilt and technology type (fixed axis, tracking, etc)
- Wind generation output is dependant on location and site conditions
- New thermal generation is typically more flexible in output than traditional thermal generation
- Batteries have differences in operational patterns depending on the owners interest in arbitrage, FCAS markets and/or future markets (caps)

In addition, the MLF methodology process historically aligned with the Market Modelling Methodology for the production of traces for both solar and wind. However the Market Modelling Methodology has since been revised, and as such the methodologies no longer align.

Methodology review:
5.4 Generator Data

Key Considerations: New Generation Profiles / Commissioning Profiles

Requirement: Methodology change

1. AEMO to produce forecast (based on reference year data) profiles for wind and solar

AEMO has implemented a process where generation profiles for both solar and wind are produced internally, then provided to the relevant proponent for feedback.

Solar Process

Reference year irradiance data is sourced from the BoM, this is then utilised as an input to the System Advisor Model (SAM from NREL) to produce an output with considerations given for longitude, latitude, elevation and technology type.

Wind Process

Reference year wind speed data is sourced from DNVGL, this is then utilised to calculate an output by applying a power curve.

This would bring the MLF process into alignment with ESOO, and as the generation profiles are published alongside each ESOO publication also increases transparency around MLF inputs. More information on the ESOO process can be found within the *Market Modelling Methodology* in section 4.3.

Methodology review:
5.4 Generator Data

Key Considerations: New Generation Profiles / Commissioning Profiles

Requirement: Methodology Change

1. AEMO to produce forecast (based on reference year data) profiles for wind and solar (Continued)

Generic commissioning profiles are then implemented prior to the commercial operation date,

Solar Process

- 1/3 Capacity for 4 weeks
- 2/3 Capacity for 4 weeks
- 3/3 Capacity thereafter

Wind Process

- Linear ramp of capacity for 9 months

The generic hold points listed above have been created with input from the AEMO network connections team, who have based the commissioning profiles on their historical experiences.

Methodology review:
5.5 Supply Demand Balance

Issue: Stable operation of thermal plant

Thermal generators have limitations when operating at lower levels, for larger generators the range for stable operation can be relatively small relative to the total capacity.

The current method for balancing supply and demand in the MLF process does not contain a mechanism to ensure thermal plant are operating within this stable range and with future increases in forecast semi-scheduled generation we may see thermal generation dispatched to levels below the stable operation range.

Key Considerations: Stable operation of thermal plant

Requirement: Methodology

1. Incorporate a mixed level of 'firmness' for thermal plant, with capacity between 0MW and the determined safe minimum generation level being 'firm' and additional capacity above this level being 'variable'.

This would bring the MLF process into alignment with both the ESOO and ISP, utilising the *Input and Assumptions Workbook* as a source for the minimum stable operating levels.

2. Manually observe dispatch outcomes for thermal generation, and where operation at levels below the safe minimum generation levels are observed either increase output or decrease output to 0MW.

Methodology review:
5.5 Supply Demand Balance

Issue: Minimal Extrapolation Theory

The current minimal extrapolation theory was designed in a time where there was significantly fewer forms of technology in the generation mix.

Generators under the current framework have two primary settings that impact on their treatment during dispatch within the MLF process which are,

Type: Thermal/Hydro

Energy Constrained: Yes/No

Generators are dispatched based on a hierarchy which is determined by a combination of the above as well as availability, online status and capacity. The limited configurations available are problematic given the large variety of technologies within the NEM.

Methodology review:
5.5 Supply Demand Balance

Key Considerations: Minimal Extrapolation Theory

Requirement: Methodology Change

1. Retain minimal extrapolation theory yet expand on generator categorisation to improve accuracy of dispatch outcomes

    The minimal extrapolation process could be expanded, to incorporate additional categories reflecting the 'firmness' of different generation technologies and to expand the dispatch hierarchy.

2. Move away from minimal extrapolation theory toward a more complicated yet accurate system

    Consider moving to an alternative method for balancing supply and demand, noting that as intent is to incorporate for 2021-22 FY MLFs there may be limited capability to implement this.

Methodology review:
5.5 Supply Demand Balance

Issue: Extrapolation Capping

In scenarios where demand is forecast to grow above the increase in generation for the target year, the extrapolated generation is subject to a capping process.

The capping process considers historical generation (5 years excluding outliers) levels, the increase in demand in comparison to reference year and the percentage of the change of the relevant generator to total generation in the target year. Additionally, a buffer may be utilised where the capped generation is insufficient to meet demand.

While this process is unlikely to be implemented in the foreseeable future (given generation is likely to exceed demand), it may be required in the case of the closure of a large power station.

Where this may potentially be problematic is when we have a large step change in generation capacity (closure of large), historical data for the previous 5 years is unlikely to be reflective of the outcome in the following years.

Methodology review:
5.5 Supply Demand Balance

Key Considerations: Extrapolation Capping

Requirement: Methodology change

1. Revise capping requirement

Incorporate additional variable to represent material reductions in generation capacity, allowing generators to be extrapolated above their 5 year historical averages.

2. Remove capping requirement

Remove the capping requirement entirely. If removing, consider additional methods for limiting increases in general (maximum capacity factors).

Methodology review:
5.5 Supply-demand balance

Issue: Parallel AC/DC Interconnectors

The current MLF process prescribes that where an AC interconnector is parallel to a DC interconnector that the DC interconnector operates in proportion to the AC counterpart based on the maximum capacity. The MLF process models system normal conditions and when the system is unconstrained, dispatch process utilises marginal losses to allocate flows across parallel ICs.

Key Considerations: Parallel AC/DC Interconnectors

Requirement: Methodology change

1. Utilise ratios based on historical flows rather than capacities

Historical flows could be measured for both seasonal and diurnal variation to ascertain ratios that are more reflective of actual outcomes.

If historical flows are to be utilised to ascertain ratios, periods where high impact network outages occurred may need to be excluded from the historical data.

Season	TOD	Direction	Ratio
Summer	Peak	Reverse	
		Forward	
	Off Peak	Reverse	
		Forward	
Winter	Peak	Reverse	
		Forward	
	Off Peak	Reverse	
		Forward	

Methodology review:
5.5 Supply Demand Balance

Issue: Intra – regional constraints

Increasingly, we are seeing high impact intra-regional constraints in areas within the NEM with large levels of new generation under system normal conditions (no outages).

These constraints often severely limit the impacted generators output, potentially resulting in a significantly lower level of generation than would be anticipated within the MLF studies if the constraints were not considered.

If these constraints are not effectively captured when preparing MLF studies, it may lead to MLF outcomes that are overly pessimistic and in turn result in an unjust penalty to both the impacted generators as well as generators within surrounding regions.

Methodology review:
5.5 Supply Demand Balance

Key Considerations: Intra – regional constraints

Requirement: Methodology change and guideline update

The AEMO has incorporated intra-regional constraints into recent MLF studies to ensure that MLFs reflect the impact we would like to ensure the assumptions and processes surrounding this are transparent in nature and that the processes have stakeholder support.

In recent years, high impact constraints have been included in MLF studies based on the outcomes of discussions with both internal teams and external stakeholders.

The current process for implementing constraints has been designed to align with the minimal extrapolation theory. All the impacted semi-scheduled/scheduled generators have their output reduced by the same ratio on a pro-rata basis to manage the limit.

1. Retain the current approach, incorporating intra-regional constraints with a process that aligns with the minimal extrapolation theory

2. Create new process for incorporating intra-regional constraints that does not align with the minimal extrapolation theory

Methodology review:
5.8 Publication

Issue: Transparency of MLFs

Concerns around transparency of MLFs, in particular large year on year step changes and difficulty replicating results externally. Previously, the first indication of MLFs for a target year was in the draft report which is published a month prior to the final MLFs.

This resulted in stakeholders having a very short window to consider the potential impact prior to the final results being published, and a short time between initial draft publication and implementation (4 months).

Key Considerations: Transparency of MLFs

The AEMO is intending to publish additional reports on annual basis to provide additional information on MLFs including the following publications,

1. Sensitivity Study

   The sensitivity study is intended to provide stakeholders with insight into the potential outcomes for several different scenarios.

2. Preliminary Report

   The preliminary report is intended to be an initial indication of the MLFs for the target year and will include analysis of the results.

Methodology review:
5.8 Publication

Issue: Intra-year revisions

Under the NER, the AEMO is required to revise MLFs intra-year where a material change in capacity at a transmission network connection point has been identified that was not captured in the initial MLF study for the target year.

Intra-year revisions only impact the MLF of the transmission network connection point where the change has been identified, and only occurs where the AEMO defines the change in capacity as material in nature.

Key Considerations: Intra-year revisions

Requirement: Publication change / Stakeholder engagement process change

1. The AEMO will commit to taking several steps to ensure intra-year changes to MLFs are more visible

The AEMO is committed to instate a prescribed timeline for quarterly revisions to the published MLFs to represent any changes that have occurred intra-year.

The AEMO is committed to instating a process to ensure that where generators are impacted by an intra-year revision to MLFs they are notified of this change.

The AEMO is committed to publishing live reports on MLFs via NEMWeb, which will be accessible at the following link.

http://www.nemweb.com.au/Reports/Current/Marginal_Loss_Factors/

Methodology review:
5.8 Publication

Issue: Indicative extrapolation report

On an annual basis, the AEMO publishes indicative extrapolation results. These results allow generators to review their forecast GWh levels for the target year, and for them to provide feedback to the AEMO where they believe there is a material and physical reason the values presented are not appropriate for use.

Currently, the process only includes thermal and hydro generation and no results are published for wind or solar generation.

Key Considerations: Indicative extrapolation report

Requirement: Methodology

1. In addition to the results currently published, publish forecast GWh for both solar and wind generation.

2. Continue to publish as per existing methodology.

Closing summary

Chris Muffett

Next steps

- Upcoming workshops:
  - Workshop 3: Friday 26th June, 1-3pm
- Information from previous forums and all workshops available at: https://aemo.com.au/energy-systems/electricity/national-electricity-market-nem/market-operations/loss-factors-and-regional-boundaries/review-of-marginal-loss-factor-calculation-processes
- Any feedback or questions should be directed to: mlf_feedback@aemo.com.au

- Thank you all for your participation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