# Unpanned transmission outage rates
# FRG consultation

27 January 2022 FRG Meeting

energy.forecasting@aemo.com.au

AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

# Background and Purpose

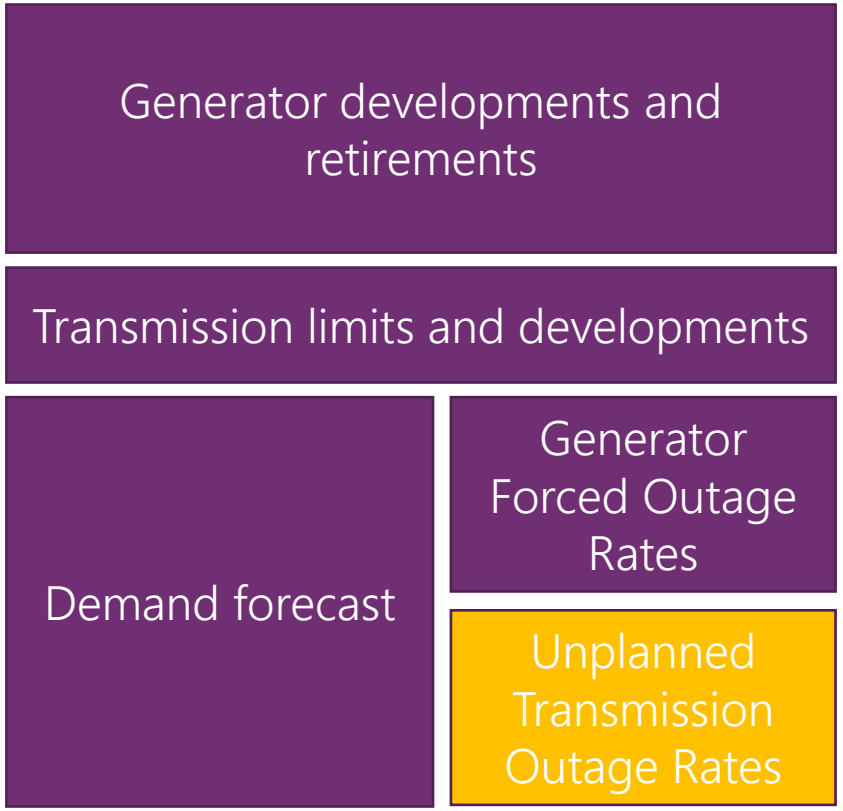
The purpose of today's presentation and discussion is to *consult* on the unplanned transmission outage rate methodology for the purposes of calculating power system reliability in the Electricity Statement of Opportunities (ESOO).

- Submissions may be made verbally, and written submissions will be accepted for two weeks. (Close 10 February 2022)
- Today's agenda includes:
  - Line selection criteria
  - Outage rate calculation
  - Constraint implementation

| Timing | Relevant topic | Responsible |
|---|---|---|
| Jun 2021 FRG meeting | Discussion on 2021 outrage rates forecasts | AEMO, Consultants |
| **Today** | **FRG consultation on unplanned transmission outage rate forecasting methodology** | **AEMO, FRG** |
| 10 Feb 2022 | Written submissions close | FRG |
| 29 June 2022 FRG meeting | Discuss calculated generator and transmission outage rates calculated for the ESOO | AEMO |

# Why unplanned transmission outage rates matter

Typical Impact to Reliability Forecast




The materiality of unplanned transmission outage rates vary year to year, but depending on methodology, could result in low to moderate changes in forecast unserved energy (USE)

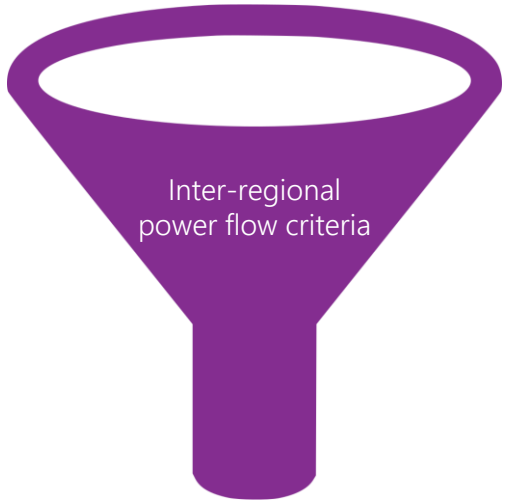
# Which lines should be included in unplanned outage rate calculations?

## The NER 3.9.3C(b) defines unserved energy (USE)

- USE includes reliability incidents that arise from the unavailability* of transmission elements that materially contribute to inter-regional power transfer.

This definition makes no distinction between Transmission Network Service Providers (TNSPs) and Market Network Service Providers (MNSPs).

All transmission elements (1000s)




Transmission lines whose unplanned outage rates will be included in Reliability Forecasts

* See further slides for the type of transmission unavailability considered

# Changing approach to line inclusion in unplanned outage rate calculations

## 2021 selection criteria

The line/flow path should be an interconnector; or connect an interconnector to stronger meshed elements of each regional grid.

The line/flow path should have sufficient outage history to justify the additional modelling complexity.

When a single credible contingency occurs on the line, it has an effect on inter-regional transfer limits.

## Proposed updated selection criteria

**(to be implemented annually)**

Consider all transmission elements that form an inter-regional flow path from Regional Reference Node (RRN) to RRN.

Exclude all transmission elements from that list that connect each RRN with significant remote intra-regional generation output.

Exclude other elements in the interregional flow path that if unavailable, would not increase reliability risk

# Changing approach to line inclusion in unplanned outage rate calculations

**Lines considered in the 2021 ESOO**

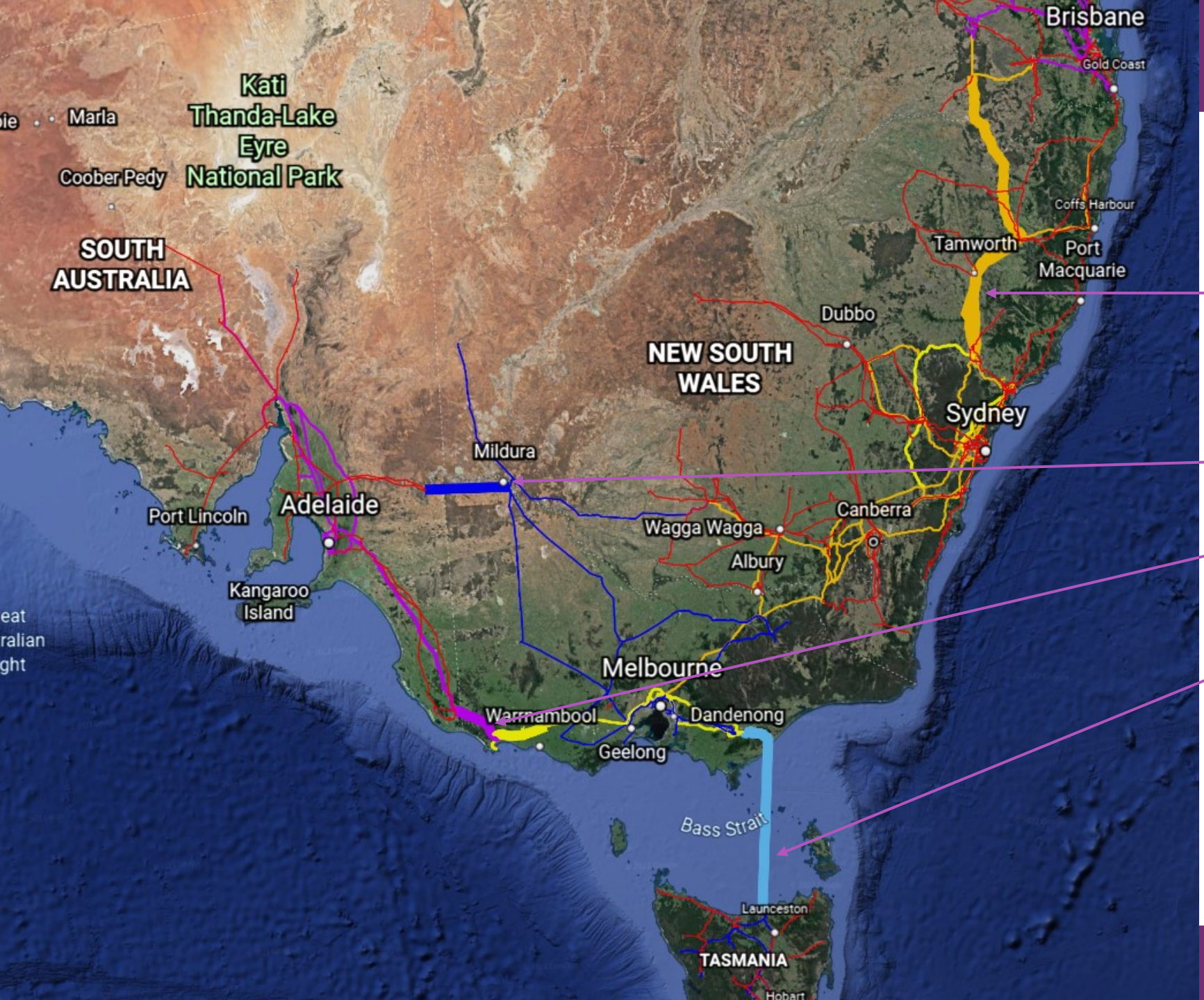
- Dederang – South Morang
- Dederang – Murray – Upper/Lower Tumut
- Moorabool - Mortlake – Heywood – South East – Tailem Bend
- Murraylink
- Basslink
- Liddell – Muswellbrook – Tamworth – Armidale – Dumaresq – Bulli Creek

**Lines proposed for consideration in the 2022 ESOO**

- Mortlake – Heywood – South East
- Murraylink
- Basslink
- Liddell – Muswellbrook – Tamworth – Armidale – Dumaresq – Bulli Creek

**Case Study: proposed VNI exclusion**

1. Numerous transmission elements form a flow path between Victoria and New South Wales RRNs.
2. Significant remote generation exists close to the regional boundaries on both sides.
3. The unavailability of remaining elements would be substituted by remote intra-regional generation.




- Liddell – Muswellbrook – Tamworth – Armidale – Dumaresq – Bulli Creek
- Murraylink
- Mortlake – Heywood – South East
- Basslink

# Which lines should be included in unplanned outage rate calculations?

## Consultation questions:

1. Are the proposed selection criteria appropriate, or are further considerations required?

2. Are the lines proposed for 2022 an appropriate implementation of those selection criteria?

# How should unplanned outage rates be calculated?

## NER 3.9.3C(b) definition of unserved energy (USE):

USE includes reliability incidents arising from single credible contingency events and excludes incidents arising from multiple or non-credible contingency events.

Simplified definitions (NER 4.2.3):
**Single contingency** – an event which AEMO expects would likely involve the failure or removal from operational service of one or more generating units and/or transmission elements.
**Credible contingency** – a contingency event which AEMO considers to be reasonably possible in the surrounding circumstances including the technical envelope.
**Reclassification** – a non-credible contingency event which is more likely to occur because of the existence of abnormal conditions that poses added risks to the power system.

## In calculating outage rates AEMO proposes to consider:

1. Single credible contingency events observed on relevant transmission elements.
2. Reclassification events observed on relevant transmission elements, unless it can be identified that the reclassification occurred in response to a multiple or non-credible contingency event.

# How should unplanned outage rates be calculated?

## Proposed treatment of single credible contingency events

AEMO to:

- collect historical data on the occurrence of single credible contingencies from Network Service Providers (NSPs) over at least 10 years.
- collect 10 year projected outage rates or insights from NSPs.
- use above data sources to calculate (in the absence of NSP insight) unplanned outage rates over the forecast horizon.

Harmonises NSP requirements with generator participants. The NSP request is voluntary but highly encouraged in 2022.

## Proposed treatment of reclassification events

AEMO to:

- collate historical data as derived from AEMO's reclassification database*.
- use reasonable judgement to filter larger events to exclude reclassification events that occurred in response to a multiple or non-credible contingency event.
- apply the historical rate over the 10 year horizon.

* https://aemo.com.au/en/energy-systems/electricity/national-electricity-market-nem/nem-events-and-reports/power-system-reclassification-events

# How should unplanned outage rates be calculated?

## For both single credible contingencies and reclassification events

- AEMO will implement weather variable outage rates where either event category is predominantly driven by, and is correlated with measurable weather.
- If relevant, AEMO will include additional trends for climate change.
- In the absence of a causal relationship with weather, static annual unplanned outage rates will be implemented as reference year traces.
- Outages will be included in the ESOO model over the forecast horizon using Monte Carlo simulations.
- The outage mean time to repair will be derived from observed events.
- Unless NSP insights advise otherwise, AEMO proposes to include observed long duration events in calculated unplanned outage rates. This is a materially consistent approach with generator long duration outages.

**Case Study: Basslink long duration outages**

Basslink has had numerous long duration outages.

In the event that the projected unplanned outage rate is calculated using the historical rate, the projection would implicitly incorporate the reoccurrence of such events.

# How should unplanned outage rates be calculated?

## Consultation

1. Is the proposed process for gathering observed and projected unplanned outage rates appropriate?

2. Are long duration unplanned outages observed on transmission elements sufficiently different from long duration forced outages observed on generators to require special consideration?

# How should the unplanned outage constraints be implemented?

Constraint: equations that limit generator output to reflect transmission and other limitations.

Developing constraint sets for unplanned outage simulations is time consuming, so simplifications are required. AEMO proposes to:

- use a constraint set that applies during a single credible contingency event on the transmission segment most representative of the flow path's interconnector
  - For example, the constraint set that would apply during a single credible contingency event on Dumaresq-Bulli Creek would be used to simulate the impact of all outages on the Liddell – Bulli Creek flow path.
- use the constraints to reduce inter-regional transfer limits during simulated unplanned outages to:
  - 0 MW, for single circuit lines
  - a non-zero value consistent with operational constraints, for all other lines
- update, where possible, constraint sets to reflect committed transmission investments

# How should the unplanned outage constraints be implemented?

## Consultation

- Is the proposed process for implementing constraints during simulated unplanned outages appropriate?

Submissions to energy.forecasting@aemo.com.au close on 10 February 2022