20.6 Planning the green energy transition. The AEMO 2020 Integrated System Plan

Purpose: **To explain the purpose of the ISP, its scenarios and assumptions**

The Critical Issues:

(1) Scheduled retirement of scheduled generators (coal, gas, battery), with construction of intermittent wind and solar:

Period	Retired dispatchable MW	Built dispatchable MW	Intermittent MW
2010-2020	2,500		7,100 built
2020-2030	5,800	2,400 (incl Snowy 2)	10,500 underway
2030-2040	14,000		39,000 announced
2040-2050	12,000		

(2) The ISP is the official National Electricity Market transmission network plan. It requires network operators to begin planning the transmission projects that AEMO wants. It is designed to encourage more wind and solar into the network.

This is central planning at its worst – many network companies are privatised with foreign ownership. Because of the regulated cost recovery, network companies earn more from more assets. Every km of network adds to Australian consumer power bills and makes the country less competitive.

(3) Despite the massive amounts of wind and solar being built, the grid still requires investment in dispatchable generation. The ISP cost benefit analysis for transmission projects relies on modelling that includes a carbon price (CSIRO GenCost) and assumptions that are unfavourable to coal and gas. The taxpayer funded Snowy 2.0 is the only dispatchable generation planned apart from AGL's 250 MW gas peaker in Newcastle and some minor upgrades to existing plant capacity. Much more will be needed.

(4) No allowance is made in the ISP for replacement of coal fired power stations, despite Australia's ready access to high quality thermal coal as fuel. This can only be described as ideology, not economics or science.

Key features of the situation. (Briefing Paper follows)

Recommendations.

That all politicians and media be advised:

- The National Electricity Market network is becoming centrally planned, with accountability being removed from the states
- The ISP assumes massive amounts of wind and solar will be built, and is planning to build new networks not only to accommodate wind and solar, but to expand it beyond the bounds of open market competition
- The ISP deliberately applies unfavourable assumptions to economic modelling of coal and gas
- A larger more complex network costs more to build and maintain – foreign owned transmission network companies recover these costs at regulated profit margins – this is incentive to build more transmission networks
- CSIRO GenCost mentions "renewables" 70x, "carbon price" 52x, "reliability" 1x, "intermittent" 0x

Briefing Paper – The AEMO 2020 Integrated System Plan (ISP)

Purpose: To explain the purpose of the ISP

AEMO's ISP is described as a cost benefit analysis and risk assessment culminating in a set of recommendations for transmission investment over the next 20yrs. The ISP is being made 'actionable' by replacing the first stage of the transmission investment decision process (RIT-T). The practical outcome of the ISP is that transmission companies are obliged to progress the 'actionable' ISP transmission selections, detailed in 2020 ISP Appendix 3.

Project	Capacity (MW)	Cost ($m)	Description
VNI Minor	170	105	an upgrade to the existing Victoria to New South Wales Interconnector (VNI) to improve transfer from Victoria to New South Wales
Project Energy Connect	800	1990	a proposed 330 kV interconnector between South Australia and New South Wales.
HumeLink	2500	2100	a proposed major transmission line in New South Wales to connect the Snowy Mountains hydroelectric scheme to the Greater Sydney load centre
Central-West Orana REZ	3000	650	expansion of the network to connect 3,000 MW of new generation which is expected as part of the New South Wales Electricity Strategy
VNI West	2000	1730	a proposed interconnector between Victoria and New South Wales
Marinus Link Stage 1	750	1845	a proposed HVDC link between Tasmania and Victoria
TOTAL		8420	

The ISP is not a plan setting out what, when or where investment shall be aimed in new generation. Instead the ISP defines scenarios of system-wide generation changes, ranging from likely (based on existing government policy) to unlikely (accelerated uptake and reducing cost of wind, solar and batteries). One of the largest drivers of change in the NEM is the scheduled retirement of coal-fired generation. Investment is required to replace (or extend the life of) these generators. The ISP assumes that the renewable transition is inevitable and defines scenarios to suit. The scenarios are, from slowest to fastest:

- Slow change – slow technology cost change, and low emissions reduction effort, some coal generator life extensions
- Central – current government policies and generator retirement as scheduled
- Fast change – increased subsidies and lower costs for wind and solar and batteries, early coal generator retirement
- High DER – low technology cost, high participation (rooftop solar, home batteries, EV, VPP)
- Step change – fast change, plus high consumer participation in DER

No ISP scenario (and therefore no transmission option) considers new coal, which is excluded from the mix based on capital and fuel cost projections. The ISP excludes coal-fired power from its modelling scenarios by:

- Limiting coal-fired power life-extensions to 10yrs (Slow change scenario only)
- Aggregating hourly demand in system reliability modelling (smoothing peaks)
- Restricting coal-fired power to minimum capacity in economic modelling (low capacity factor)
- Using CSIRO GenCost for future build rates and costs with a built-in carbon price that increases over time
- Assuming greenfield projects only, with new rail and land development costs on top of physical generation
- Assuming thermal coal fuel at international prices

The ISP includes several fast change scenarios, and only one slow change scenario. The central scenario rests on existing state and federal government policies but assumes market forces are driving the transition to renewables. In fact, those same state and federal government policies have distorted the market, so the overwhelming majority of generation built in the last decade has been wind and solar. Alongside the market favouritism deliberately applied to wind and solar generators, the risk of carbon pricing makes for an unfavourable investment environment for new coal fired power stations.

A fundamental truth of the NEM is that 15 GW (60%) of the coal-fired power station fleet have scheduled retirement dates before 2040. The ISP central scenario assumes (encourages) replacement of 15 GW of retiring coal-fired generators, including site rehabilitation costs, with:

- New 26 GW variable generation (wind and solar)
- New 6 – 19 GW of gas, batteries, pumped hydro and demand management
- New $11b of transmission to connect wind and solar, and interconnectors between states to allow excess generation to spill into other states
- New demand management and auxiliary services (market reform) to keep the system stable

The ISP calls this plan 'least cost' based on the zero fuel costs, and lower capital costs, of large-scale wind and solar. But the ISP does not include any life-extension of existing coal-fired power plant in the central scenario, only in the slow change scenario (and only for 10yrs), which the ISP modelling says needs only 8 GW of wind and solar to become the least cost pathway. AEMO modelling of the slow change scenario avoids most new interconnector builds because the coal-fired power station life-extensions avoid wind and solar investment.

The ISP's 2020 Market Modelling Methodologies report explains simplifications made in the modelling that disadvantage coal-fired power:

- Aggregating hourly demand – this can hide spikes in demand that wind and solar cannot match, and dips in demand caused by wind and cloud variances, that wind and solar can also not correct
- Using minimum capacity factors and loads for thermal generators – this not only increases the per unit cost of generation but increases the emissions – overall lower efficiency
- Thermal generators modelled using a notional capacity – e.g. if the model asks for a 150 MW of coal power, but the notional capacity is set at 750 MW, that contribution from coal is excluded and replaced with other sources
- The ISP modelling does not make allowances for intermittent generation lowering the capacity factor of every generator participating in the wholesale market

AEMO's 2019 Forecasting and Planning Scenarios, Inputs, and Assumptions report associates the slow change scenario with RCP8.5, a UN IPCC climate change metric assuming a massive increase in global emissions – not a realistic proposition – and higher finance costs than all other scenarios. Technology cost projections are taken from the CSIRO GenCost model, with the ISP central scenario getting the '4-degrees' cost projection figures.

A notable extract from the Inputs and Assumptions report is:

"For the 2019-20 planning and forecasting publications, AEMO will use cost projections to build new generation technologies developed by CSIRO's Global and Local Learning Model (GALLM), which has been the subject of extensively consultation with stakeholders within the GenCost 2018 project."

Followed by this:

Build cost scenarios

CSIRO GALLM build cost projections are a function of global and local technology deployment. As the global technology deployment depends on the global climate policy, CSIRO GALLM build cost projections are given for two scenarios, termed "4-degrees" and "2-degrees" to describe the global climate policy goal. These form the basis for the technology cost reductions assumed in each scenario, as outlined in Table 3. Note that these costs only represent the capital cost component of a new power station. To understand the delivered cost of energy for each technology, a number of additional factors need to be considered, for example, fuel costs (if applicable) and capacity factors.

Consulting the CSIRO GenCost 2019 report, issued with the 2020 AEMO ISP, we find the following explanation of GALLME modelling:

A.1.2 The modelling framework

In order to project the future cost of a technology using experience curves, the future level of cumulative capacity/uptake needs to be known. However, this is dependent on the costs. The GALLMs solve this problem by simultaneously projecting both the cost and uptake of the technologies. The optimisation problem includes constraints such as government policies, demand for electricity or transport, capacity of existing technologies, exogenous costs such as for fossil fuels and limits on resources (e.g. rooftops for solar photovoltaics). The models have been divided into 13 regions and each region has unique assumptions and data for the above listed constraints.

A.2 GALLME assumptions

A.2.1 Government policies

GALLME contains government policies which act as incentives for technologies to reduce costs or limits their uptake. The key assumption about government policy that has an impact on results is a carbon price. The carbon prices are based on those of Clarke et al. (2014).

The Central scenario uses the 4-degrees carbon price trajectory from GenCost 2018. The High VRE and Diverse technology carbon price trajectories are shown in and the Central scenario carbon price trajectory is shown in are designed and are shown in Apx Figure A.2and Apx Figure A.3 respectively.