Victoria to NSW Interconnector West (VNI West)

Consultation Report | Gippsland REZ

28 March 2023

We acknowledge the Traditional Owners of country throughout Australia and recognise their continuing connection to land, waters and culture.

We pay respect to Elders past, present and emerging.

Agenda

	Agenda item
Model overview	VNI West market modelling optimisation
Gippsland REZ	Background on REZ modelling
	Gippsland input assumptions
	Gippsland REZ outcomes
	Gippsland REZ outcomes – offshore wind
Renewable energy spill	Spill calculation
	Spill outcomes
Resources	

Purpose: to give clarity about REZ modelling and Gippsland REZ inputs assumptions and outcomes in particular.

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Model overview

VNI West RIT-T market modelling

Inputs: 2021 IASR and 2022 ISP	
Existing generators and storages parameters	Carbon budget
Demand forecast	Committed policies
New entrant options (wind, solar, battery, pumped hydro)	Network constraints
New entrant parameters	Network augmentations (PEC, HumeLink, etc.)
Weather pattern reference years	REZ constraints (transmission, resource, land)
Coal retirements	VNI West options assumptions

Hourly Time sequential Integrated Resource Planner (TSIRP)

Least cost optimisation (minimises cost of demand supply subject to network and non-network constraints)

Outcomes (Base Case and with each option)

- *Capacity and generation outlook (including REZ transmission)*
- Capital cost of new generation and storage
- FOM, VOM, and fuel costs
- REZ transmission costs
- Cost of voluntary load curtailment
- Cost of involuntary load curtailment

- Compare cost of supply (system cost) with and without the augmentation being assessed and compare against augmentation cost, outside of the market modelling.
- Consistent with RIT-T guidelines for actional ISP projects published by AER.

Sources: Market modelling report accompanying the Additional Consultation Report, Appendix C
Australian Energy Regulator, August 2020, Cost benefit analysis guidelines

Gippsland REZ

REZ background – *ISP methodology*

Concept	Definition
REZ initial resource limit (MW)	• Initial resource limit reflecting assessment (by AEMO for ISP) of land availability and resource quality. • Separate value for wind high capacity factor, wind medium capacity factor and solar per REZ. • 'Soft' limits that can be exceeded at a penalty cost.
REZ resource limit violation penalty factor ($/MW)	• Represents additional land cost for difficulties in obtaining land and more complicated approval process as REZs become more developed.
REZ maximum build limit based on land area (MW)	• A 'hard' land use limit of 5% for onshore wind and 1% for solar; 0.24 km^2/MW for wind and 0.02km^2/MW for solar. • Separate values for wind and solar per REZ.
REZ transmission limit (MW)	• The transfer capability of the shared transmission network, and taking into account any local load (done by AEMO for ISP through PSS®E studies). • Imposed on dispatch per hour. • 'Soft' limit. There is no maximum REZ transmission limit.
REZ transmission expansion cost ($/MW)	• Assumed cost of optional expansion for each REZ. If incurred, increases the right-hand side of the dispatch constraint for the remainder of study
REZ wind and solar quality	• Capacity factors for available generation (wind high, wind medium and solar) • Vary with weather/reference years

Sources: AEMO, July 2021, *2021 Inputs, assumptions and scenarios report*, Sections 3.6.2 and 3.9
AEMO, August 2021, *ISP methodology report*, Section 2.3.4

Example of multiple constraints

Example	Wind resource limit (MW)	Land area (km^2)	Resource limit based on land usage (MW)	REZ transmission limit (MW)	REZ transmission expansion cost ($/MW)	Hard limit for wind resource
Resource limit only	2,000 MW	Unlimited	Unlimited	Unlimited	N/A	• Base cost up to 2,000 MW wind • At additional cost after 2,000 MW wind • Unlimited total wind build
Resource limit and land area limit, large REZ	2,000 MW	20,000 km^2	~4,160 MW = 20,000 km^2* 5% / 0.24 km^2/MW	Unlimited	N/A	• Base cost up to 2,000 MW wind • At additional cost after 2,000 MW wind • Up to total 4,160 MW wind
Resource limit and land area limit, small REZ	2,000 MW	5,000 km^2	~1,000 MW = 5,000 km^2 * 5% / 0.24km^2/MW	Unlimited	N/A	• Base cost up to 2,000 MW wind • No further build since initial resource limit is greater than land use limit
Resource limit and land area limit, large REZ, with transmission limit	2,000 MW	20,000 km^2	~4,160 MW = 20,000 km^2* 5% / 0.24 km^2/MW	4,000 MW	0.5 $M/MW	• Base cost up to 2,000 MW wind • At additional cost after 2,000 MW wind • At additional transmission cost after 4,000 MW dispatch required • Up to total 4,160 MW wind

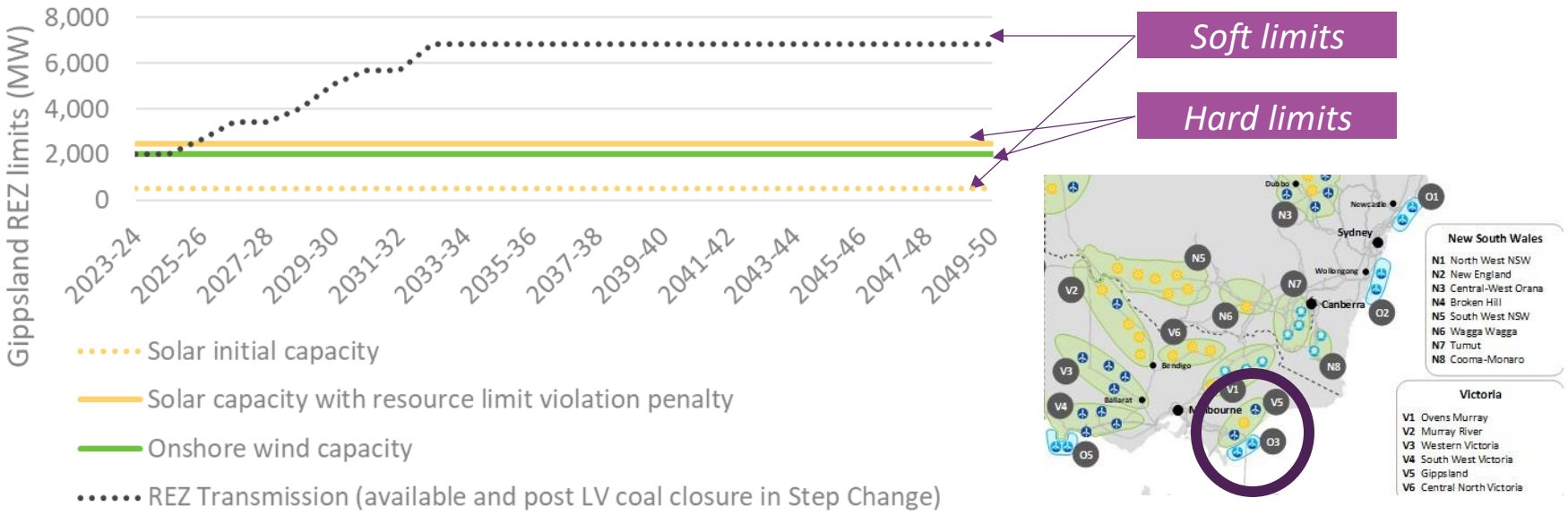
- Solar resource limits and land area limits also layered on top.
- REZ transmission limits are a dispatch limit. Model can build more wind and solar, but only dispatch at limit in each hour.

Gippsland REZ – *ISP 2022 input assumptions*

REZ ID	REZ Name	Wind generation total limits (MW)			Solar PV limits (MW)	REZ resource limit violation penalty factor ($M/MW)	REZ transmission network limit	Indicative transmission expansion cost ($M/MW)	Land area (km²)[9]
		High capacity factor	Medium capacity factor	Offshore					
V5	Gippsland	500	1,500	-	500	0.25	2,000, increase with coal closures	0.57	4,947
O3	Gippsland Coast	-	-	10,000	-	-	Included in V5 limit	As per V5	-

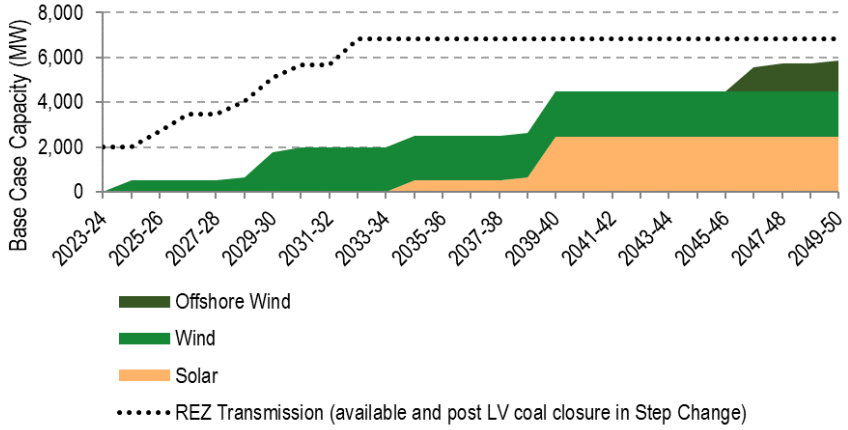
Transmission constraint
onshore wind generation + offshore wind generation + solar generation < 2,000 + retired Latrobe Valley coal capacity + optional REZ transmission build

Constraint is met on hourly basis, right-hand side can increase at the cost of REZ transmission expansion cost.

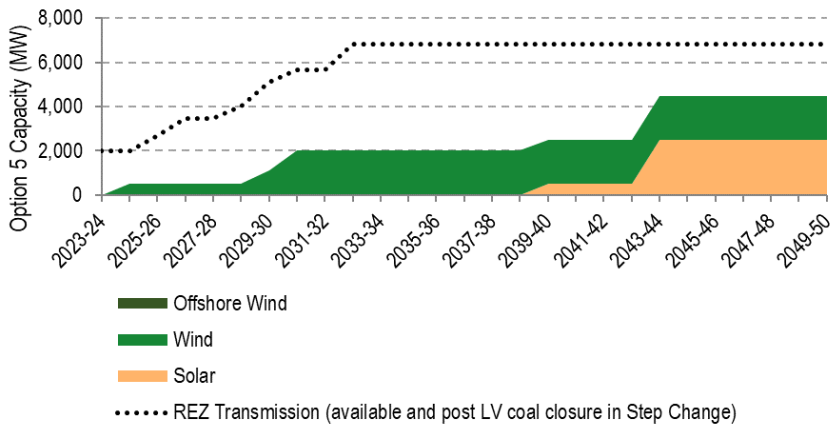


Gippsland REZ – Step Change outcomes

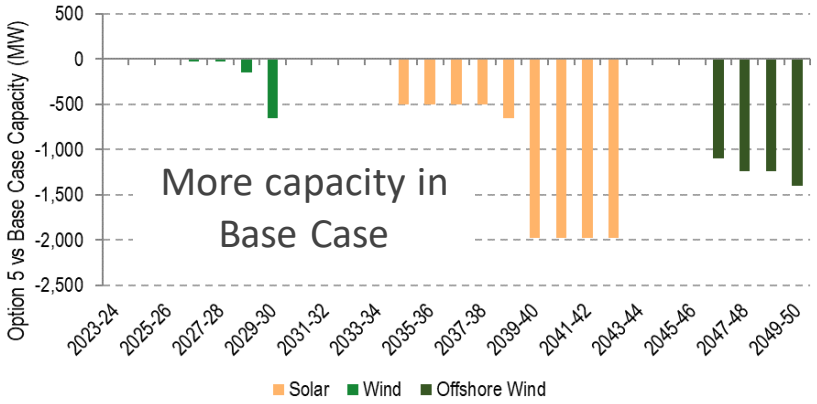
Base Case



Option 5



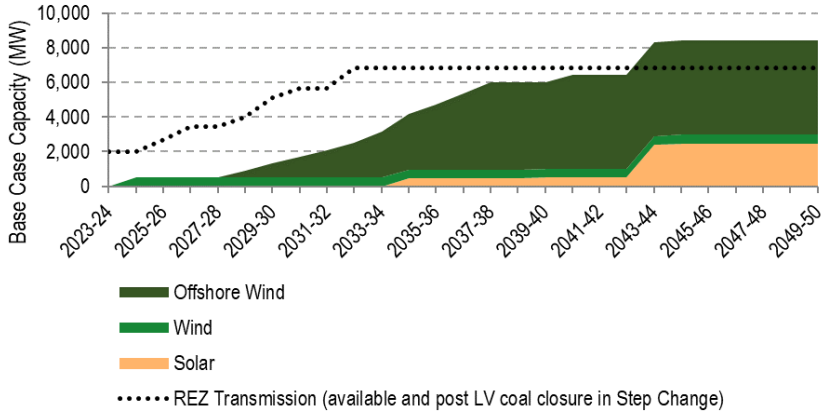
Option 5 minus Base Case



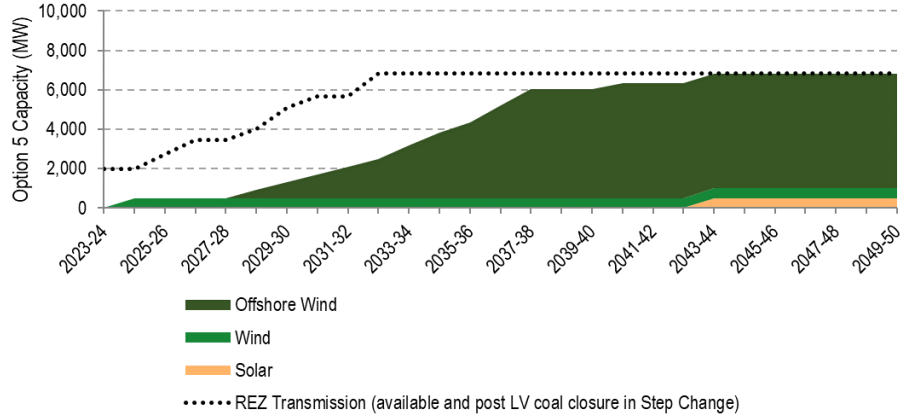
- Transmission is not limiting build in Gippsland REZ
- Model has the option to increase the REZ transmission limit for additional cost, but this is not part of the least-cost outcome in the Base Case or any option cases in the Step Change scenario because of the additional headroom provided by Latrobe Valley coal retirements.

Gippsland REZ – Step Change, offshore wind sensitivity outcomes

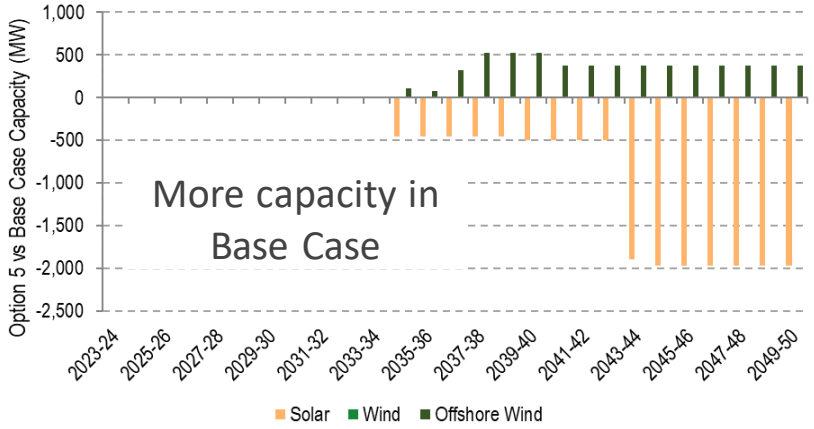
Base Case



Option 5



Option 5 minus Base Case



- Offshore wind options in Portland and Gippsland, and the model forecasts how much to build in each REZ to meet the 9 GW announced policy.
- Transmission constraint is modelled as a dispatch constraint, so even though the total wind+solar build in the Base Case is greater than the transmission limit, transmission expansion for this REZ is not forecast.

Large Scale Variable Renewable Spill

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Variable renewable spill – Step Change outcomes

- Approach 1 used in additional consultation report:

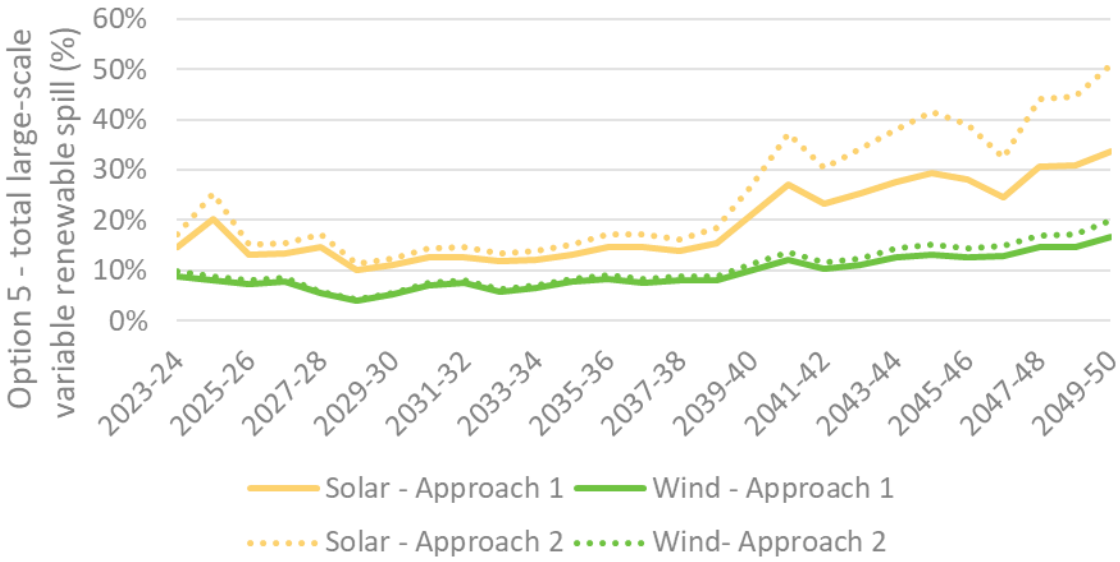
$$Spill(\%) = \frac{Available\ generation - actual\ generation}{\boldsymbol{available}\ generation}$$

- Approach 2 used in submissions:

$$Spill(\%) = \frac{Available\ generation - actual\ generation}{\boldsymbol{actual}\ generation}$$

  - Example: a solar farm with available generation of 100 GWh and spill of 51 GWh
    - % spill using approach 1 = 51/100 = 51%
    - % spill using approach 2 = 51/(100-51) = 104%
  - The amount of spill in GWh is the same.

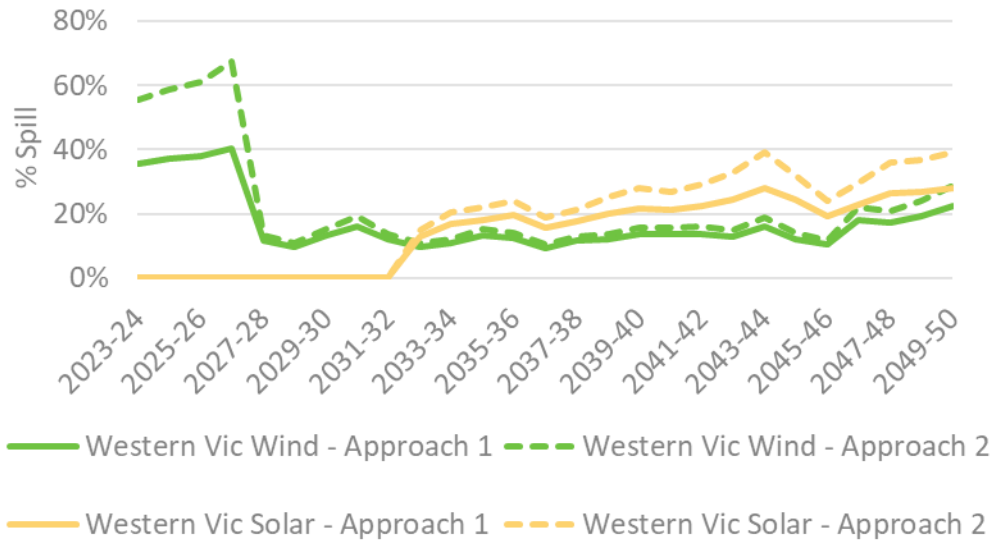
NEM large-scale variable renewable spill, Step Change scenario



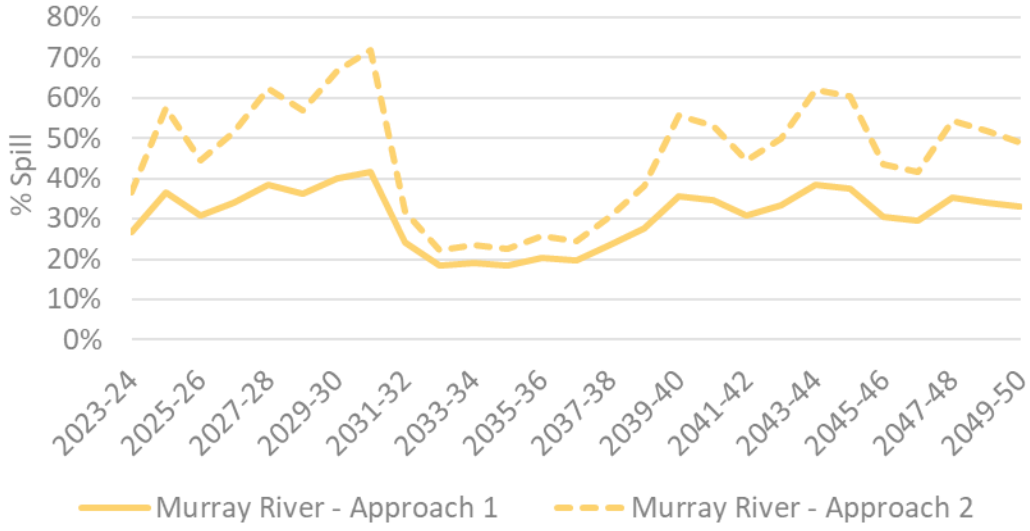
Spill outcomes observed are comparable to AEMO ISP 2022 outcomes

Variable renewable spill – Step Change outcomes

Western Victoria REZ spill



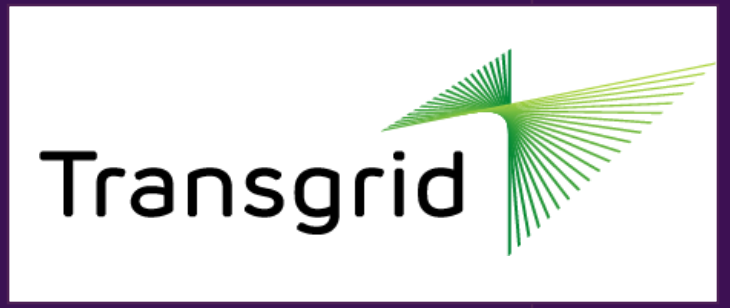
Murray River REZ spill



List of resources

References

Topic	Further reading
Least-cost optimisation	Market modelling report accompanying the Additional Consultation Report, Appendix C
	Australian Energy Regulator, August 2020, *Cost benefit analysis guidelines*
REZ concepts	AEMO, August 2021, *ISP methodology report*, Section 2.3.4
REZ input assumptions	AEMO, July 2021, *2021 Inputs, assumptions and scenarios report*, Sections 3.6.2 and 3.9
	AEMO Input assumptions and scenario report workbook v3.4, July 2022, Sheet 'Build limits'
AEMO ISP 2022 spill outcomes	AEMO 2022 Integrated System Plan, June 2022, Section 3.5
VNI West model outcomes	Market modelling workbooks accompanying the Additional Consultation Report



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