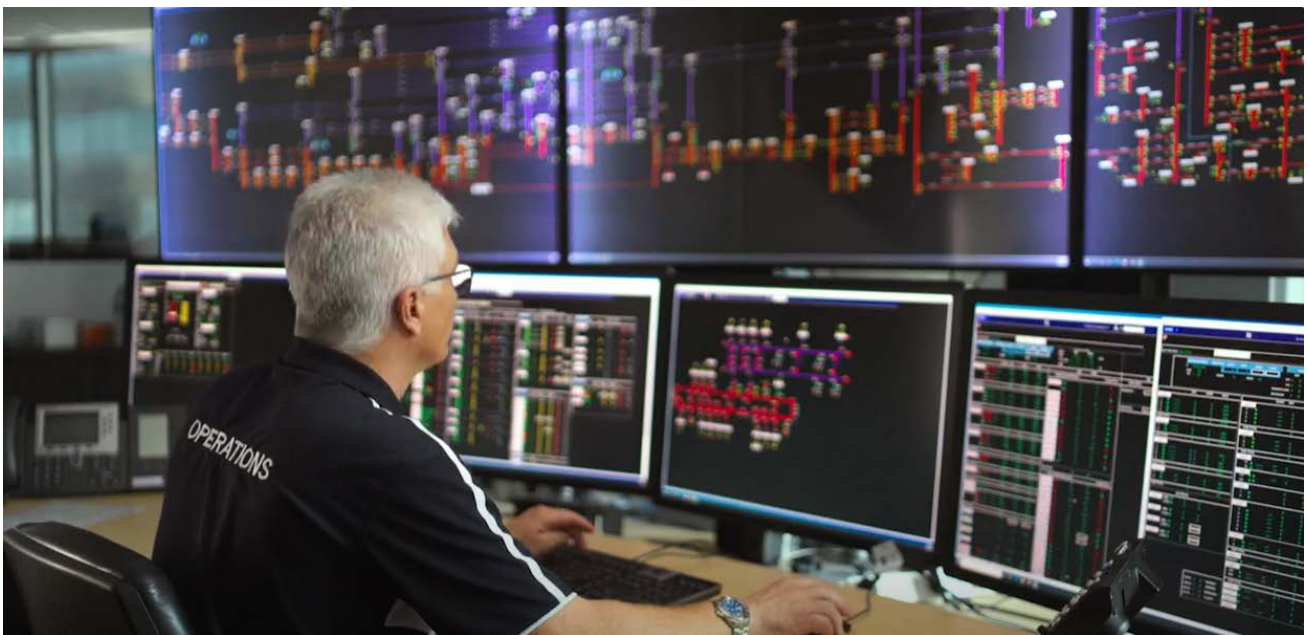


The energy transition

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On 6 November 2024, renewable energy met 75.6% of electricity needs in the National Electricity Market (NEM) that serves eastern Australia. Just days later, on 17 November, the South West Interconnected System (SWIS) in Western Australia reached a renewable contribution record of 85.1%.

Both NEM and SWIS power systems have now seen periods where there was enough renewable energy potential on the system to meet 100% of electricity needs, although for market and operational reasons not all that potential could be used to meet demand.

These days, breaking power system records is a regular event. With South Australia's last coal-fired power station having exited the market, the state has seen corresponding innovation to keep the power system secure, including four new synchronous condensers and fast frequency response provided by batteries.

Households and businesses are also playing a role. Growth in new rooftop solar systems has averaged 12% year on year over the past five years, and parts of the power system already able at times to meet 100% of demand from these consumer-owned generators. A second wave of change is also on the way as households increasingly electrify their hot water and heating systems and begin to invest in home batteries and electric vehicles.

The energy transition is a once-in-a-century change to the way Australians generate and consume energy. To continue breaking records and deliver the energy transition in a way that meets the long-term needs of Australian consumers, we will require increased investment in new and existing technologies, advanced operational capabilities, and a skilled and diverse workforce.

Increased investment in new and existing technologies

AEMO's *Integrated System Plan* (ISP) optimal development path sets out the generation, storage and transmission needed to support the energy transition to net zero by 2050 under current policy settings in Australia. The 2024 ISP, released in June, calls for investment that would:

- triple grid-scale variable renewable energy by 2030, and increase it six-fold by 2050
- focus grid-scale generation in renewable energy zones
- almost quadruple the firming capacity provided from technologies like grid-scale batteries, pumped hydro and other hydro, coordinated consumer energy resources (CER) operating as virtual power plants, and gas-powered generation
- see close to 10,000 km of new transmission network built by 2050
- support a forecast four-fold increase in rooftop solar capacity
- leverage system security services and operational practices to ensure the NEM stays reliable and secure as the renewable share of generation approaches 100%.

This new investment would require \$142 billion in upfront capital expenditure on essential electricity infrastructure and would deliver significant net market benefits for consumers. But there are significant risks. To realise this necessary investment, Australia's governments, regulators, AEMO and market participants must ready market and policy settings, earn and maintain social licence with affected communities and consumer groups, and overcome supply chain challenges.

Advanced operational capabilities

AEMO's Engineering Roadmaps for the NEM and SWIS are intended to advance our operational capabilities for times of high renewables, keep ahead of the engineering challenges as we move through the energy transition, and support the continuing market growth of renewables. AEMO sees the priority actions for the energy sector as:

- delivering foundational transition enablers, including defining new roles and responsibilities for new technical matters and establishing effective processes for future system operation. One example is the introduction of clear governance frameworks for the integration and operation of increasing volumes of CER, such as rooftop solar
- providing long-range investment visibility, by identifying future power system needs that may need investment from multiple parties, as well as providing clarity on what will be needed from different technologies to meet those needs. Last year, AEMO released a voluntary specification for grid-forming inverters to support this need
- progressing operational readiness, to make sure power system security is maintained in real-time operations with increasing contributions from variable, inverter-based and distributed resources.

The sector has a lot of urgent work ahead to prepare for the energy transition and make sure the necessary market and operational procedures are in place before the change is upon us.

A skilled and diverse workforce

A large and skilled workforce is needed in Australia across every discipline (not just engineering) to deliver the energy transition. In the 2024 ISP, AEMO estimates that the demand for skilled people directly employed to build and maintain energy infrastructure is forecast to increase from approximately 36,000 in 2025 to over 60,000 in 2050.

There is a role for all of us to play in meeting the energy transition challenge. I encourage you to read the insights provided in this essay series – from Dr Alan Finkel’s advice on gaining social licence for the transition, through to Satya Tanner and Heidi Lee’s thoughts on how Australia will thrive in the shift to clean energy – and join me in taking up the opportunities offered by this once-in-a-century change to the way energy is generated, stored, moved and used across the economy.

About the author

Daniel Westerman commenced as CEO and Managing Director of the Australian Energy Market Operator (AEMO) in May 2021. He oversees AEMO’s strategy and operations, including collaboration with industry and policymakers. Under Daniel’s leadership, AEMO has ensured a secure and reliable supply of electricity and gas for customers through increasingly complex operations across Australia’s energy grids, and has developed a trusted set of roadmaps to transition Australia to a net zero energy system. Internally, AEMO has built a purpose-led and values-based culture, with strong uplifts in employee engagement, diversity and inclusion, customer orientation, and financial performance. AEMO is a trusted partner of both industry and government.

Prior to joining AEMO, Daniel held a variety of senior executive roles with London-listed electricity and gas utility National Grid Plc., after an earlier career with McKinsey & Company and Ford Motor Company.

Daniel holds degrees in engineering and mathematics from the University of Melbourne, and an MBA from Melbourne Business School. He is a Fellow of the Australian Academy of Technological Sciences and Engineering, a Chartered Engineer, and a Fellow of the Institute of Directors.