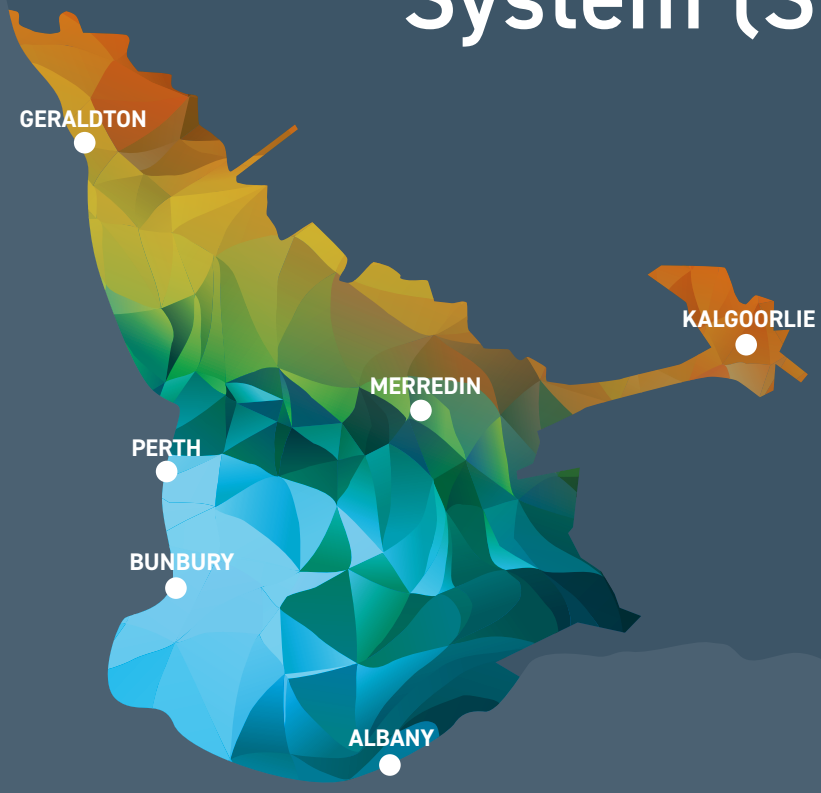
CME
The Chamber of Minerals and Energy of Western Australia

Energy costs in transition: Decarbonising Western Australia's South West Interconnected System (SWIS)



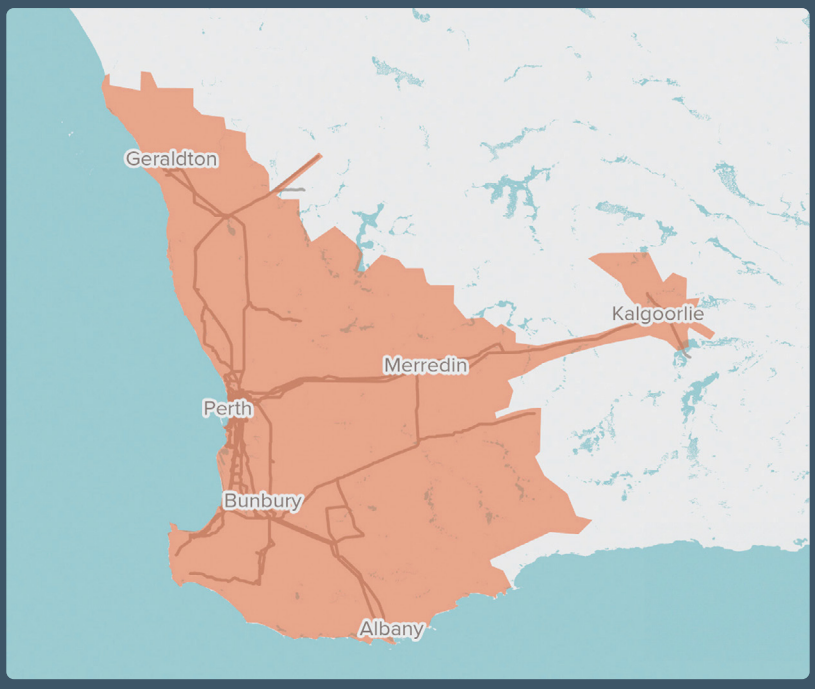
Decarbonising Western Australia's South West Interconnected System

The South West Interconnected System (SWIS) is one of Western Australia's two main electricity grids. The SWIS network of electricity generation, storage, transmission and distribution infrastructure services the vast majority of the WA population, stretching from Albany in the Great Southern, up through the South West and Perth metropolitan area to Geraldton in the Mid West, and east through the Wheatbelt to Kalgoorlie.

The SWIS services over 1 million residential, commercial and industrial customers, including a large number of the Chamber of Minerals and Energy of WA's (CME's) member companies who rely on the SWIS for reliable, cost-competitive electricity for their operations. As such, the SWIS is critical to both the ongoing viability and the decarbonisation pathways of CME members.

CME and its members are committed to net zero by 2050 or sooner and welcome the WA Government's actions to date to decarbonise the SWIS. However, there remains an enormous task ahead to deliver on the trilemma of low emissions, reliable and cost-competitive energy supply.

This report raises industry's concerns at the current trajectory of prices and reliability in the SWIS, both of which threaten the sustainability of our energy-intensive resources and manufacturing industries. It then outlines key learnings from third party modelling commissioned from Endgame Economics to support an effective, timely and efficient transformation of the SWIS.



South West Interconnected System

The SWIS is critical to the ongoing viability and decarbonisation of the WA resources sector

The resources sector's operations in the SWIS-connected regions of the South West, Peel and Goldfields are incredibly diverse, including critical minerals such as lithium, silicon, titanium, zirconium, rare earths and tantalum, alongside gold, bauxite, coal, copper, silver and tin. Many of these commodities are further processed and manufactured locally into products such as alumina, lithium hydroxide, silicon, synthetic rutile and titanium dioxide pigments.

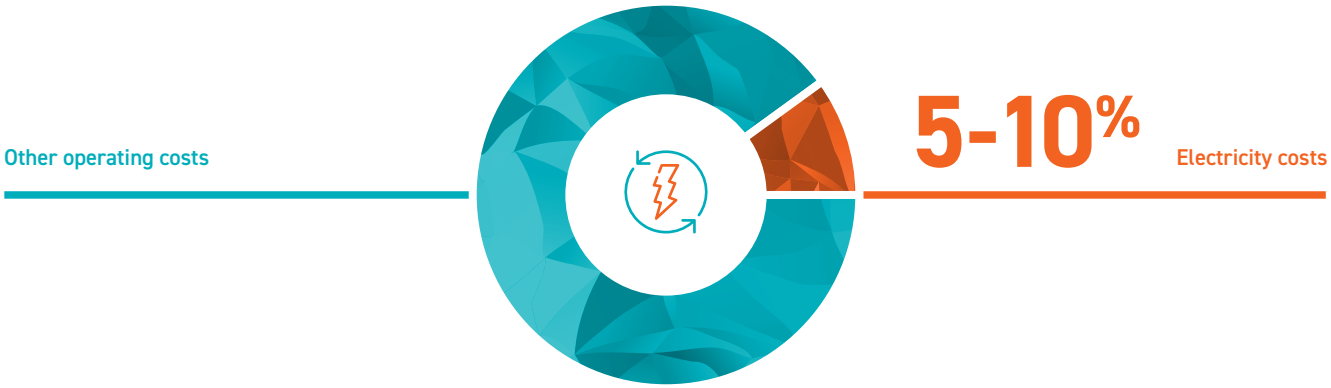
All of these activities are energy-intensive, with energy requirements currently coming in many forms including electricity, coal, gas and liquid fuels such as diesel. CME members are estimated to account for around 60 per cent of large industrial electricity demand on the SWIS.

Replacing emissions-intensive energy sources with electricity produced in a low emissions manner is a key pathway to reducing emissions and meeting voluntary and legislated 2030 targets.[1] This will require existing electricity generation to be decarbonised as well as significant additional low emissions electricity to support new or expanded projects and operations converting to electricity from other energy sources (electrification).

The WA Government's SWIS Demand Assessment (SWIS DA) highlights the potential scale of electricity demand arising from electrification and new demand out to 2042.[2] Under the central 'Future Ready' scenario peak energy demand is expected to triple and total annual demand is expected to increase 5-fold. It is estimated that this would require 50 GW of new generation and storage (wind, solar, firming gas and battery storage) along with 4,000 kms of new transmission lines.

Supporting this, survey data from SWIS-connected CME members indicates that in some cases the electricity share of operating costs could double by 2030 from roughly 5-10 per cent currently, depending on the technical and commercial viability of electrification projects. There is at least $2 billion in electrification investment decisions under consideration that are reliant on the WA Government providing industry with certainty regarding a timely SWIS transformation.

Due to land and zoning restrictions, businesses within the SWIS network are relying on the WA Government and its entities to deliver a low emission, reliable and cost-competitive grid to meet 2030 targets. Industry urgently needs certainty regarding the delivery of this SWIS transformation to ensure the ongoing viability of existing projects and to facilitate final investment decisions on both electrification projects and new projects such as critical minerals, hydrogen and green metals.

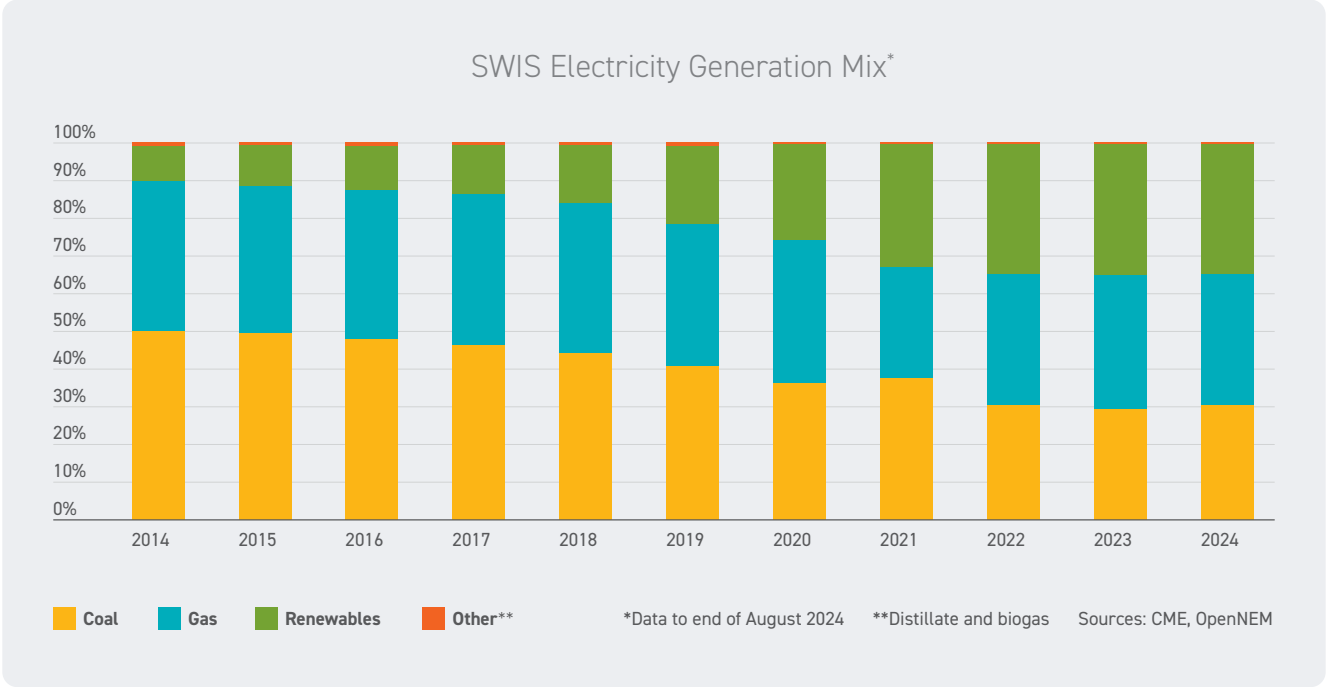


[1] Australia has a national target of 43 per cent emissions reduction relative to 2005 by 2030 and many of our members have their own 2030 voluntary commitments.
[2] WA Government, SWIS Demand Assessment 2023 to 2042: A future ready grid, May 2023.

A grid in transition: Progress on reducing emissions is welcome...

> "CME's policy position is that WA's future energy system, including the SWIS, must be low emissions, reliable and globally cost-competitive."

With regards to reducing emissions, there has been some pleasing progress in the SWIS to date. The graph below shows that the share of renewable generation has more than doubled from 15 to 35 per cent since 2018, reflecting a significant uptake of rooftop solar panels by households alongside the development of new large-scale wind and solar farms. This increase in renewable generation has largely displaced coal-fired generation (down to 30 per cent of total generation), with the share of gas-fired generation remaining relatively constant at around 35 per cent. Reflecting these developments, the emissions intensity of the SWIS, measured as the volume of carbon dioxide emissions divided by total megawatt-hours (MWh) generated, has also fallen by one quarter since 2018.[3]



Looking forward, the WA Government has announced the retirement of the State-owned coal generation fleet by 2030.[4] However, replacing this baseload coal-fired generation capacity with sufficient quantities of firmed renewable generation capacity within this timeframe remains a significant challenge. The Australian Energy Market Operator's (AEMO's) 2024 Electricity Statement of Opportunities (ESOO) highlights that "critical investment in power generation, storage, demand-side response and transmission will be needed to meet demand and replace retiring coal-fired power stations by 2030 and beyond."[5]

[3] OpenNEM, Energy: Western Australia (SWIS) - Generation, accessed 16 August 2024.
[4] WA Government, State-owned coal power stations to be retired by 2030, 14 June 2022.
[5] AEMO, Near-term capacity outlook improves for WA's main grid, but more investment needed from 2027, 18 June 2024.

… but prices are rising sharply, generating significant concern among industry

Electricity prices can be broadly grouped into four main categories:

1. **Wholesale costs.** Paid to those generating or dispatching electricity in real time.
2. **Reliability costs.** Paid to those providing stability services, firming capacity or demand reduction services to prevent grid outages at times of excess demand relative to supply.[6]
3. **Transmission and distribution costs.** The cost of long-distance, high voltage transmission networks and to a smaller extent local-scale distribution networks.
4. **Administration costs.** Market fees charged by the AEMO to operate the WA Wholesale Electricity Market (WEM) in the SWIS.

All of these cost categories are exhibiting sharp increases. While it is challenging to accurately estimate total electricity costs for industrial users on the SWIS, based on the developments below CME estimates total costs have roughly doubled over recent years.

Wholesale costs

2x

After remaining steady for a decade wholesale electricity costs in the SWIS have doubled over the past 3 years, from around $46/MWh in 2021 to $96/MWh in 2024 to date.[7] This reflects a combination of rising coal and gas input prices (driven by coal and gas supply issues) and decreasing reliability of coal-fired plants.

Reliability costs

5x

Key grid stability and reliability costs have increased 5-fold since the introduction of the new Essential System Services (ESS) market on 1 October 2023.[8]

Transmission and distribution costs

1.5x

Transmission and distribution costs for large industrial users have increased by 45 per cent between 2021-22 and 2024-25.[9]

Admin costs

3x

While a small share of total costs, market fees of roughly $2.5/MWh in 2024-25 will be almost triple the fee charged in 2020-21.[10] This largely reflects costs associated with implementing reforms to WA's energy market to adapt to an increasing share of renewable generation.

[6] Reliability costs include the Reserve Capacity Mechanism, ESS, Supplemental Reserve Capacity, the cost of Demand Side Programs, Frequency Co-optimised Essential System Services (FCESS) and Non-Co-optimised Essential System Services (NCESS).

[7] AEMO, Market Data: Short-term Energy Market (STEM) – Summary, accessed 16 August 2024.

[8] ESS costs (including FCESS and NCESS) have increased to around $100 million per quarter since Q3 2024, compared with roughly $20 million per quarter in power system management costs in 2021-22. AEMO, Quarterly Energy Dynamics Q4 2023, 25 January 2024; AEMO, Quarterly Energy Dynamics Q2 2024, 15 July 2024.

[9] Forecast transmission and distribution revenue for Reference Tariff 7 – High Voltage Contract Maximum Demand has increased from $142.55 million in 2021-22 to $206.54 million in 2024-25. Economic Regulation Authority (ERA), Determination on the proposed 2021-22 price list for the Western Power network, 21 May 2021, Table 2; ERA, 2024-25 Price List for the Western Power Network, 14 May 2024, Table 1.5.

[10] Economic Regulation Authority, Australian Energy Market Operator's AR6 second in-period allowable revenue and forecast capital expenditure proposal: Final Determination, 28 June 2024. Figure 2, p 15.

Declining grid reliability would further exacerbate the impact of rising prices on industry's viability

The resources sector operates in competitive global markets subject to large swings in prices for its products. In addition to the impact of rising electricity costs on the SWIS, decreasing grid reliability which results in more frequent electricity outages would harm production volumes, further increasing operating costs per unit of output.

Moving from a grid underpinned by baseload thermal generation to one dominated by intermittent renewable generation requires additional investment in 'firming capacity' such as battery energy storage systems and peaking gas-fired power stations that can provide power at short notice when renewable generation is insufficient. Another tool used to address insufficient electricity supply and protect the grid from blackouts is demand side programs (DSPs), which involve large industrial users reducing their demand (i.e. powering down).

While public data on SWIS reliability is limited, the information available indicates growing challenges. In Q4 2022 AEMO sought supplemental (additional) reserve capacity (SRC) for only the second time in the history of the WEM,[11] and in Q2 2023 a DSP was activated in a June month for the first time.[12] In Q1 2024 there were 14 instances of either DSP or SRC dispatch.[13] There are also particular concerns regarding reliability in the Goldfields, with Kalgoorlie-Boulder and surrounding areas experiencing a multi-day blackout in January 2024[14] and a half-day blackout on 23 August 2024.[15]

Feedback from SWIS-connected companies also supports a perception of declining reliability. Data from a sample of CME's SWIS-connected members indicates they were asked to reduce their power demands on more than 66 individual ocassions during 2023-24, totalling 317 hours of lost production.

WA Government amendments to the WEM Rules in December 2022 to increase spare capacity (the reserve margin) from 300 MW in 2023-24 to over 1,000 MW from 2024-25 are designed to improve reliability going forward.

[11] AEMO, Quarterly Energy Dynamics Q4 2022, January 2023.
[12] AEMO, Quarterly Energy Dynamics Q2 2023, July 2023.
[13] AEMO, Quarterly Energy Dynamics Q1 2024, April 2024.
[14] ABC News, Power being restored to Kalgoorlie-Boulder after outages ground the Goldfields city to a halt, 19 January 2024.
[15] ABC News, Goldfields, Wheatbelt residents frustrated by half-day power outage, following extended blackout in January, 24 August 2024.

Third party modelling illuminates the path to a low carbon grid ...

An enormous amount of work remains to deliver the once-in-a-generation transformation of the SWIS to a low emission, reliable and cost-competitive electricity grid.

To support and inform our ongoing engagement with the WA and Australian Governments and broader market participants, CME commissioned Endgame Economics to model whole-of-system capital costs, prices, carbon emissions, generation and capacity mix out to 2042 under three illustrative scenarios. All scenarios used the SWIS DA's central 'Future Ready' electricity demand forecasts out to 2042 (to reflect a high electricity demand scenario) and imposed standard WEM reliability requirements. All coal-fired power plants are assumed to exit by 2030 and for simplicity the available build options are limited to wind, solar, gas and batteries.

The three scenarios modelled were:

Scenario 1: Unconstrained.
This scenario sought to model the lowest-cost generation mix in the absence of a renewable generation target (or carbon constraint) to establish a benchmark lowest-cost system.[16]

Scenario 2: Swift Decarbonisation.
This scenario imposed a 90 per cent renewable generation target by 2040, with an interim target of 75 per cent by 2030. New gas-fired generation is permitted to provide grid firming.

Scenario 3: No New Gas.
This scenario had the same renewable generation constraints as in Scenario 2 but no new gas-fired generation is permitted (though existing gas generation remains operational until each generator's end of life). This scenario explores the impact of a near-100 per cent renewables grid.

Endgame Economics used industry-standard quantitative modelling software (PLEXOS) to model wholesale electricity market costs under each scenario. To provide a more complete picture of total system cost they also made separate estimates of non-market costs including transmission, market fees and certain system reliability costs.[17]

[16] Capital costs for generation and storage technologies were sourced from the CSIRO's 2023 GenCost Report.
[17] System reliability costs included NCESS and the Rate of Change of Frequency Control Service.

... highlighting the significant investment in new generation and transmission infrastructure required

The three scenarios yielded several key observations relevant to the decarbonisation of the SWIS:

- **Rebuilding and expanding the SWIS to meet potential electricity demand over the next 20 years is going to require substantial investment in new transmission, generation and storage capacity.** At least a tripling of total generation and storage capacity will be required, with efficient total system costs (both capital and operating costs) to exceed $100 billion.
- **A swift decarbonisation of the SWIS is feasible at limited additional cost.** The modelling indicates that significant emissions reduction under the Swift Decarbonisation scenario adds only $10/MWh in efficient total system costs relative to the Unconstrained scenario.
- **A grid without new gas-fired firming generation would have minimal emissions but substantially higher electricity prices, risking the ongoing viability of existing industry or the development of new industries.** The enormous investment in new generation, storage and transmission capacity envisaged under the No New Gas scenario would also be extremely difficult to deliver.

A visual summary of the key results is provided below. It should be noted that the efficient total system cost assumes new transmission, generation and storage is built on time and on budget. As such, it should be viewed as an absolute lower bound and is not a price prediction.

	Unconstrained	Swift Decarbonisation	No New Gas
Total generation and storage capacity required (Multiple of current)[18]	**30 GW** (3x)	**40 GW** (4x)	**65 GW** (~6x)
New transmission investment[19]	**$10 billion**	**$15 billion**	**$32 billion**
Emissions profile	**High**	**Low**	**Very low**
Efficient total system cost[20]	**$110 billion** (~$110/MWh)	**$125 billion** (~$120/MWh)	**$180 billion** (~$180/MWh)

[18] Total installed generation and storage capacity at time of analysis was 9.3 GW (including rooftop solar).
[19] Costs in real 2024 dollars.
[20] Includes both capital and operating costs. Costs in real 2024 dollars, $/MWh estimates based on amortised system costs.

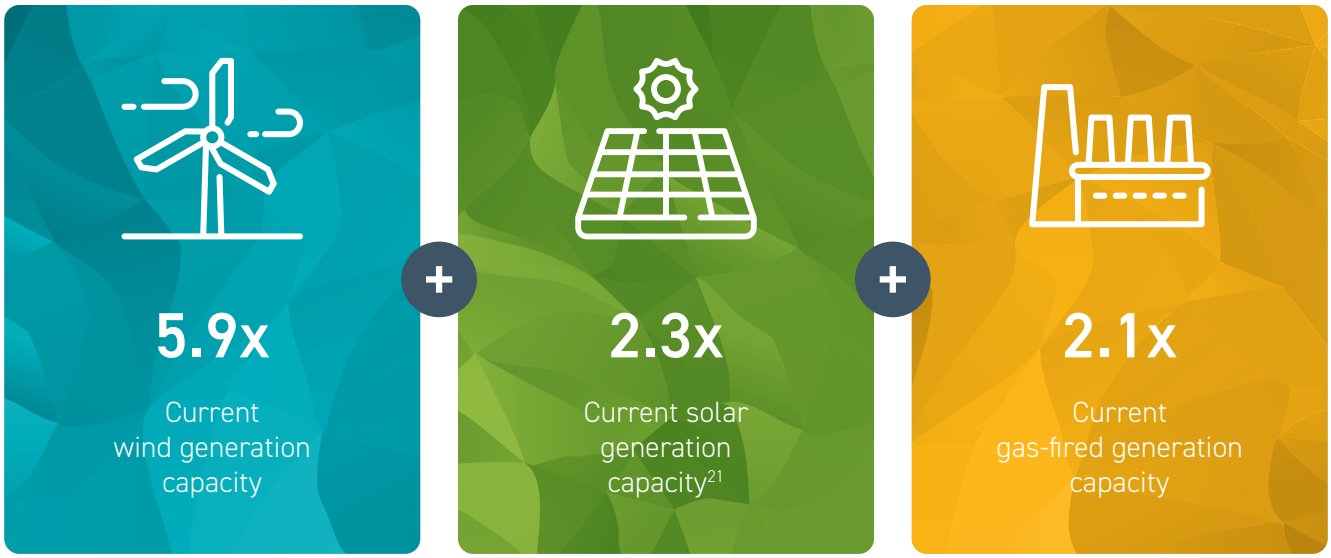
Transition lessons from the Swift Decarbonisation scenario

The Swift Decarbonisation scenario provides an indicative roadmap to a SWIS that is low emissions, reliable and only marginally higher cost than the Unconstrained scenario. As such, the modelling can provide some lessons for the transition of our state's main electricity grid.

> "The overarching message is that the near-term focus must be on new generation and transmission investment."

- **Current and under-construction 4-hour battery storage capacity is likely to be sufficient until 2030.** A focus on longer duration energy storage options such as 8 hour-plus batteries is required over the medium-term.
- **Significant new peaking gas-fired generation is required to ensure grid reliability at lowest cost in a renewables-dominated network.** The modelling suggests that a doubling of gas-fired generation capacity would be required by 2030 (from 2.6 GW in 2024 to 5.5 GW in 2030) and a tripling by 2040 (to 7 GW).
- **Additional large-scale wind generation is crucial to support grid reliability in a system without coal,** given its different generation profile to solar.
- **Transmission investment is critical to connect the renewables build out.** New renewable generation is dependent on matched investment and build out of the connecting transmission infrastructure. The lumpiness of required transmission investment, such as around 2030 when electricity demand is anticipated to increase strongly, is likely to require innovative and flexible financing models that allow earlier build out to smooth the infrastructure pipeline.
- **Further market reforms are likely to be required to ensure revenue sufficiency in a renewables-dominated grid.**

Under the Swift Decarbonisation scenario we would need the following by 2030:



[21] Includes both rooftop solar and utility-scale solar capacity.

Recommendations

The WA Government must act with urgency to coordinate and deliver a once-in-a-generation rebuild and expansion of the SWIS. With reference to the transition lessons arising from Endgame Economic's modelling, CME recommends the WA Government undertake the following actions:

- Urgently release a draft master transmission plan for the SWIS to guide public-private investment and provide certainty to customers and generation and storage proponents. Appropriately resource the construction of transmission infrastructure to support industry decarbonisation in a manner that does not disadvantage first movers.
- In parallel, consult with industry, market participants and potential investors to co-design flexible, genuine user-pays transmission funding models.
- Review the WEM market structure and other relevant policies to ensure there are appropriate incentives to deliver the required future generation and storage mix to ensure a low emission, reliable and globally cost-competitive grid. In the near term, there is a need to engage with the Australian Government to ensure the Capacity Investment Scheme delivers sufficient incentives for wind generation and long-duration generation or storage.
- Deliver efficient and non-duplicative approvals processes for energy infrastructure projects.
- Establish an Energy Transition Working Group comprising representatives from industry and government entities to inform and support the WA Government's Cabinet-level Committee overseeing the state's energy transition.

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