

Thank you for providing the opportunity for submissions in relation to the redesign of the Australian energy market post 2025. The ESB's investigation of this subject area is urgently needed, in light of the simultaneous revolutions occurring in Australia's electricity markets, transport systems and their energy sources, and the pressing need for integration of these changes with those also emerging in relation to industrial fuel and energy systems.

This submission focuses on the centrality and transformational impact of energy storage in relation to the future design of Australia's energy markets, energy security and domestic economic efficiency.

Summary of Submissions and Recommendations

1. The huge declines in the cost of renewable energy generation, especially solar PV and wind, have resulted in a fundamental reshaping of the economics of energy production in Australia for both domestic consumption (across all sectors, most immediately electricity production but also increasingly, and inevitably, in transport and industry). This reshaping is already substantially advanced, and is continuing to occur much faster than suggested by official projections from regulators (AEMO, AER, and especially AEMC) or in previous Federal agency forecasts (such as the Australian Energy Technology Assessment). Chronic under-estimation of cost reductions and efficiency gains delivered by renewable energy have distorted energy market management, policy and infrastructure planning, resulting in significant misdirection of capital investment and cost increases for energy consumers. It has also resulted in Australia's poor performance against carbon emissions reduction targets.

Recommendation 1: The ESB and COAG Energy Council should ensure that all future energy market and system design processes are based on projections of renewable energy and energy storage cost reduction reflecting actual experience and market evidence since 2010 of renewable energy and energy storage technology cost reduction and uptake - globally and in Australia. The historic and pervasive practice of Federal government agency under-estimation of the rate of uptake of, and reduction in cost of, renewable energy production and storage has caused significant market and policy confusion, and capital allocation inefficiency and system reliability inefficiency. This practice must be abandoned and replaced by default expectations of cost reduction and uptake which reflect evidence, particularly in the period since 2010.

2. Energy storage is already commercially viable and viability is improving and expanding across market segments and industries (industry, transport, agriculture, mining as well as electricity consumers). These trends are irreversible and transformational. They are driven by multiple factors, all of which are also accelerating: (a) technology improvement (both as to specific systems and technologies, and as to digitisation of services for integration of systems, technologies and services), (b) consumer awareness and demand (across all segments of consumption), and (c) accelerating innovation in energy-related finance. The only impediments to these trends are policy uncertainty and active retarding policy intervention by Federal government.

Recommendation 2: ESB and COAG Energy Council planning must be based on the high probability that widespread uptake of energy storage in all forms is inevitable and will accelerate, including (a) electricity in batteries (of multiple technology types), (b) kinetic energy in the form of pumped hydro, (c) chemical storage (hydrogen, ammonia and hydrogen energy carriers) and (d) thermal energy storage (including integrated solar thermal).

3. Moreover these trends towards increasing energy storage capacity across all energy market segments are highly desirable - in terms of efficiency of energy production, distribution and use. Reduction in reliance on production and distribution systems that are

based on immediate energy production and use will result in greater overall capital efficiency by minimising excessive production capacity (spinning reserve) and optimising transmission and distribution infrastructure capacity (reducing peak energy flow requirements). It will deliver greater overall system reliability and security by facilitating an optimised mix of local energy production and storage with regionalised and centralised capacity. Energy market capital efficiency, security of supply and reliability of supply will be best supported by policy and market design measures that encourage innovation (rather than, as presently, seeking overall to maintain historic status quo and protect historic production, transmission and distribution asset values). Market design must provide flexibility to enable capital to move to the most economically efficient composition of production, distribution and storage infrastructure. Write-downs of historic capital values in redundant assets (in energy production, transmission and distribution) are inevitable; these have been artificially delayed to date, retarding efficiency overall, but must now be allowed to flow through energy sector balance sheets. It is appreciated that this will require difficult adjustments for State governments still holding significant assets in these classes. However, to fail to permit this natural evolution in capital structures across the energy, transport and industrial sectors will continue to deliver mis-allocation of investment and poor system and pricing outcomes.

Recommendation 3: Planning and market design must recognise the inevitability and desirability of wide-spread uptake of multiple forms of energy storage and must reflect the inevitable impact this will have on existing (historic) asset values in the NEM. Future market design must include measures to encourage and to manage the process of historic asset write-down in relation to energy production, transmission and distribution assets made redundant by the conversion to an energy-storage based market and system.

4. Convergence of electricity, transport and industrial energy segments creates a fundamentally different energy model from that which has prevailed through the 20th and early 21st centuries. From the early 20th century, transport was been fueled by oil, and electricity by (predominantly) coal, added to subsequently by other non-transport fuel types (gas, nuclear). Concentration of capital in energy markets has as a consequence been split in two for over 100 years - to oil and gas on the one hand, and coal on the other. This separation of capital for electricity and for transport respectively disappears with high levels of energy storage uptake. Transport, electricity markets, agriculture and industrial energy markets, can all be served from essentially the same pool of production, storage and distribution infrastructure. The resulting concentration of capital will (absent active negative policy intervention to protect historic assets) drive significant productivity and efficiency improvements. This is particularly so where, as in Australia, transport energy requirements are overwhelmingly met by imported product (oil) - reduction in oil imports and their replacement by domestically produced and stored energy is overwhelmingly positive economically, and in strategic and energy security terms. It follows that convergence of energy markets - across electricity, transport, agriculture and industry - should be a focus of and an explicit objective of ESB and COAG Energy Council policy and market design. This logically requires that the structure of energy market regulation should be overhauled, and the National Electricity Objective be fundamentally reviewed to ensure integration of objectives across energy market segments.

Recommendation 4: Convergence of electricity, transport, agriculture and industry energy systems will deliver major economic, strategic and security benefits for Australia, and should be facilitated by market design and policy. It will increase energy self-sufficiency exponentially, reducing reliance on imported and geographically exposed fuels, and enable massive capital efficiency gains (and consequent cost reductions) through integration of infrastructure for production, storage and distribution of electricity and domestically produced (clean) fuels. Encouraging and accelerating convergence of energy markets - across electricity, transport, agriculture and industry - should be a focus of and an explicit objective of ESB and COAG Energy Council policy and market design. The National

Electricity Objective should be reviewed and updated to reflect, and to provide policy support for, this convergence.

5. Australia stands to benefit economically and strategically from working closely with, and integrating policy objectives with, major regional trading partners Japan, South Korea and Singapore in relation to hydrogen-based energy systems. These benefits can be extended and deepened by Australia working also with ASEAN+ and APEC partners presently considering future energy security and decarbonisation priorities, to ensure their energy policies also incorporate a major role for hydrogen-based energy and transport systems. These benefits are in two forms: first, the potential for Australia's domestic energy markets (given their relatively small scale) to enjoy significant cost reductions through leveraging infrastructure and investment scale in these of these major north Asian markets, as they invest in supply chains to secure long-term security of low-cost supply of clean energy imports; and second, the potential for export revenues and direct investment on a scale comparable to Australia's LNG industry, for clean energy production in Australia for export to Asia. Hydrogen (liquid or gaseous), ammonia, and other hydrogen energy carriers have major potential to facilitate these benefits for Australia. Direct (HVDC) transmission links also have significant, though geographically limited, potential to provide similar benefits.

Recommendation 5: Australian energy market policy and design should take full account of, and incorporate measures and mechanisms designed to win for Australia a major share of, the emerging market in Asia for clean energy supply in the form of hydrogen (transported in various forms, including particularly ammonia), and electricity (via HVDC link). The immense scale of potential demand for clean energy - carbon-free electricity and fuels - in these markets, can provide economies of scale making Australia's domestic electricity and clean fuels world-leading in low cost, and at the same time create for Australia a major new export industry comparable in export revenue and in direct capital attraction to the LNG industry.

Kind regards

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