Executive summary

Technological change in electricity generation is a global effort that is strongly linked to global climate change policy ambitions. While the rate of change remains uncertain and the level of commitment of each country varies over time, in broad terms, there is continued support for collective action limiting global average temperature increases. At a domestic level, the Commonwealth government, together with all Australian states and territories aspire to or have legislated net zero emissions (NZE) by 2050 targets.

Globally, renewables (led by wind and solar PV) are the fastest growing energy source, and the role of electricity is expected to increase materially over the next 30 years with electricity technologies presenting some of the lowest cost abatement opportunities.

Purpose and scope

GenCost is a collaboration between CSIRO and AEMO to deliver an annual process of updating the capital costs of electricity generation, energy storage and hydrogen production technologies with a strong emphasis on stakeholder engagement. GenCost represents Australia's most comprehensive electricity generation cost projection report. It uses the best available information each cycle to provide an objective annual benchmark on cost projections and updates forecasts accordingly to guide decision making, given technology costs change each year. This is the seventh update following the inaugural report in 2018.

Technology costs are one piece of the puzzle. They are an important input to electricity sector analysis which is why we have made consultation an important part of the process of updating data and projections.

The report encompasses updated current capital cost estimates commissioned by AEMO and delivered by GHD. Based on these updated current capital costs, the report provides projections of future changes in costs consistent with updated global electricity scenarios which incorporate different levels of achievement of global climate policy ambition. Levelised costs of electricity (LCOEs) are also included and provide a summary of the relative competitiveness of generation technologies.

New method for estimating integration costs

This report revises the methodology for estimating the integration costs of renewables and other technologies into the electricity system based on stakeholder feedback. Through various submissions over several years, stakeholders requested that the methodology be revised in two ways:

1. Use a System Levelised Cost of Electricity (SLCOE) approach. A SLCOE takes the cost of electricity directly from an electricity system model by dividing all system costs from multiple existing and new technology deployments by the total useful electricity supply in a given year. This concept is also equivalent to the average annual unit cost of electricity for a given electricity system.

2. Provide greater transparency with regard to the data inputs and the modelling system used.

Separate from these two items the new method also seeks to make electricity system modelling more accessible to stakeholders. To address these objectives, a new open source electricity system model and data set was created to calculate SLCOE, replacing the previous method for estimating the integration costs for solar PV and wind.

The key findings from applying the new costing method are

- The average cost of electricity in the NEM consistent with meeting the 2030 82% renewables target is projected to be $91/MWh including transmission or $81/MWh for wholesale generation cost only.
- To determine the cost of electricity in 2050, we must first determine the efficient contribution of the electricity sector to achieving the net zero by 2050 policy target since that target alone does not define the emissions level for the electricity sector.
- In a whole of economy effort to reach net zero by 2050, the modelling found that it will not be efficient to eliminate all emissions from the electricity sector. It will be more efficient to undertake further abatement elsewhere in the economy.
- The efficient range of emissions intensity of the electricity sector lies somewhere between 0.02tCO_2e/MWh to 0.05tCO_2e/MWh depending on the uncertainty in the whole of economy abatement cost.
- Achieving the electricity sector's efficient role in whole of economy net zero abatement is projected to result in electricity costs in 2050 of between $135/MWh to $148/MWh in the NEM inclusive of new transmission costs or $115/MWh to $124/MWh measured as wholesale generation costs only. For context, in 2024-25, the historical average NEM volume weighted generation price is estimated to be slightly higher than the top end of this range at $129/MWh.
- The combination of solar PV, onshore wind, storage and either natural gas or hydrogen was the least cost technology mix in all cases examined with the addition of carbon capture and storage, offshore wind and nuclear leading to higher average electricity costs. These outcomes are based on average costs. Offshore wind has a much wider capital cost uncertainty range and so could perform better under alternative cost scenarios not explored.
- Achieving weak or no progress in reducing electricity sector emissions in the period between 2030 and 2050 is not efficient for achieving net zero because electricity sector emissions reduction is substantially lower cost than emissions reduction elsewhere in the economy.

These cost estimates do not guarantee future generation prices. Changes in generation prices are also subject to:

- Supply-demand imbalance as a result of too much or too little deployment relative to demand growth and retirements.
- Fuel price and weather volatility.

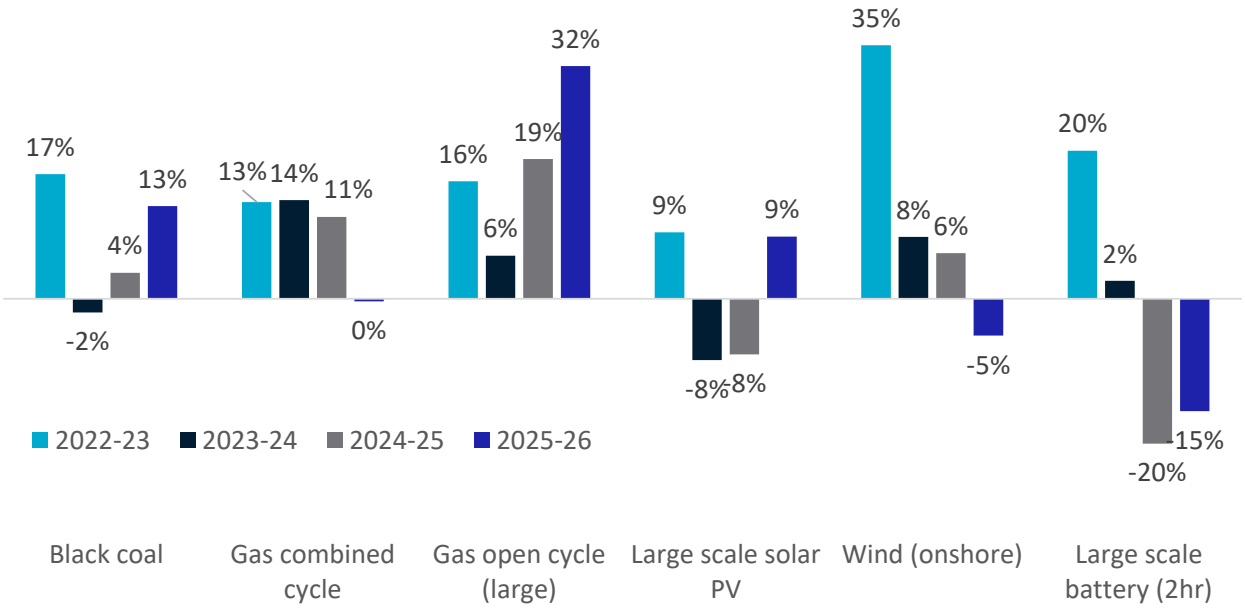
- The level of competition amongst suppliers.

These additional drivers of generation price formation can lead to prices significantly lower or higher than the underlying cost of the system and can take many years to correct due to the long lead times for capacity deployment. Generation prices are currently around 33% of retail prices. Transmission is around 7%, distribution around 34% with the remainder made up of metering, retail services and government programs.

Key changes in capital costs in the past year

The COVID-19 pandemic led to global supply chain constraints which impacted the prices of raw materials needed in technology manufacturing and freight costs. Consequently, past reports have observed consecutive increases in technology costs. For some technologies, the inflationary pressures have progressively eased but the results remain mixed. Technologies have been affected differently because they each have a unique set of material inputs and supply chains.

The biggest recent increases have been in coal and gas open cycle costs. This reflects general increases in gas turbine and steam turbine costs. Battery costs have performed the best in terms of delivering consecutive cost reductions. Onshore wind costs are showing tentative signs of stabilising after experiencing the largest increase in 2022-23.



ES Figure 0-1 Year on year change in current capital costs of selected technologies in the past four years (in real terms)