

# 2021 Forced Outage Rates

30 June 2021 FRG Meeting

[Energy.forecasting@aemo.com.au](mailto:Energy.forecasting@aemo.com.au)

[www.Sli.do](https://www.Sli.do) #FRG

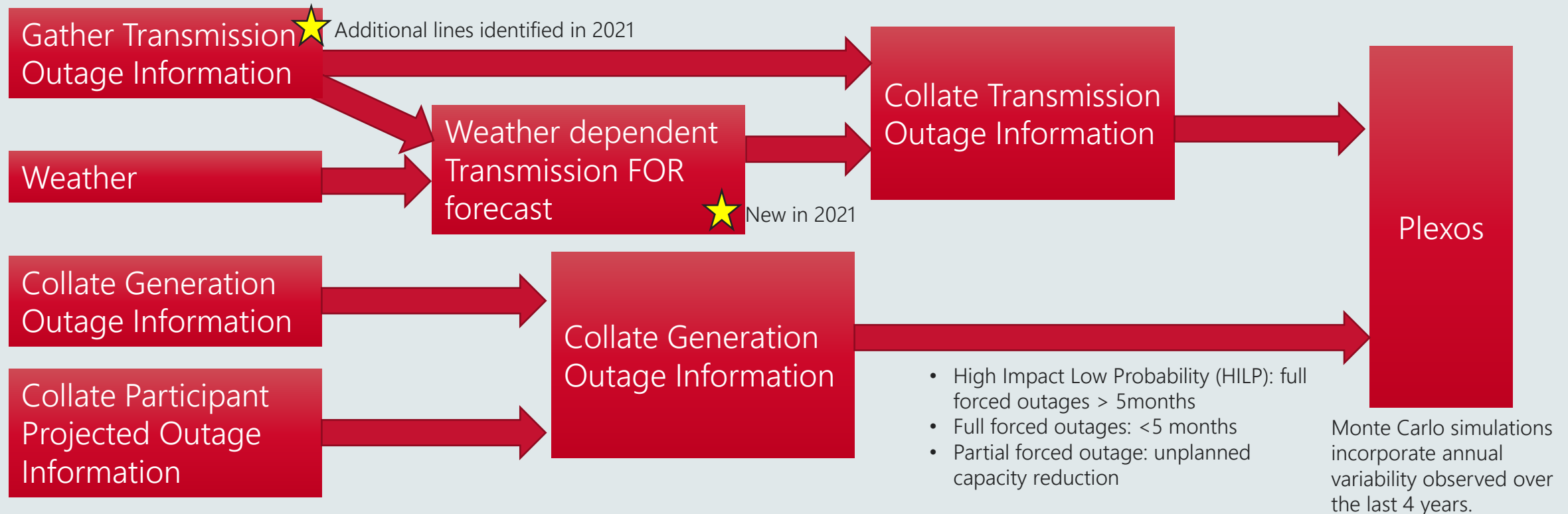
# Background and Purpose

- The purpose of today's presentation is to present and discuss the 2021 Forced Outage Rates (FOR) forecast, a key input to the 2021 ESOO.
- Today's agenda includes:
  - Purpose and method
  - Generator FOR
  - Transmission FOR
  - Discussion

Timing	FOR projections	Responsible
Dec 2020	Forecast Accuracy Report and Improvement Program noted several improvements for Transmission FOR.	AEMO
30 April 2021	FOR history and projections provided by participants.	Participants
4 June 2021	FOR calculations and projections provided back to participants, and comments/adjustments received by AEMO.	AEMO/ Participants
<b>Today</b>	<b>Presentation of 2021 forecasts</b>	<b>AEMO</b>
Aug 2021	ESOO published	AEMO

# Generation and Transmission Forced Outage Rates (FOR) are a key Reliability Forecast input

Periods of Unserved Energy (USE) typically occur when Variable Renewable Energy (VRE) output is low, demand is high and Generators and/or Transmission are on unplanned outages.



# Transmission Forced Outage Rates are consistent with the NER

AEMO models the impact of single credible contingencies and reclassifications (derating) on only those transmission lines that materially contribute to inter-regional transfer capability.

Many noteworthy transmission incidents involve multiple (double circuit) or non credible contingencies that are specifically excluded from the definition and calculation of unserved energy.

Consistent with generator FOR's, transmission outages and derating events are modelled using Monte Carlo simulations, with only one rate and time to repair implemented.

NER 3.9.3C provides the definition for *unserved energy*, which incorporates outages arising from single *credible contingencies*, and excludes multiple and *non-credible contingencies* on *inter-regional transmission elements*.

It clarifies that '*inter-regional transmission elements*' include only those *transmission elements* that materially contribute to *inter-regional power transfer*.

# High Impact Low Probability (HILP) generation outages are important, but stable as averaged over 11 years

HILP generator outages include all generator outages greater than 5 months.

These outages are removed from the calculation of station specific outage rates and are instead applied to all stations within the technology category.

The rates implemented reflect average rates observed over the past 11 years.

Technology	HILP Outage Rates	Mean Time to Repair (hours)
Brown Coal	0.59%	5,290
Black Coal NSW	0.76%	5,568
Black Coal QLD	0.21%	4,656
All Coal	0.53%	5,330
OCGT	0.80%	5,580

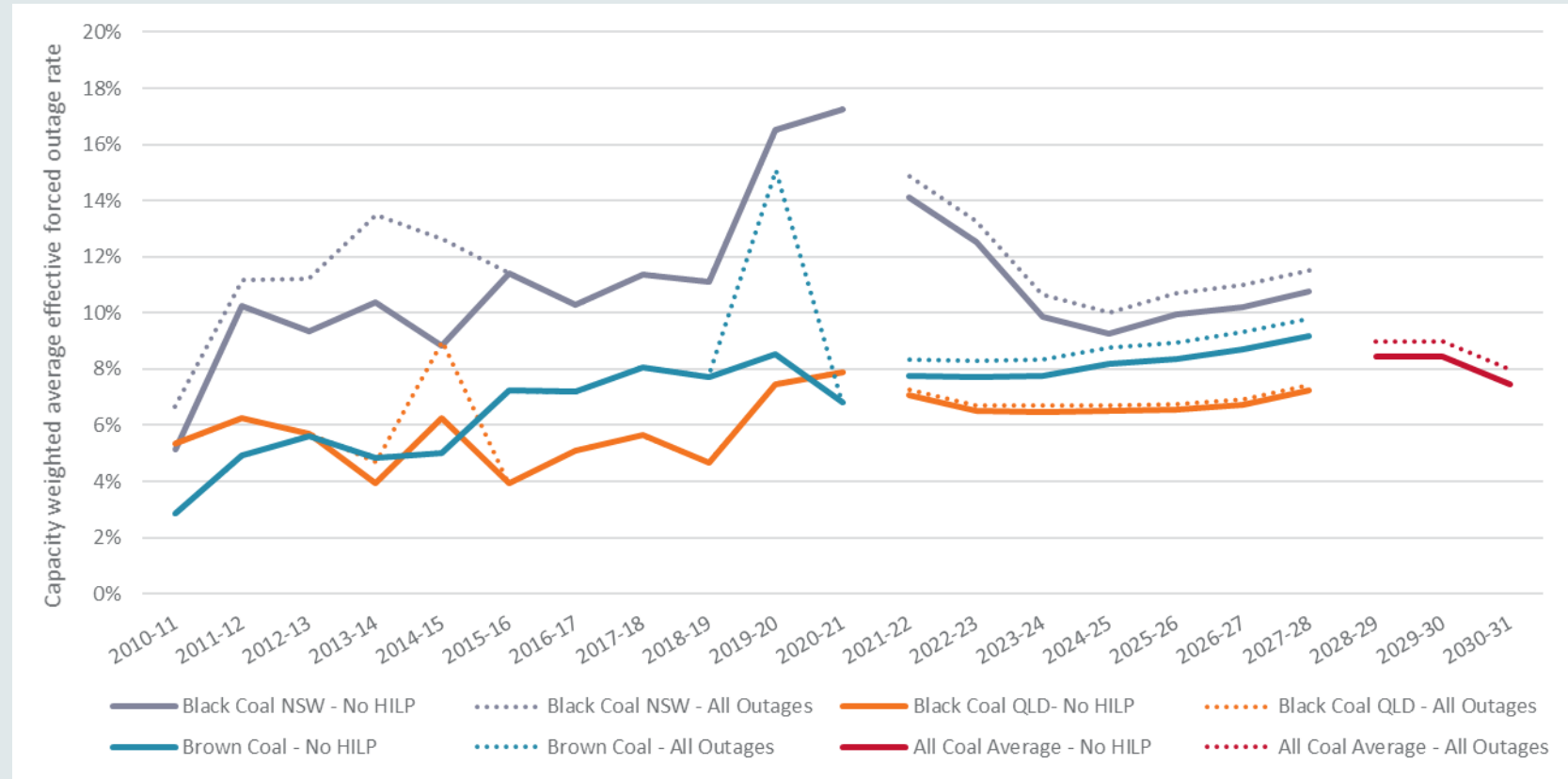
# Coal fired generation effective Forced Outage Rates now include participant provided projections

Station level full and partial forced outage rates are applied in the ESOO.

In all cases, projections were provided by, or supplemented with consultant projections in consultation with the station owner/operator.

To protect confidentiality, only technology level aggregates are published, and used in published models like the ESOO published model, and ISP. In later years of this graph, all coal stations have been aggregated together.

Participants' average effective forced outage rate projections are steady around 8% to 10%



History comprises only stations currently in service

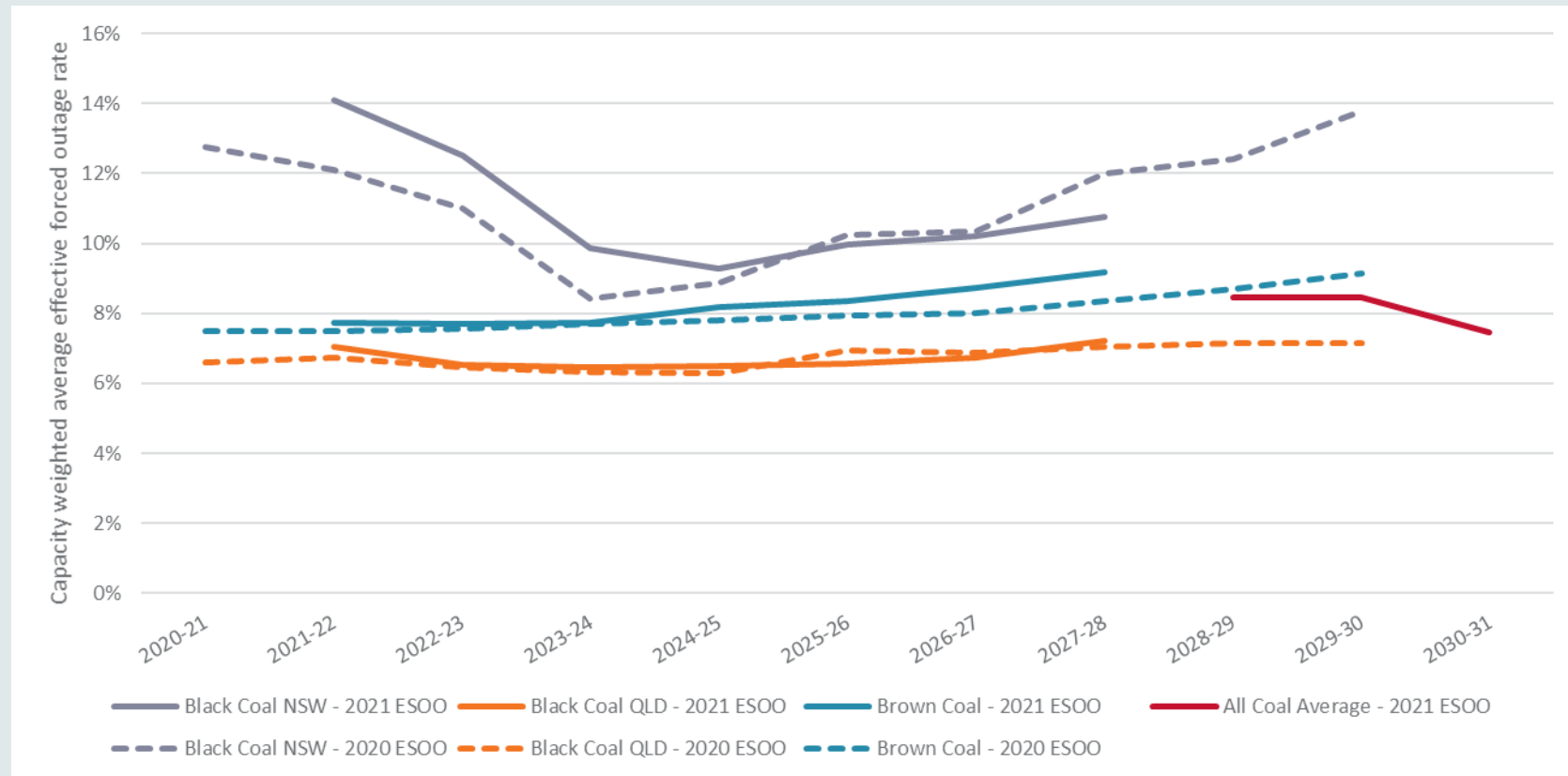
To contribute, see: [www.Sli.do](http://www.Sli.do) Event code #FRG

# Participant driven forecasts reflect expectations of reduced NSW black coal Forced Outages Rates

Based on participant provided projections:

- Brown coal projections have increased over the projection horizon.
- QLD Black coal projections have increased slightly over the projection horizon.
- NSW Black coal projections initially start above previous projections, but then show substantial medium term improvement, driven by station retirements, and participant expectations of remediations of issues affecting reliability.
- AEMO received justifications for this movement in FORs and will monitor actual FORs in the coming year against those forecast for 2022 ESOO purposes.

Comparison of 2021 and 2020 EFOR forecasts (no HILP)



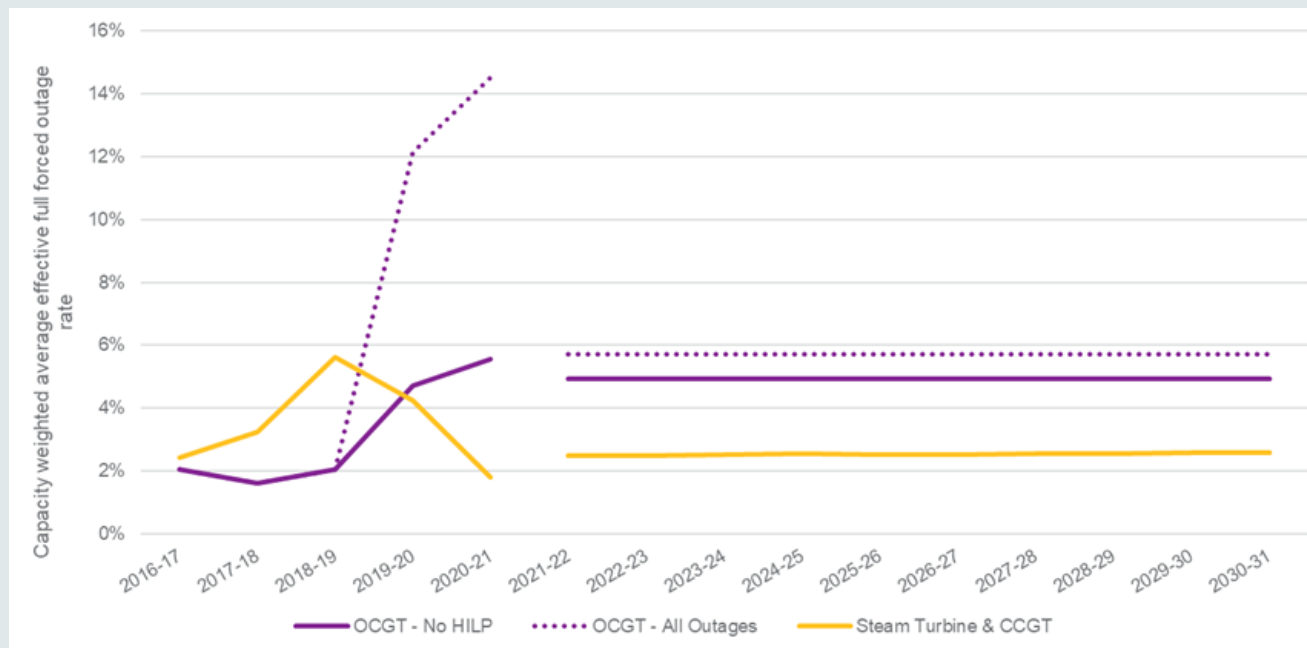
# Steady outlook for Gas and Steam Turbines Forced Outage Rates

Based on updated calculations:

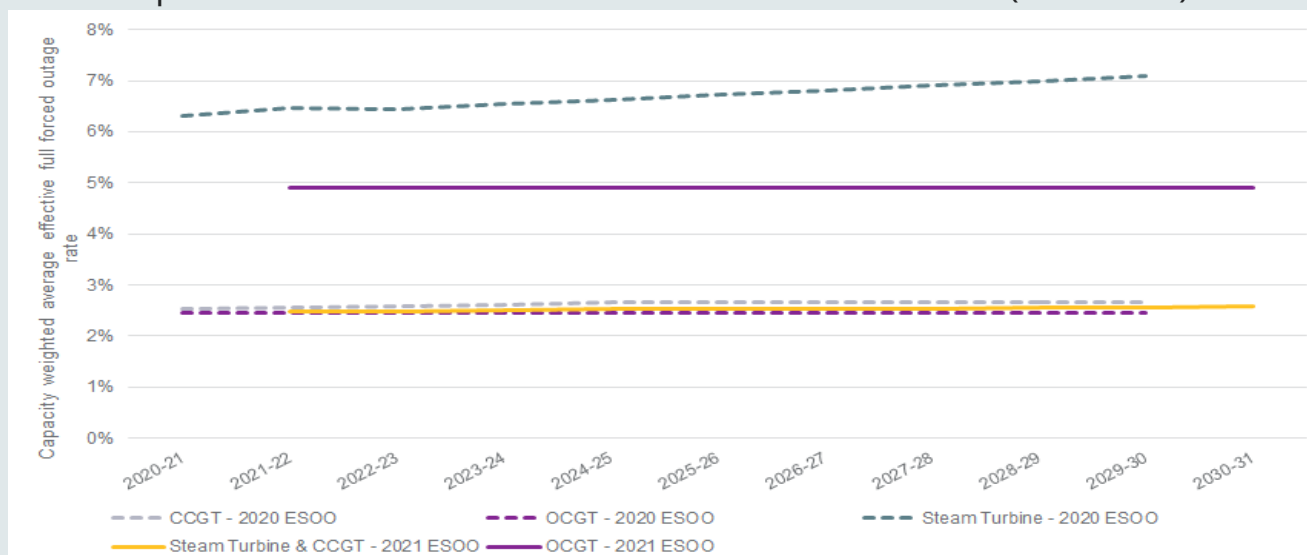
OCGT projections have increased against the 2020 ES00, reflecting recent performance.

Steam Turbine and CCGT projections are now averaged by capacity weighting. It was necessary to aggregate these two groups to protect confidentiality.

## OCGT, CCGT and Steam Turbine EFOR actuals & forecasts



## Comparison of 2021 and 2020 EFOR forecasts (no HILP)



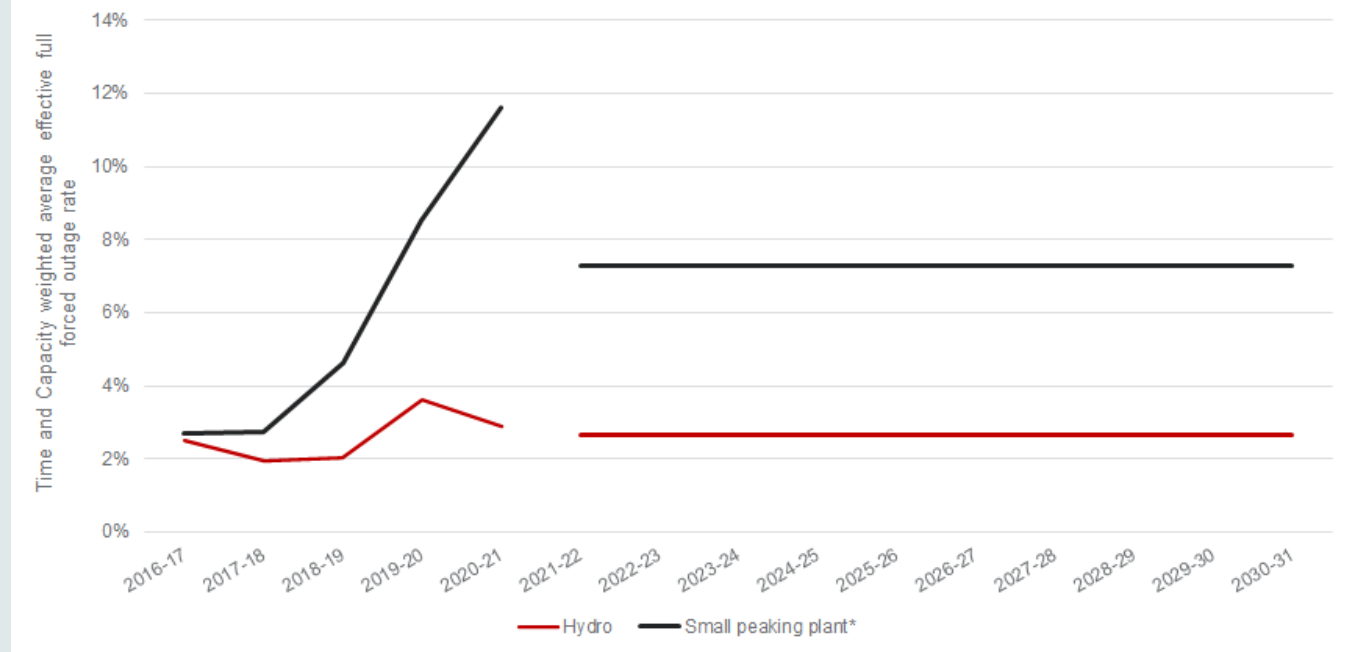
# Hydro and Small Peaking Plant Forced Outage Rates developed on agreed methodology

Based on updated calculations:

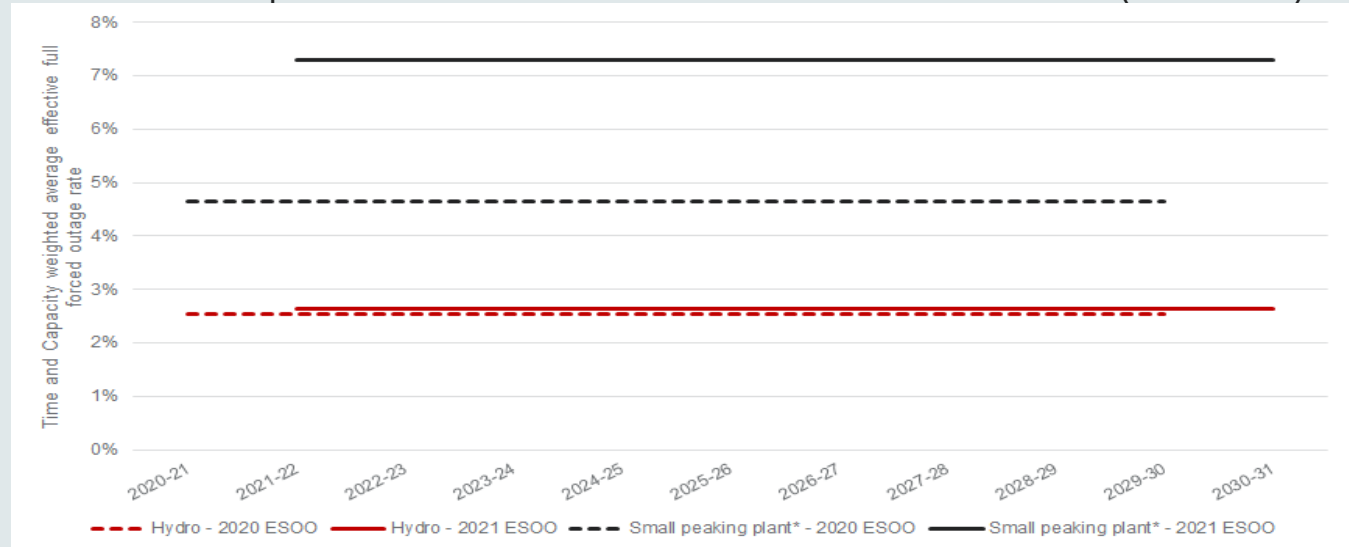
Hydro projections have not materially changed.

Small peaking plant projections have increased against the 2020 ESOO, reflecting recent performance.

## Hvdro and Small peaking plant EFOR actuals & forecasts



## Comparison of 2021 and 2020 EFOR forecasts (no HILP)



# Identification of three additional inter-regional transmission lines

The lines identified all materially contribute to inter-regional transfer capability and have sufficient historic evidence to justify inclusion.

South Morang – Dederang and Dederang to Upper/Lower Tumut are predominantly impacted by bushfire reclassification; while other lines are impacted by a variety of other causes.



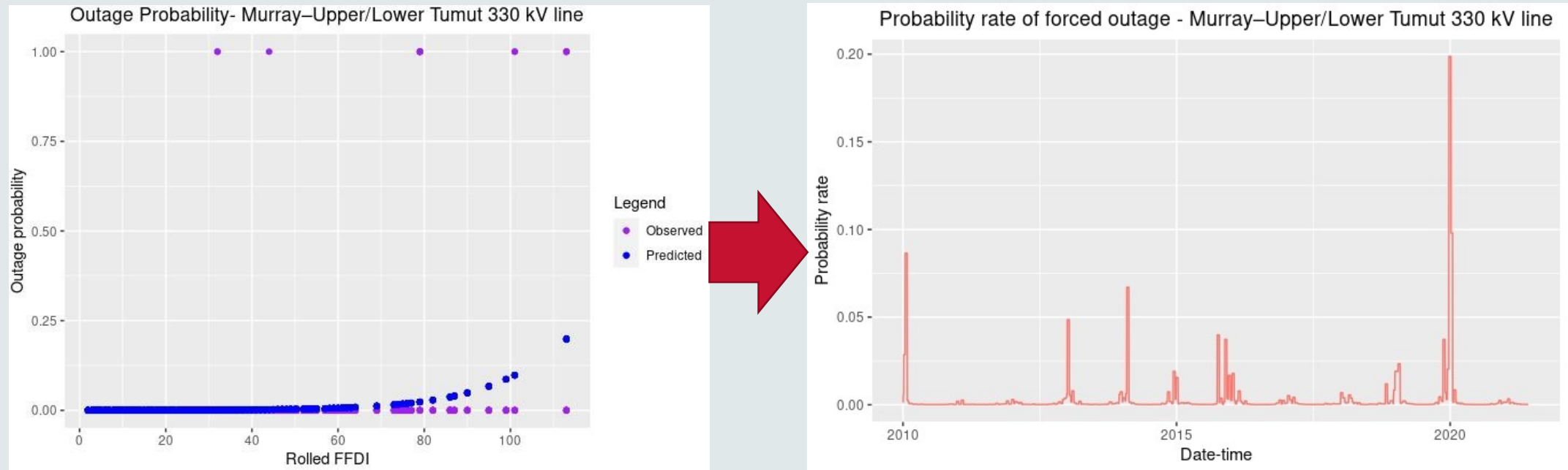
# The broader set of transmission lines more accurately informs reliability implications

Line	Modelling	2020 FOR	2021 FOR
Liddell – Dumaresq	Static annual FOR	N/A	1.30%
South Morang – Dederang	Regress against weather	0.53%	0.27%
Dederang – Upper/Lower Tumut	Regress against weather	N/A	0.98%
Murraylink	Static annual FOR	N/A	1.39%
Moorabool – Tailem Bend	Static annual FOR	2.64%	2.33%
Basslink	Static annual FOR	0.07%	0.62%

All outage rates are derived from outage history consisting of single credible contingencies and reclassifications. The constraints that will be applied when these outages are triggered reflect operational constraints during single credible contingencies (single circuit failure only) and/or reclassifications.

Due to small sample sizes, all lines will use the average Mean Time to Repair of 21.3 hours.

# Weather dependent FORs better model real-world bushfire risks to transmission changing over time



As consulted on as part of the Forecast Improvement Program, AEMO has modelled weather dependent forced outage rates where relevant.

Traces have been developed based on the observed relationship between bushfire weather (Forest Fire Danger Index [FFDI]) and transmission incidents. The rates reflect the weather dependent nature of bushfire risk in northern Victoria.

These traces influence the timing of the transmission incidents to more realistically align with the weather in the reference years.

This weather and rate are then adjusted to reflect climate change trends as discussed in the May 2021 FRG.

# Questions for consultation

- Has AEMO correctly applied its generation FOR methodology?
- Do the identified transmission lines and the identified factors appropriately reflect inter-regional transfer capability?