



Asia-Pacific Energy Transition

Adapting To Looming Execution Risks

S&P Global
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This report does not constitute a rating action

Asia-Pacific Energy Transition

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Overview

Readjusting To The Challenges

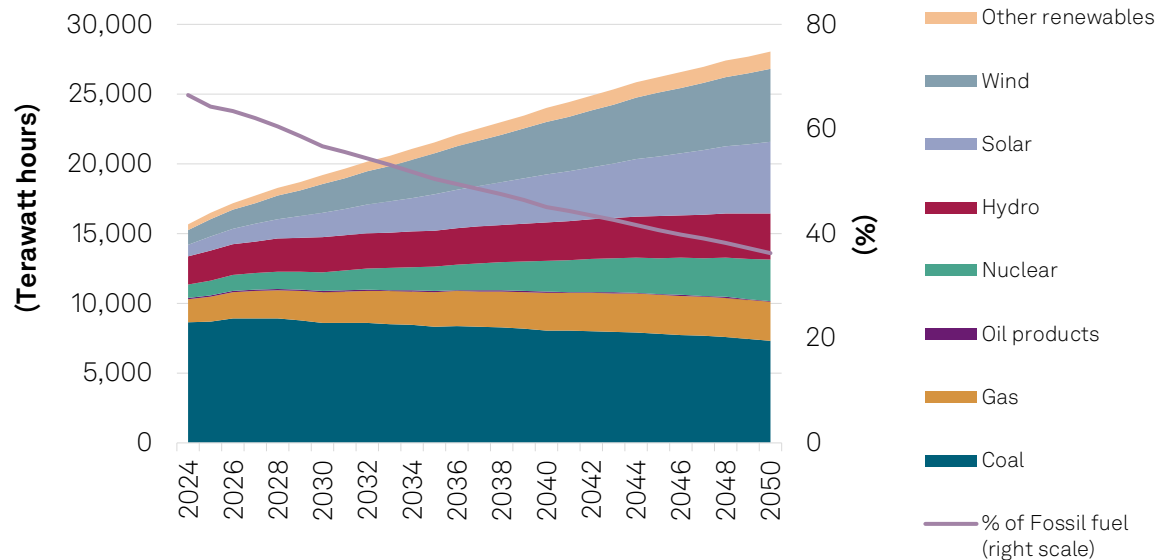
Key Takeaways

- Energy transition plans are being revised as countries move to execution, with extended reliance on coal plants (China) or new coal plants (India), delayed retirement of coal plants (Australia), and a focus on alternate sources, such as gas (Vietnam), or hydro/geothermal (Indonesia).
- Higher power demand, slower renewable capacity addition, the intermittency of renewable power, and lack of non-fossil fuel baseload power will likely result in missed 2030 targets in some Asia-Pacific countries.
- Stable supply sources with storage solutions will be critical to accelerate the transition. Easier sites may be leveraged for initial pumped storage capacities, but economical battery storage for more than four to eight hours will be key for an inflection point.
- Government will play a bigger role in China and Indonesia, while India's path will be largely shaped by market forces. Network build-out will remain a bigger risk in Vietnam and Australia.
- Weaker competitiveness (with cheaper renewables), higher carbon taxes, and increasing refinancing risk will weigh on unregulated fossil-fuel based players. The ability to pass on costs will protect most regulated utilities.
- High capital expenditure (capex) and unregulated returns will remain key credit risks for renewable developers.

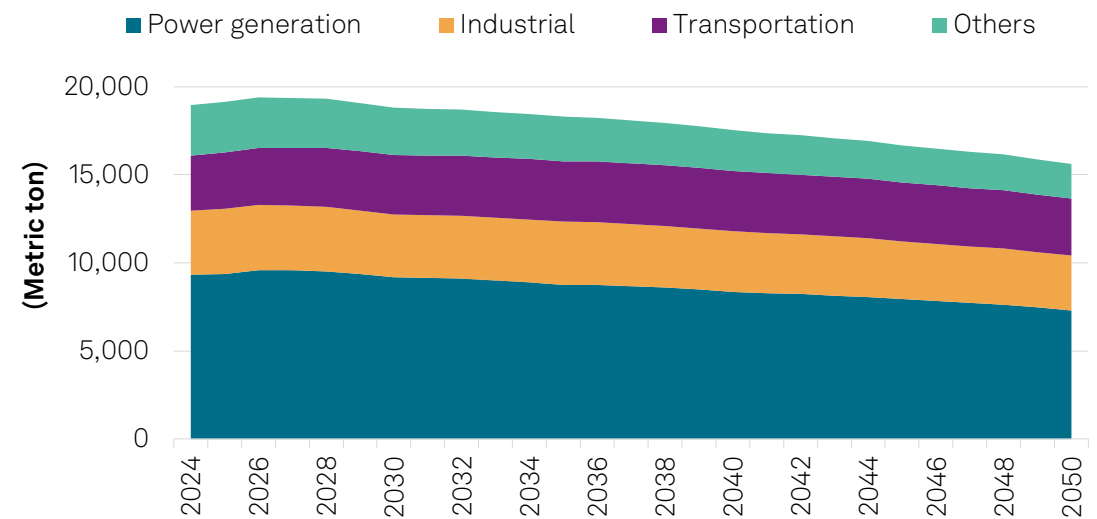
Decarbonization Of The Power Sector Is Crucial To Meeting Net-Zero Targets

- The Asia-Pacific power sector accounts for about half of regional carbon emissions; fossil fuel powers ~70% of electricity generation.
- With more than half of the growth in global power demand for the next two decades coming from Asia-Pacific, decarbonization of the power sector will be challenging but essential to achieving net-zero targets.
- Emissions may peak by 2030, driven by rising use of renewables in Asia-Pacific's electricity mix, and China achieving peak carbon earlier.

The likely evolution of the Asia-Pacific electricity mix



The likely evolution of Asia-Pacific emissions



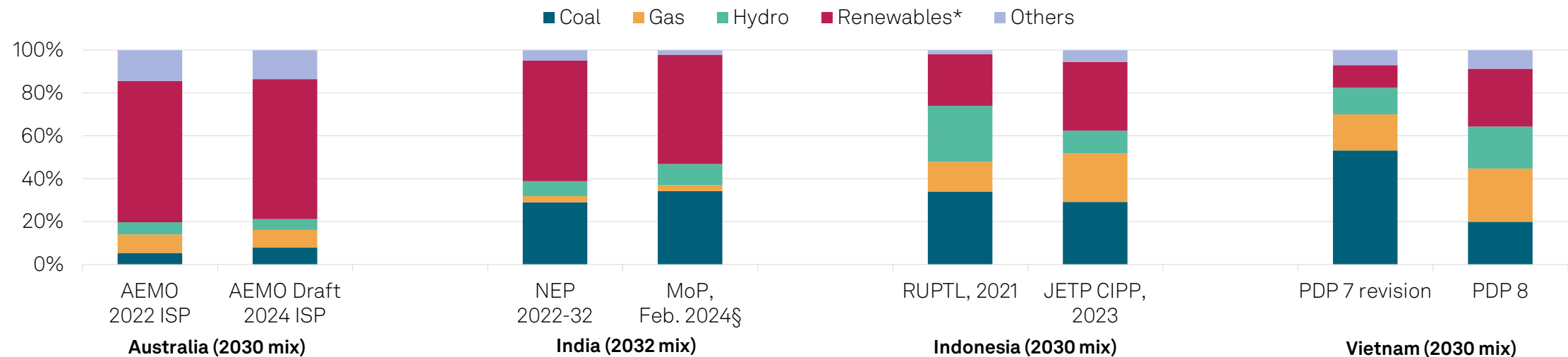
Sources: S&P Global Commodity Insights. Global Integrated Energy Model February 2024 Reference Case.

Sources: S&P Global Commodity Insights. Global Integrated Energy Model February 2024 Reference Case.

Need to Provide Stable Baseload Power Will Alter Transition Targets

- Countries are relying on coal (China, India) or gas (Australia, Indonesia, Vietnam) before storage becomes economical.
- Meeting new power targets will require faster pace of addition of renewables (India), economical and scalable renewable power (Indonesia) or stronger grid network (Vietnam).
- Grid investments will be crucial for renewables integration. Delays or shortfalls may lead to curtailment and slow renewables additions.

The evolution of target power mixes varies across plans in Asia-Pacific

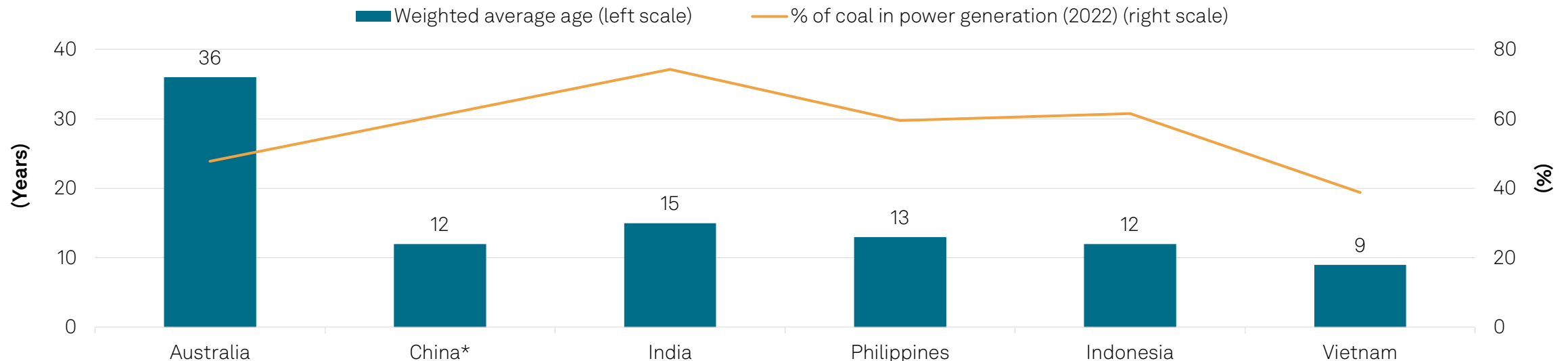


Others include nuclear, storage etc. *Mainly solar and wind. §Based on India's Ministry of Power anticipated capacity additions between 2023-32 announced in February 2024. AEMO--Australian Energy Market Operator. CIPP-- Comprehensive Investment and Policy Plan. ISP--Integrated System Plan. JETP--Just Energy Transition Partnership. MoP--Ministry of Power. NEP--National Electricity Plan. PDP--Power Development Plan. RUPTL--Indonesia Electricity Supply Business Plan. Sources: AEMO. Central Electricity Authority. NEP 2022-32. MoP. RUPTL 2021-30. CIPP. PDP 7. PDP 8.

A Young Coal Fleet Makes Retirement Challenging

- The average age of coal plants across Asia-Pacific is 15 years or less, versus economic life of at least 25 years.
- Early retirement of coal plants that have yet to recover substantial amounts of financial capital are costly. Requirement for coal plants to provide baseload power amid higher power demand will further delay their retirement.
- We have seen countries such as Australia and Indonesia delaying retirement of such plants.

Capacity weighted average coal plant age

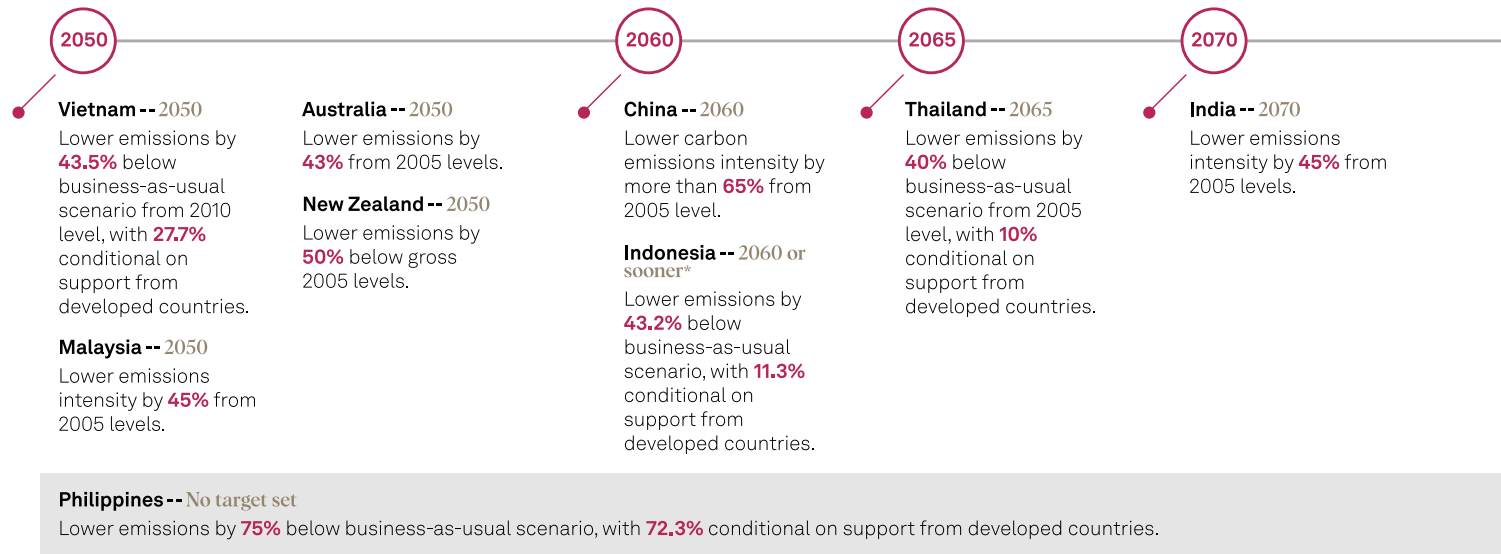


*As of 2021. Sources: S&P Global Commodity Insights. China Electricity Council. Global Energy Monitor. Statistical Review of World Energy 2023. Philippines Department of Energy.

Emissions And Net-Zero Targets Could Be Elusive

- India, Indonesia and Vietnam risk failing to meet 2030 emission targets.
- Also, emissions targets of countries such as Indonesia and Vietnam are highly contingent on international financial support.
- A lack of commitment to phase out coal by countries (China, India) also makes achieving long term net-zero targets difficult.

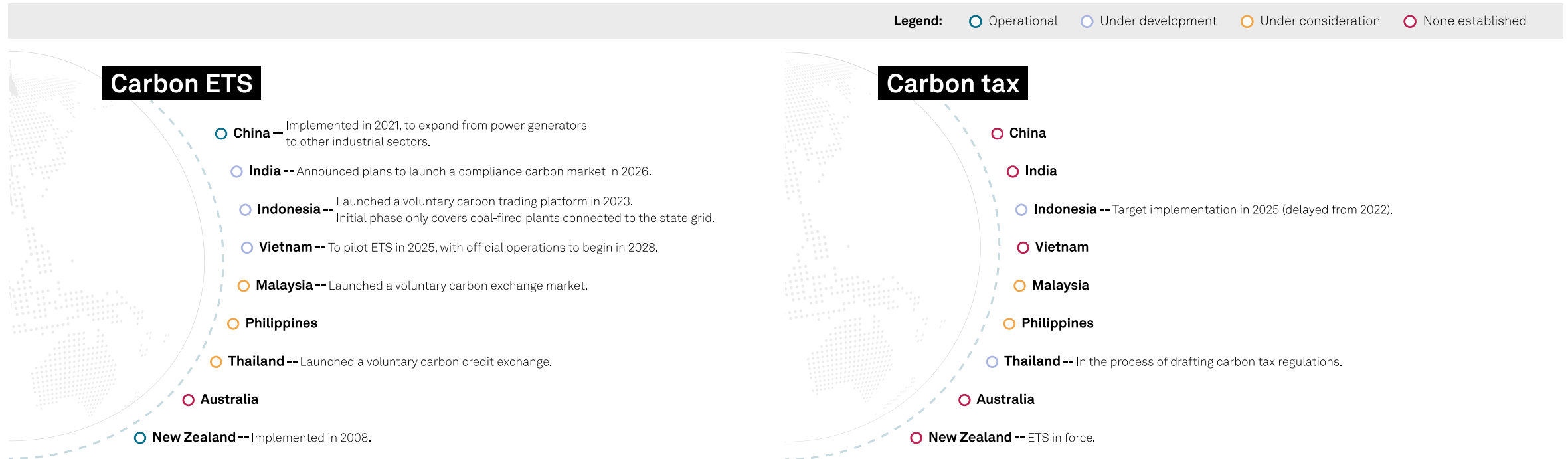
Asia-Pacific net-zero targets and 2030 emissions commitments



*2050 for power sector. Sources: S&P Global Commodity Insights. S&P Global Ratings.

Carbon Policies Yet To Make A Difference

- Most Asia-Pacific countries have failed to impose carbon taxes; carbon trading in the region is unlikely to take off until after 2025.
- Low carbon prices, delays in implementing carbon policies and a narrow scope of carbon trading limit the impact of such initiatives.
- We expect most utilities to recover additional costs under the regulatory framework; merchant players may face credit pressures.



ETS--Emissions trading system. Sources: S&P Global Ratings. S&P Global Commodity Insights.

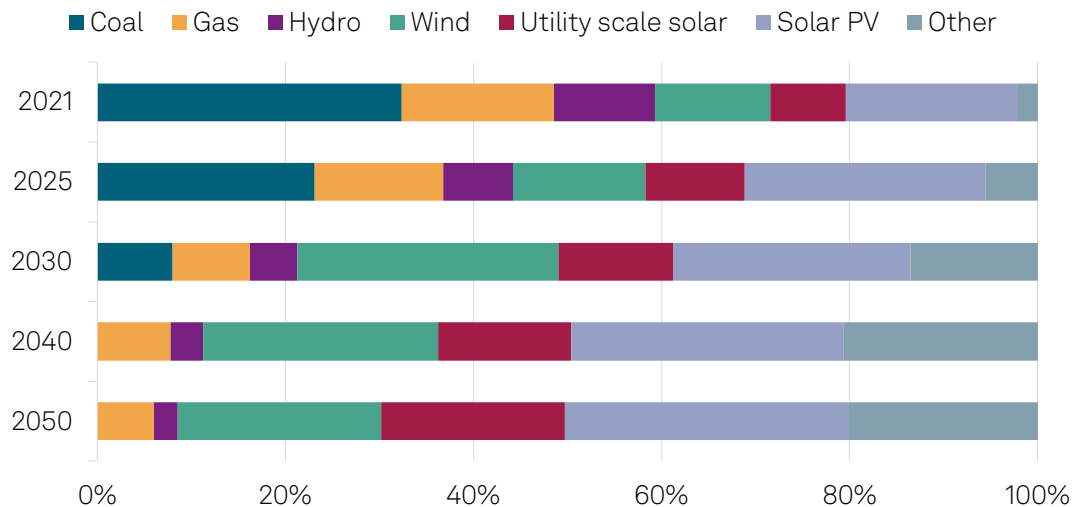
Australia

Will Community Consultation & Market Conditions
Slow The Pace Of Transition?

Australia | Planning, Policies And Market Condition Will Be Critical

- The frequency and duration of price volatility to increase as coal capacity retires, until power mixes are firmed up.
- Curtailment risk--network and economic--can slow the returns on investment in renewables.
- Can the renewable energy zones (REZ) in various states deliver the projects to reach their targets?

NEM capacity (GW) evolution till 2050 (step-change scenario)



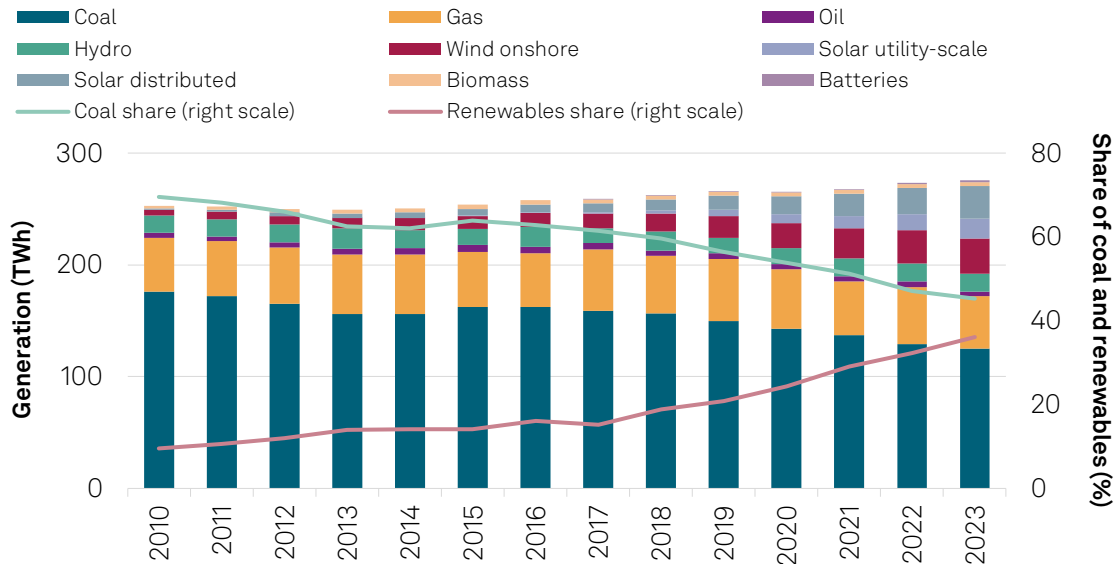
Other includes utility scale storage and distributed storage. AEMO--Australian Energy Market Operator. ETS--Emissions trading system. GW--Gigawatt. GWh--Gigawatt hour. ISP--Integrated System Plan. NEM--National Electricity Market. PV--Photovoltaic. Source: AEMO Draft 2024 ISP.

Policy	Target
Net zero	2050.
2030 emissions commitment	Lower emissions by 43% from 2005 levels.
Renewable energy	Additional 33,000 GWh per year through 2030.
Coal phase-out	AEMO forecasts coal-fired power stations to retire by 2038.
Carbon tax	None established.
Carbon ETS	None established.

Australia | A More Stable Power Supply Needed For Energy Security

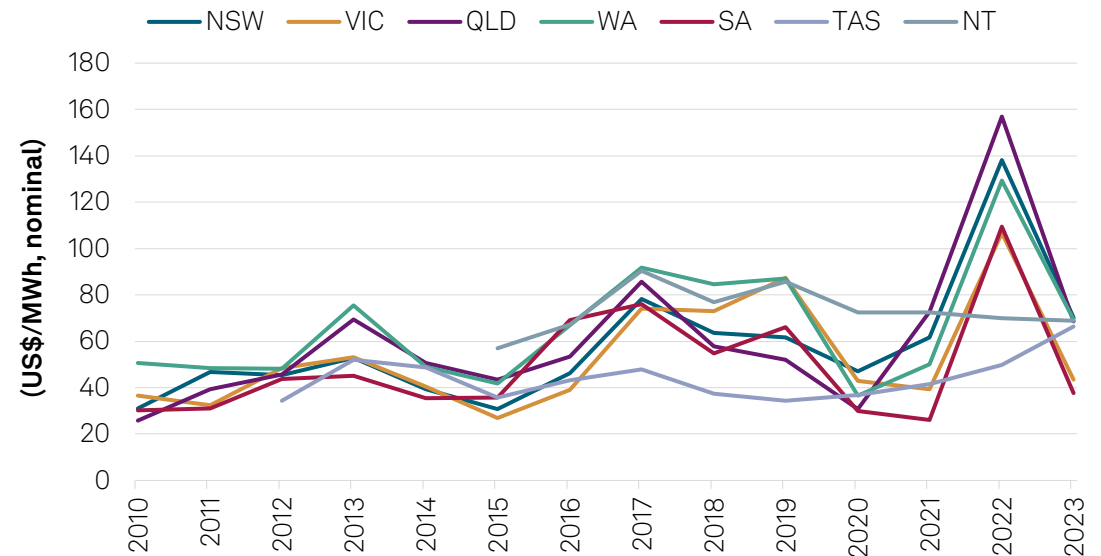
- As we expected, an increase in the share of renewables (36% of generation in 2023) is placing pressure on pool prices.
- Longer periods of low or sub-zero pool prices will push out coal plants (from the system) unless they are supported.
- Focus on dispatchable power (capacity) for energy security and to reduce price volatility.

Total power generation by technology



Data as of Feb. 15, 2024. Hydro includes pumped storage generation. TWh—Terawatt hours. Sources: S&P Global Commodity Insights, DCCCEW.

Wholesale power prices



MWh--Megawatt hour. NSW--New South Wales. NT--Northern Territory. QLD--Queensland. SA--South Australia. TAS--Tasmania. VIC--Victoria. WA--Western Australia. Sources: S&P Global Commodity Insights, AEMO.

Australia | State Targets Look Ambitious

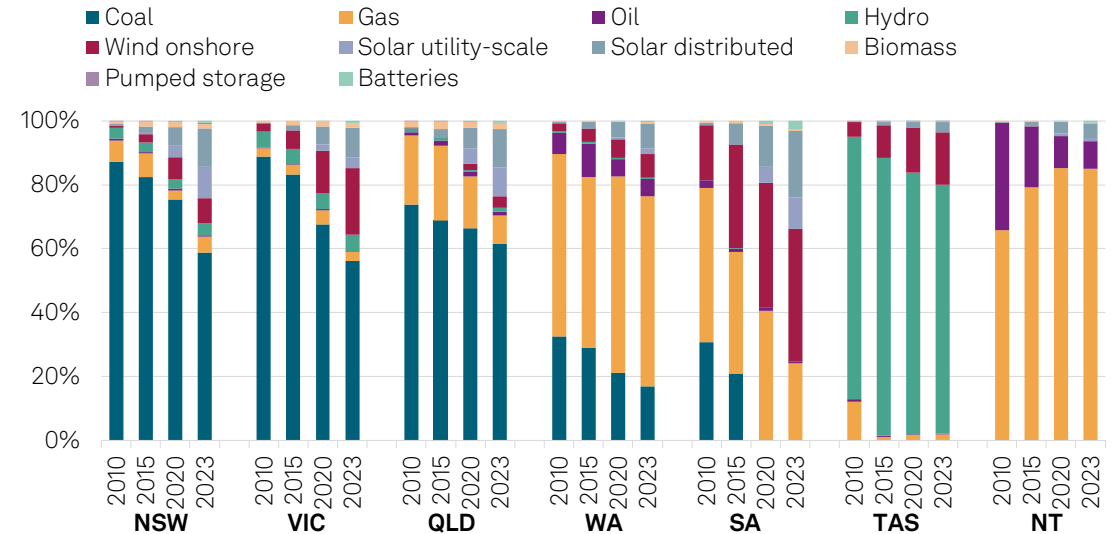
- Significant renewable capacity additions (25-30 GW) required by 2030. Five of the six states still rely heavily on coal or gas.
- Could planning approvals for generation and transmission build become the constraint?
- Will the market provide capacity for appropriate contracts and financing to support all the developments?

Renewable energy targets

Region	Share of renewable output, 2023	Renewable electricity target
Australia	36%	20% by 2020 82% by 2030 (NEM)
New South Wales	36%	12 GW of renewable energy by 2030*
Victoria	41%	40% by 2025* 50% by 2030* 95% by 2035*
Queensland	28%	50% by 2030§ 70% by 2032§ 80% by 2035§
Western Australia	18%	50% by 2030
South Australia	75%	75% by 2025 100% by 2030
Tasmania	98%	150% by 2030 200% by 2040*
Northern Territory	6%	50% by 2030

Data as of Feb. 15, 2024. *Legislated targets. §Pending legislation. GW--Gigawatt. NEM--National Electricity Market. Source: S&P Global Commodity Insights.

Regional total generation share by technology

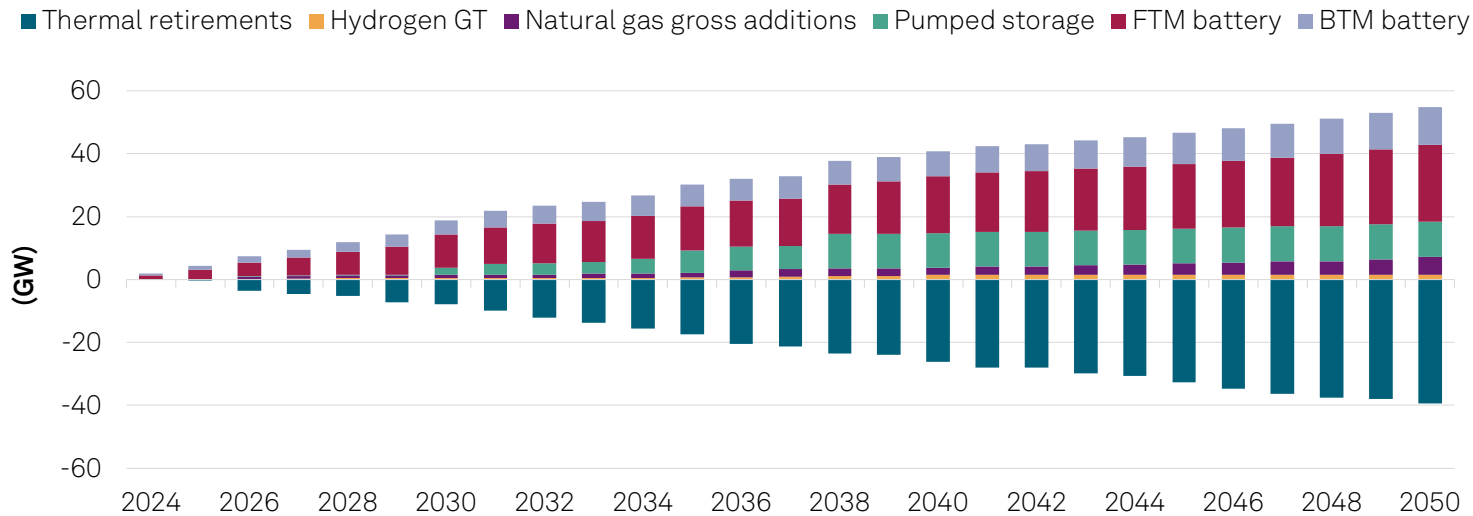


Data as of Feb. 15, 2024. Hydro includes pumped storage generation. NSW--New South Wales. NT--Northern Territory. QLD--Queensland. SA--South Australia. TAS--Tasmania. VIC--Victoria. WA--Western Australia. Sources: S&P Global Commodity Insights. DCCEEW.

Australia | Technology Change To Drive The Mix Beyond 2030

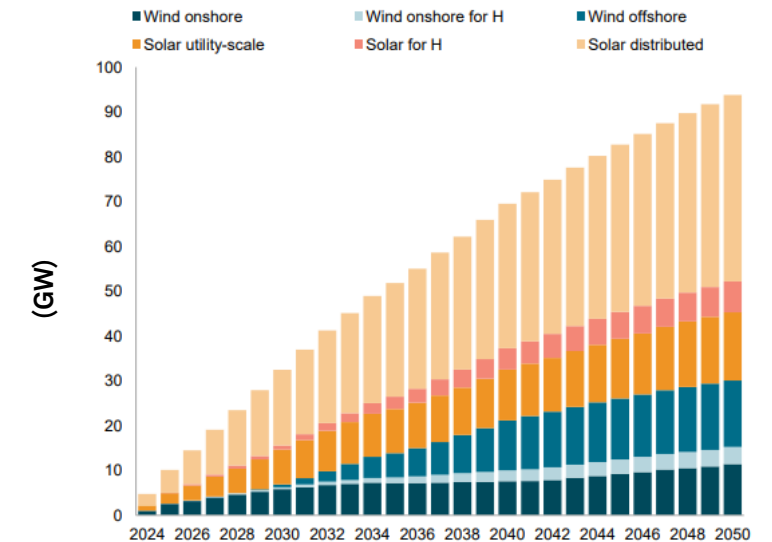
- Approximately 37 GW of aging thermal retirement expected by 2050.
- Hydro and gas-fired capacity to support the phasing out of coal until battery capacity is more established.
- The scale, cost and the economics of hydrogen will likely reach critical mass by 2030-2035 (based on our energy mix projections).

Cumulative on-grid firming capacity additions and retirements



Data as of Feb. 15, 2024. BTM--Behind the meter. FTM--Front of the meter. GT--Gas-fired turbine. GW--Gigawatt. Source: S&P Global Commodity Insights.

Cumulative on-grid variable generation capacity additions

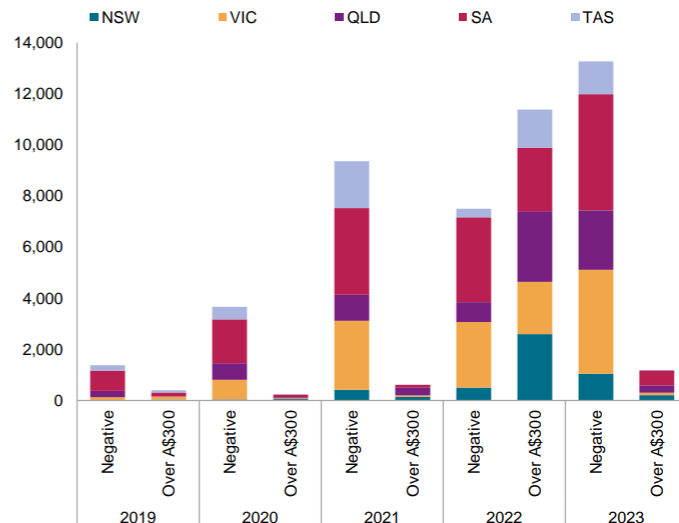


Data as of Feb. 15, 2024. GW--Gigawatt. H--Hydrogen. Source: S&P Global Commodity Insights.

Australia | Minimal Regulatory Support In A Competitive Market

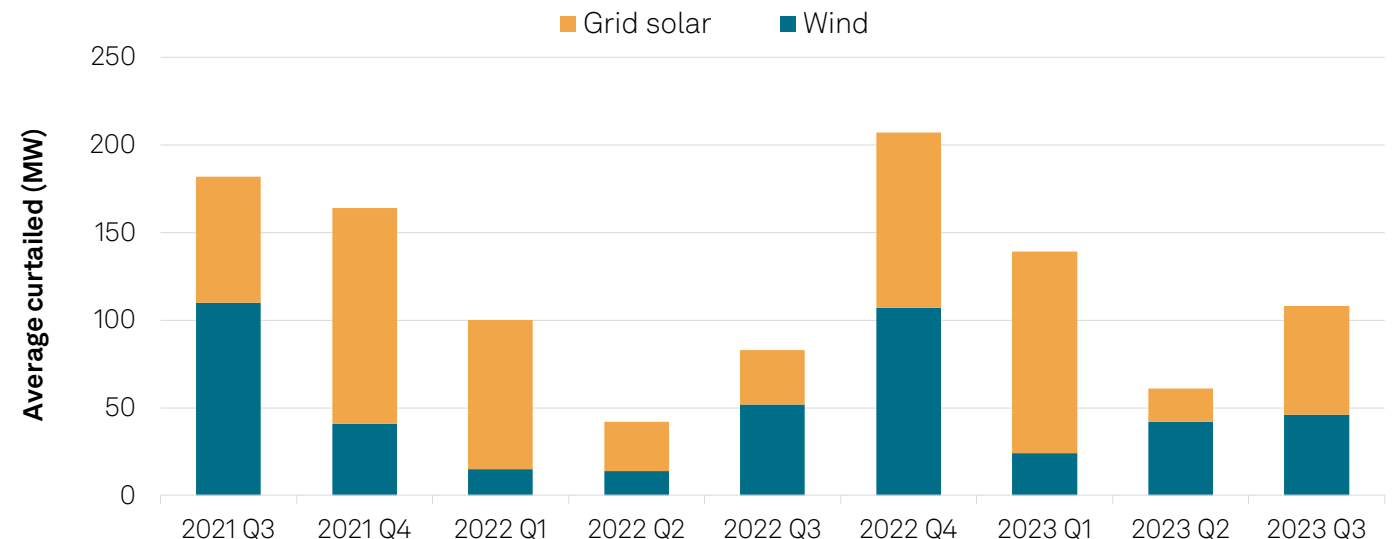
- Capacity investment scheme will play a greater role to reduce price volatility until the power mix settles over the next 10 years.
- Curtailment rates will have to be reduced to keep the sector attractive for developers and financiers.
- Remote energy (solar and wind farms) are generally insulated from curtailment risks.

Number of extreme price events based on 30-minute average settlement periods



Data as of Feb. 15, 2024. NSW--New South Wales. QLD--Queensland. SA--South Australia. TAS--Tasmania. VIC--Victoria. Sources: S&P Global Commodity Insights. AEMO.

Curtailment at solar and wind farms

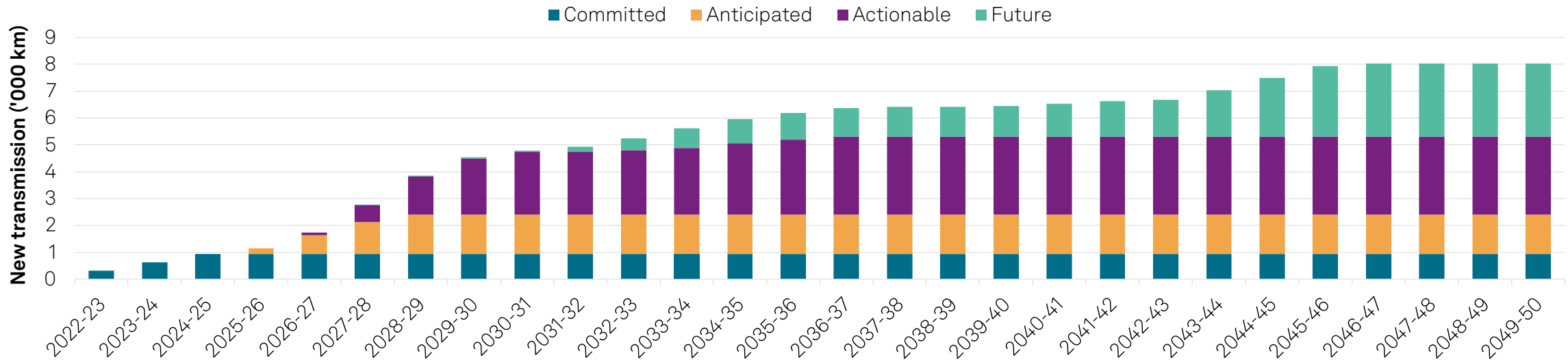


MW--Megawatt. Sources: AEMO. Quarterly Energy Dynamics Q3 2023.

Australia | The Economics Of Transmission Investment Will Be Challenging

- About 10,000 km of once-in-a-generation build-out of transmission lines expected by 2050. About 45% required by 2030.
- Federal government pledge of A\$20 billion in low-cost financing to modernize the grid.
- Planning approvals, land acquisition, cost escalations, market financing capacity for multiple projects are some major risks.

New transmission (2022-23 to 2049-50)

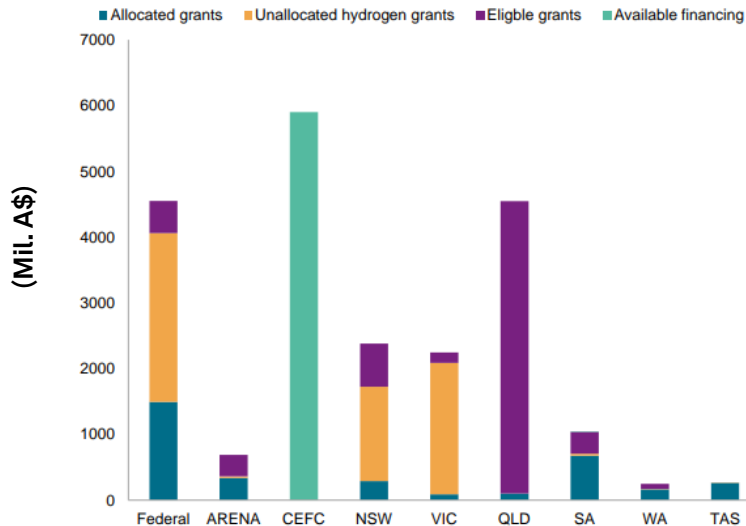


km--Kilometer. Source: AEMO Draft 2024 ISP.

Australia | Hydrogen Strategies Take Shape

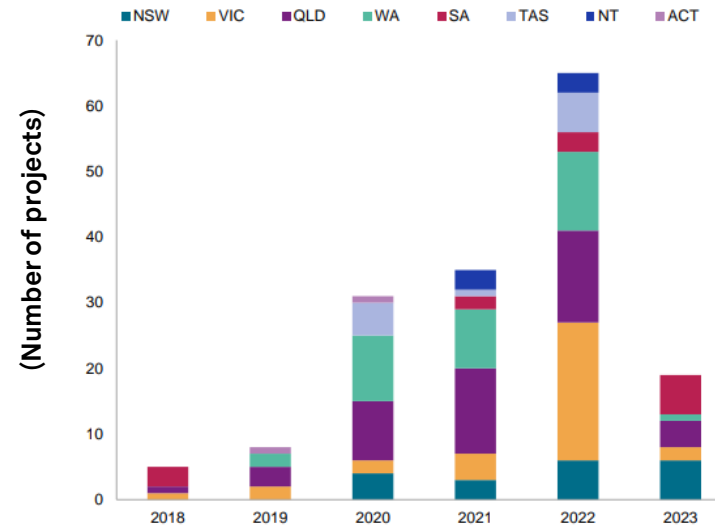
- Most hydrogen development projects are in coastal regions, with about A\$22 billion of funding available.
- A solar capacity factor of 32%, and a wind capacity factor of 50%, will likely facilitate growth in green hydrogen output and bring down the cost of production.
- Commercial-scale exports will likely* account for 89% of Australia’s hydrogen production by 2050. A decline in green hydrogen production cost by more than half to US\$1.5/kg-US\$2/kg by 2040 will be key.

Australian hydrogen industry funding



*Per S&P Global Commodity Insights. Data as of May 25, 2023.
Source: S&P Global Commodity Insights.

Hydrogen project pipeline by year announced



Data as of May 25, 2023. ACT--Australian Capital Territory. NSW--New South Wales. NT--Northern Territory. QLD--Queensland. SA--South Australia. TAS--Tasmania. VIC--Victoria. WA--Western Australia.
Source: S&P Global Commodity Insights.

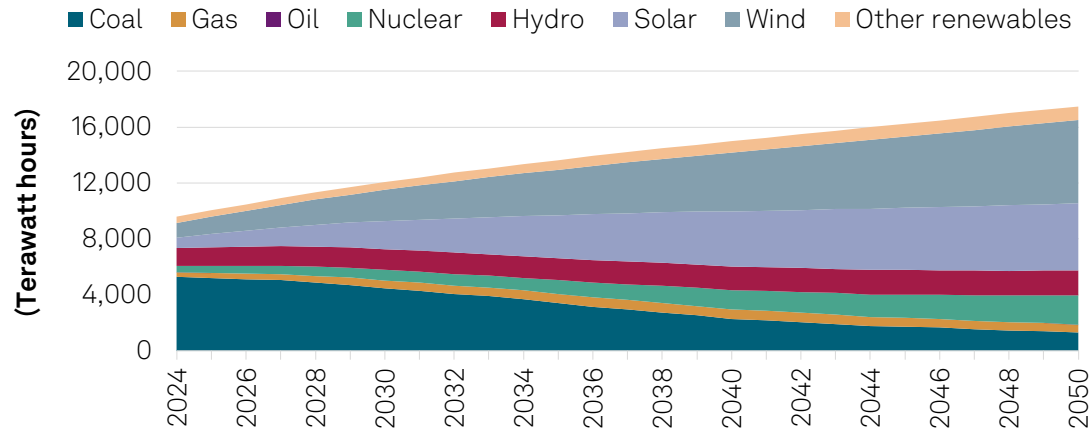
China

Power Sector Pushes Toward Peak Carbon

China | Power Sector Pushes Toward Peak Carbon

- China’s power sector will arrive at peak carbon peak by 2025, five years ahead of the national target. Moderating power consumption growth will help the sector hit this target. The country will gradually phase down coal use from 2026.
- China will add 200 GW of solar power and 75 GW of wind power in 2024, bringing up the total non-hydropower renewable capacity to 1,326 GW by end-2024, 10% more than the original 1,200 GW target. Wind and solar power will represent over half of China’s installed capacity and 35% of China’s generation in 2030.
- New Chinese additions of solar and wind capacity will account for over half of the world total in 2024.

Likely evolution of electricity mix



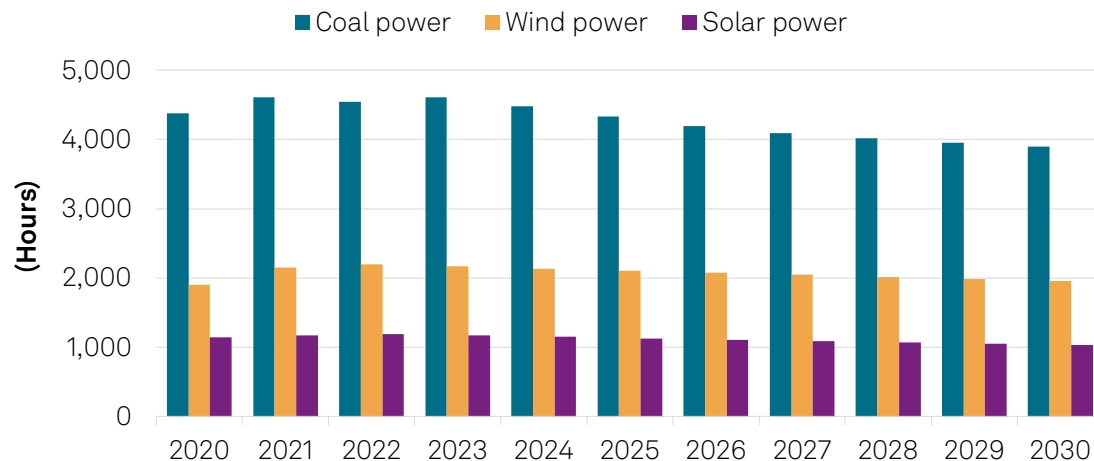
Sources: S&P Global Commodity Insights. Global Integrated Energy Model February 2024 Reference Case. S&P Global Ratings.

Policy	Target
Net zero	2060.
2030 emissions commitment	Lower carbon emissions intensity by more than 65% from 2005 levels.
Renewable energy	Wind and solar capacity to reach 1,200 GW by 2030. To add 80 GW hydro during 2021-2030.
Coal phase-out	Only committed to “phase down”.
Carbon tax	None established.
Carbon ETS	ETS in 2021, to expand from power generators to other industrial sectors.

China | Risks Piling Up For Renewable Operators

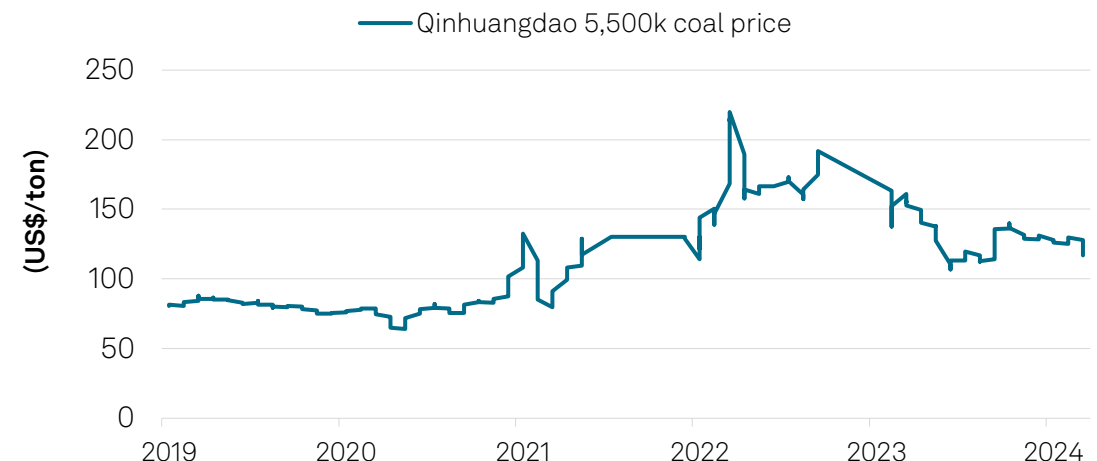
- Risk #1--Utilization hours. Surging renewable capacity in the system, trailing dispatching facilities, rising pressure of curtailment;
- Risk #2--Profitability. Higher market-based trading volumes, lower average tariffs, declining profitability for renewable projects;
- Risk #3--High capex. Elevated investment to expand renewables constrains financial improvement;
- Positive factor #1--Coal price. Coal production catching up, more import opportunity, moderating unit fuel costs;
- Positive factor #2--Refinancing cost. SOEs' advantages in capital raising, low refinancing cost, relatively stable financial metrics.

National average utilization hour over 2020-2030



Source: S&P Global Ratings.

Qinhuangdao 5,500k coal price

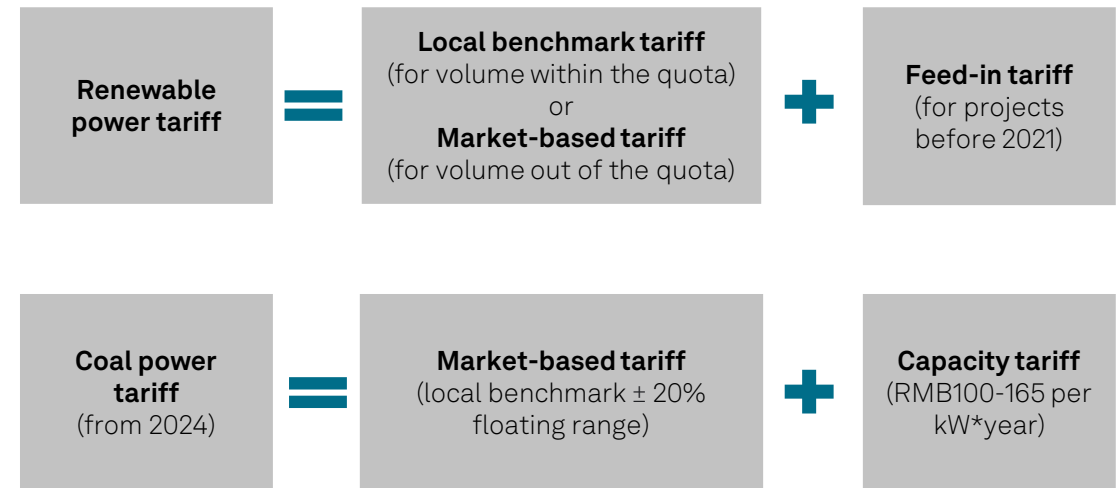
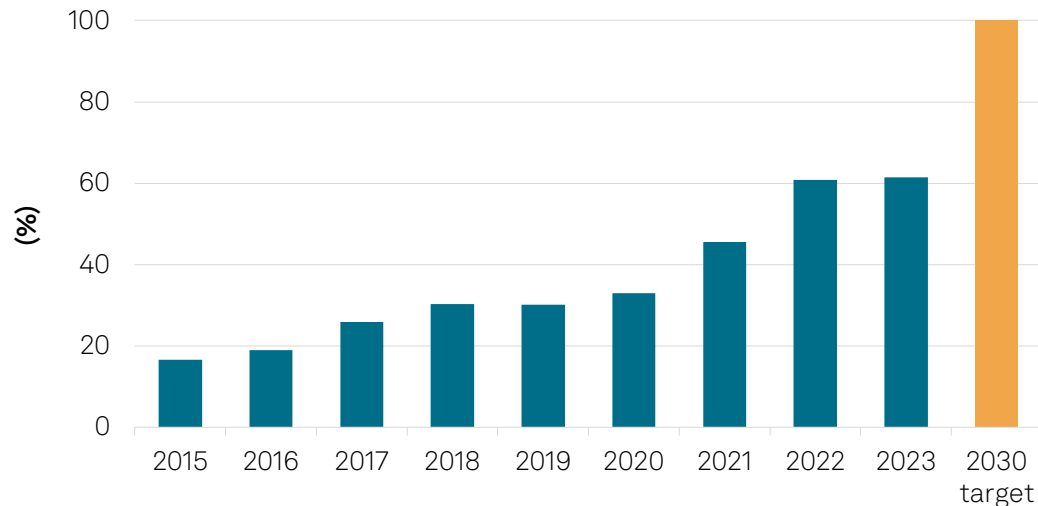


Sources: Wind, S&P Global Ratings.

China | Market Reform Deepens, Policy Support Continues

- Market reforms continue. All renewables trading will be market-based by 2030. Coal power will gradually shift from a base-load role to be used mainly to meet peak-power demand. Capacity tariff--as part of the total tariff--will compensate for reduced coal power.
- Network operators will face more scrutiny based on regulated assets and permitted returns.
- The government continues to support the sector's strong development to ensure energy security while supporting energy transition.

Market trading power share targets to reach 100% by 2030

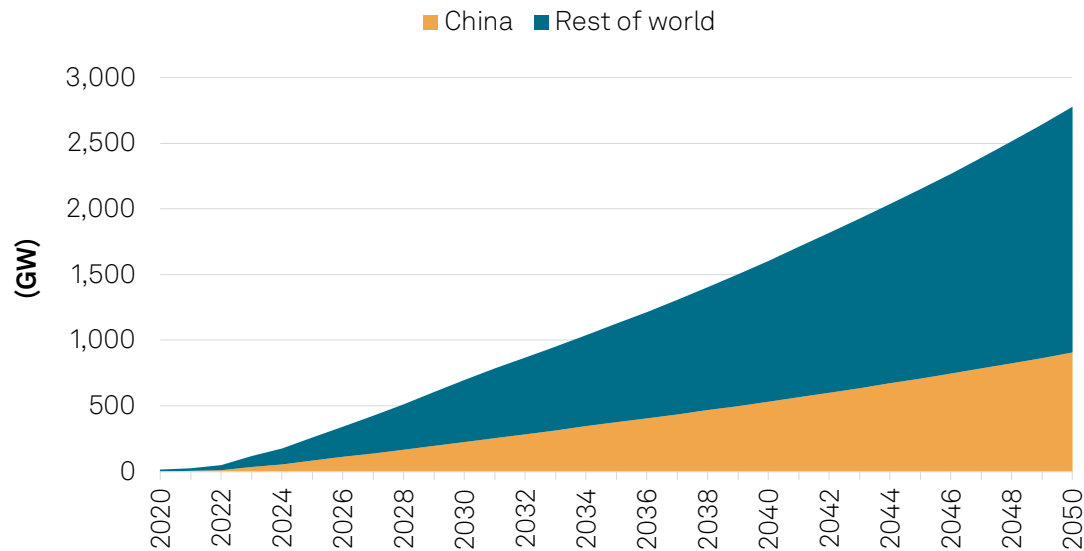


Sources: China Electricity Council, S&P Global Ratings.

China | Storage Facilities Will Be Key To Balancing Supply And Demand

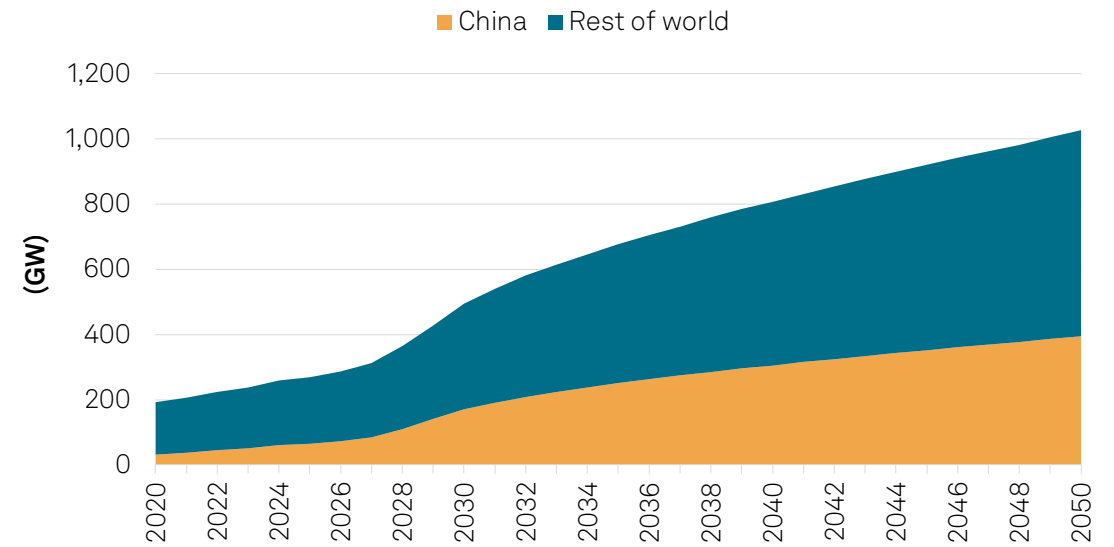
- China targets to reach 120 GW of pumped storage by 2030. Renewable developers are required to equip the projects with 10%*2 hour or more of storage facilities.
- Tariff mechanisms for power storage facilities are still developing. Currently, revenue mainly comes from capacity-based tariffs, rental income, power trading and ancillary services.

Battery storage installation over 2020-2050



GW--Gigawatt. Sources: S&P Global Commodity Insights. S&P Global Ratings.

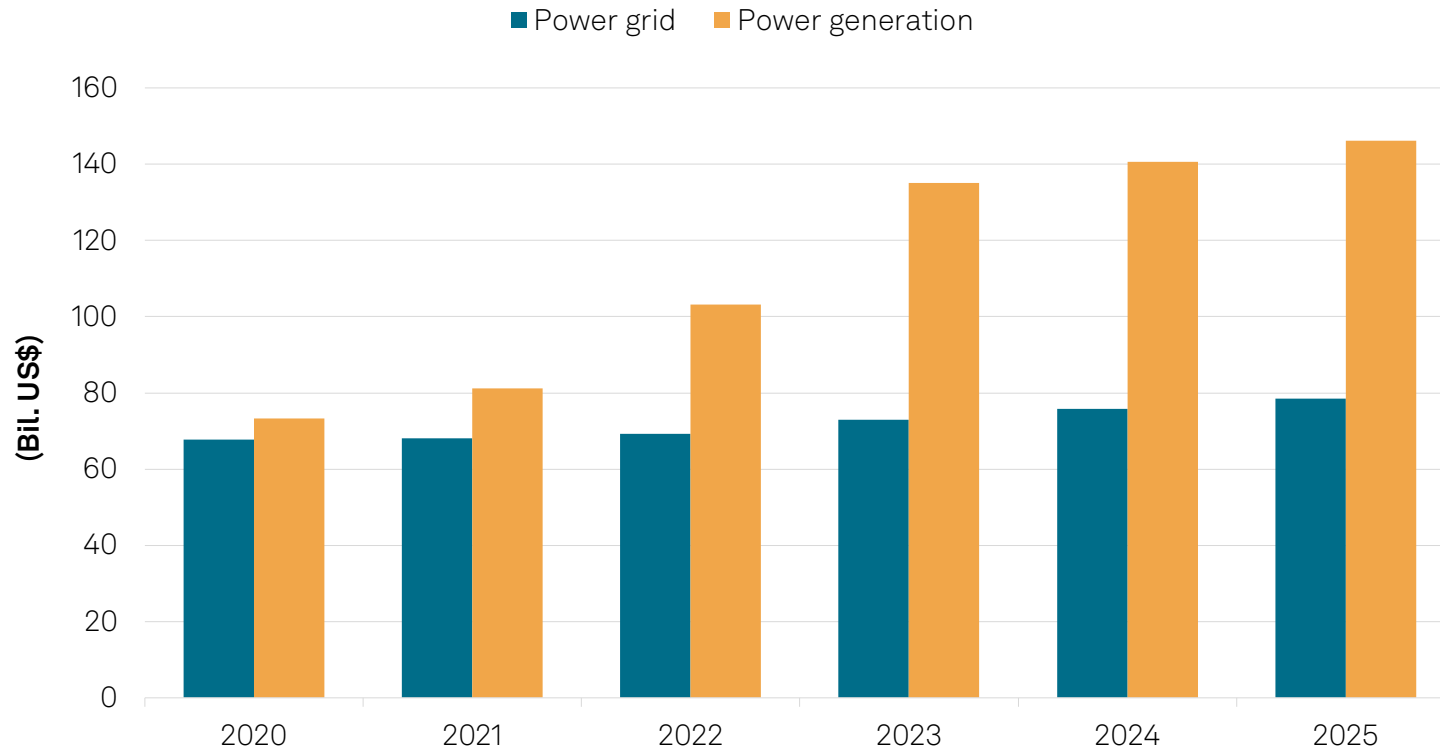
Pumped hydro storage installation over 2020-2050



GW--Gigawatt. Sources: S&P Global Commodity Insights. S&P Global Ratings.

China | Elevated Capex Required For Renewable Expansion

China's power and grid investment plan for 2020-2025



Source: S&P Global Ratings.

- Central state-owned enterprises (SOE) are leading the investment for both grids and generation projects in China.
- The combined capex of independent power producers (IPPs) will climb to US\$600 billion in 2021-2025, from US\$256 billion in 2016-2020, as they are adding more renewable projects to their capacity profile.
- Rated IPPs can cope with the massive investment needs as they will continue to benefit from low funding costs and diversified financing channels.
- Power grids' investment will stay high to upgrade infrastructure and build ultra-high voltage (UHV) lines to accommodate renewable dispatching.

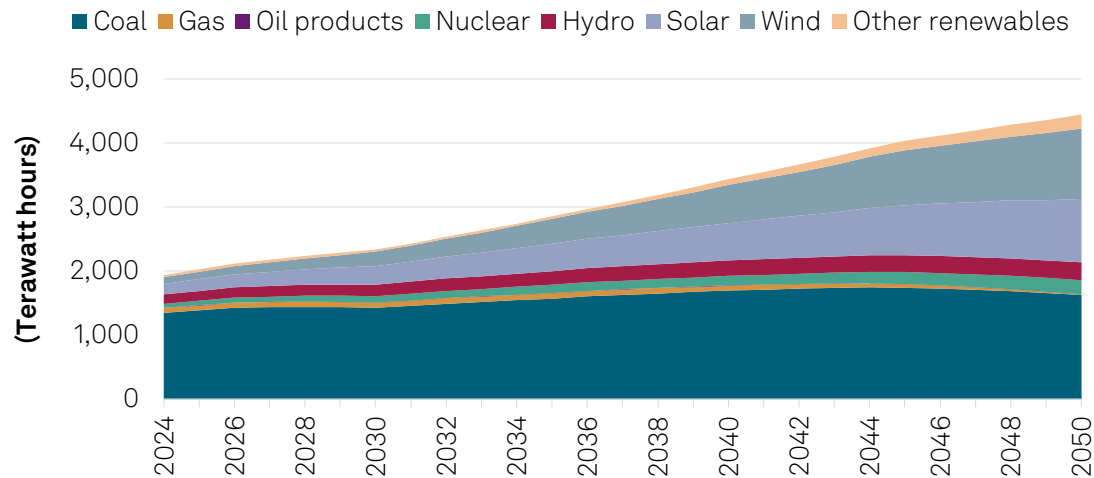
India

Demand Growth Trumps Transition Targets

India | Growth Needs Beat Transition Targets

- Power needs take priority over transition targets. High demand has led to power deficits. The intermittency of power supply from renewables, and capacity additions that have undershot targets, have resulted in additional 30 GW of coal capacity in plans.
- Increasing hybridization, round-the-clock tenders, pumped storage solutions and other power storage solutions (like batteries - but generally only for up to 2 hours) aim to address the challenge of providing stable power supply from renewable sources.
- Multidecade growth opportunities will keep capex and leverage elevated, limiting the potential for improvement in credit profiles from better diversity and scale.

Likely evolution of electricity mix



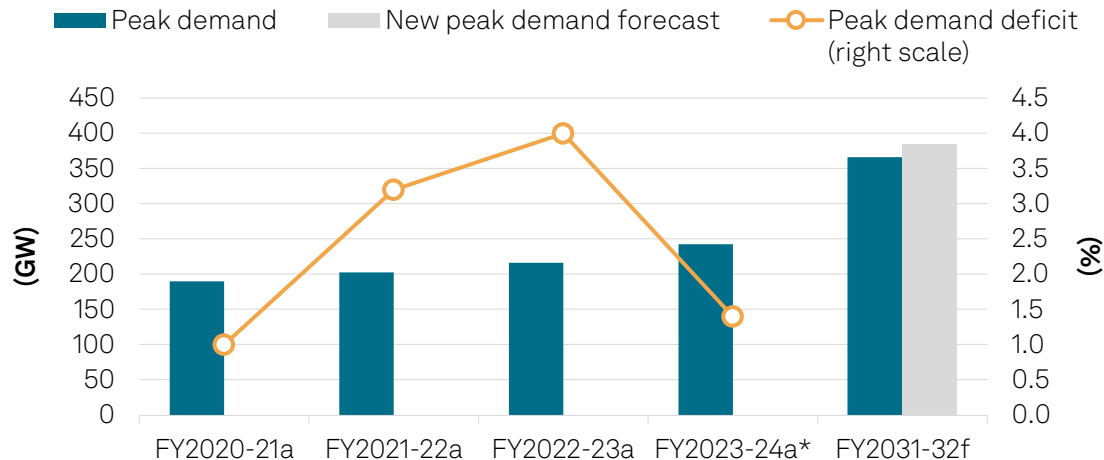
*According to a parliamentary announcement in early 2024, that target will be moved to 2032 from 2030. ETS--Emissions trading system. GW--Gigawatt. Sources: S&P Global Commodity Insights. Global Integrated Energy Model February 2024 Reference Case. S&P Global Ratings.

Policy	Target
Net zero	2070.
2030 emissions commitment	45% reduction in intensity vs 2005.
Renewable energy	500 GW of renewable capacity by 2030/2032*.
Coal phase-out	Only committed to "phase down".
Carbon tax	None established.
Carbon ETS	Under development, announced plans to launch a compliance carbon market in 2026.

India | Regulations Are Generally Supportive, With Some Caveats

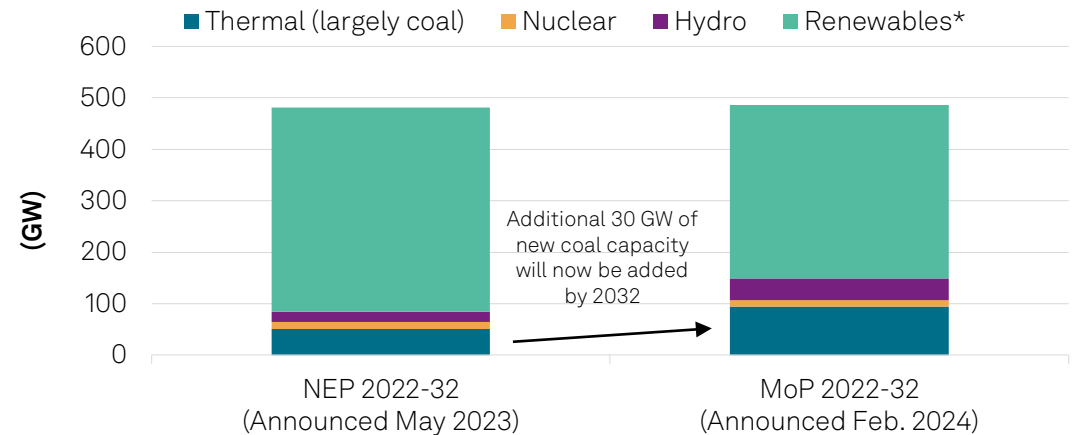
- Priority and must-dispatch status is supportive. Power deficit, lower renewables capacity additions, and intermittency has resulted in the return of additional 30 GW of new coal-fired supply by 2032 (earlier plans ruled out construction of new coal plants over 2022-2027).
- Mandatory domestic sourcing of modules under the approved list of models and manufacturers (ALMM) from April 1, 2024, could slowdown additions. The cost of modules from domestic OEMs (using imported cells) remains 15%-20% higher than imported modules.
- The Renewable Energy Certificates scheme is still evolving, while plans for a regulated carbon market covering carbon-intensive sectors slated to begin in 2026 could be delayed.

India estimates higher peak demand in 2032...



Peak demand deficit represents peak deficit as a percentage of peak demand. *As of January 2024. a--Actual. f--Forecast. FY--Fiscal year ending March. GW--Gigawatt. OEMs--Original equipment manufacturers. Source: Central Electricity Authority.

...which will require greater coal-capacity additions

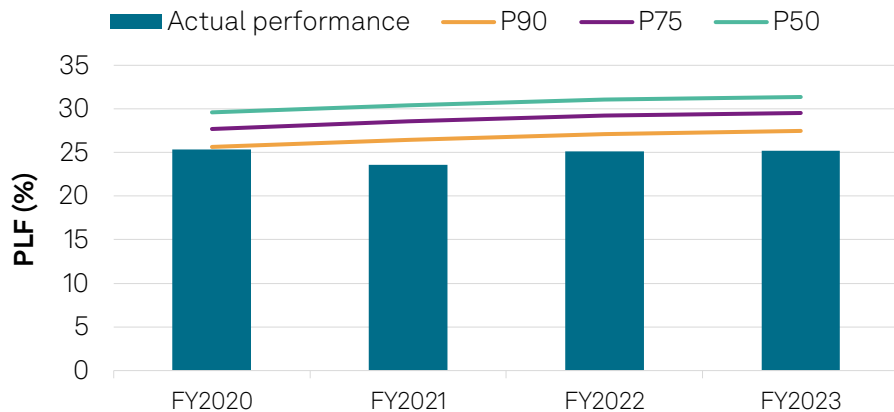


*Includes solar, wind and biomass etc. GW--Gigawatt. MoP--Ministry of Power. NEP--National Electricity Plan. Sources: Central Electricity Authority. National Electricity Plan 2022-2032. Ministry of Power.

India | Some Execution Challenges, Some Breakthroughs

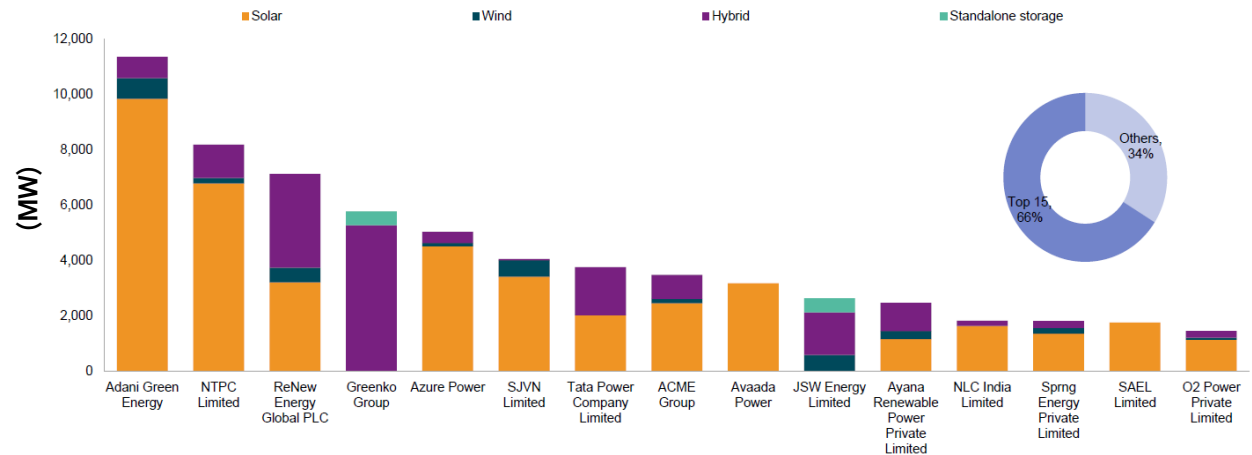
- India missed its 2022 renewables target of 175 GW of capacity (excluding large hydro) by 30%.
- Hybrid and storage projects formed about 35% of new tenders in the fourth quarter of 2023. This may help reduce intermittency within renewables and overcome poor generation for wind (missed P90 in seven out of eight years).
- 500 GW target by 2030/2032* requires more than a doubling of capacity additions to at least 40 GW yearly, compared with the current pace of up to 15 GW yearly. Enforcement of ALMM may create execution challenges.
- A 30 GW under development site to produce renewable energy with multiple developers at Khavda, with coordinated grid tenders, showcases India's new scale of ambition and execution within renewables.

Wind projects undershoot generation estimates



*According to a parliamentary announcement in early 2024, that target will be moved to 2032 from 2030. FY--Fiscal year ending March for Indian renewable companies and December for Vena Energy. PLF--Plant load factor. P90--Generation level expected to be met in at least 90% of years. Sources: Company data. S&P Global Ratings.

Solar and hybrid projects form most of the 63 GW of pipeline capacity of the 15 largest renewable companies in India

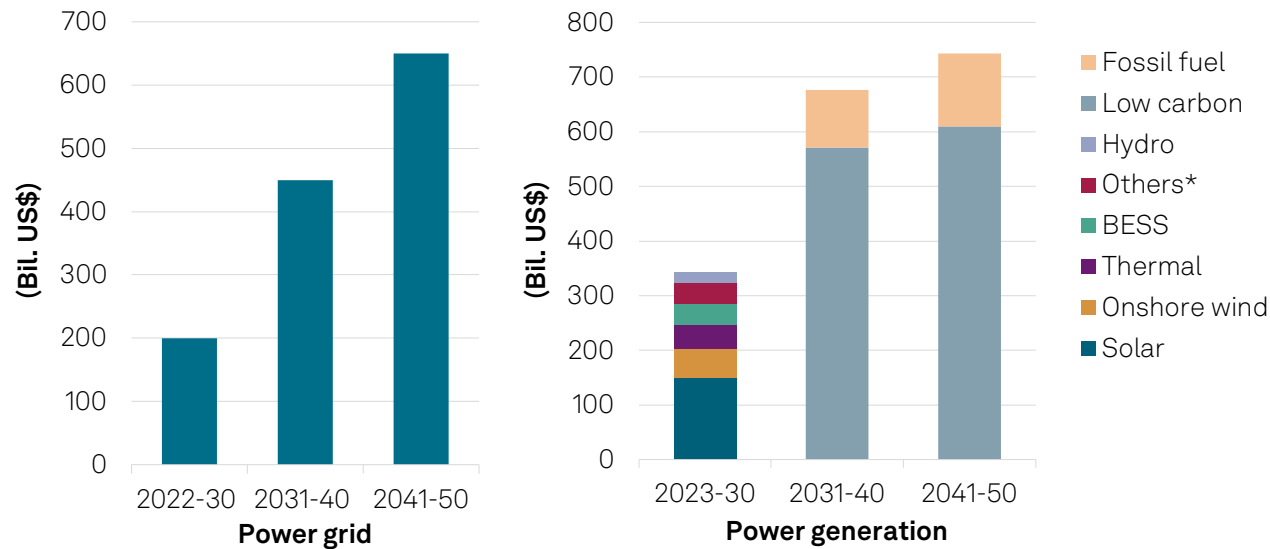


Data as of January 2024. GW--Gigawatt. MW--Megawatt. Source: S&P Global Commodity Insights.

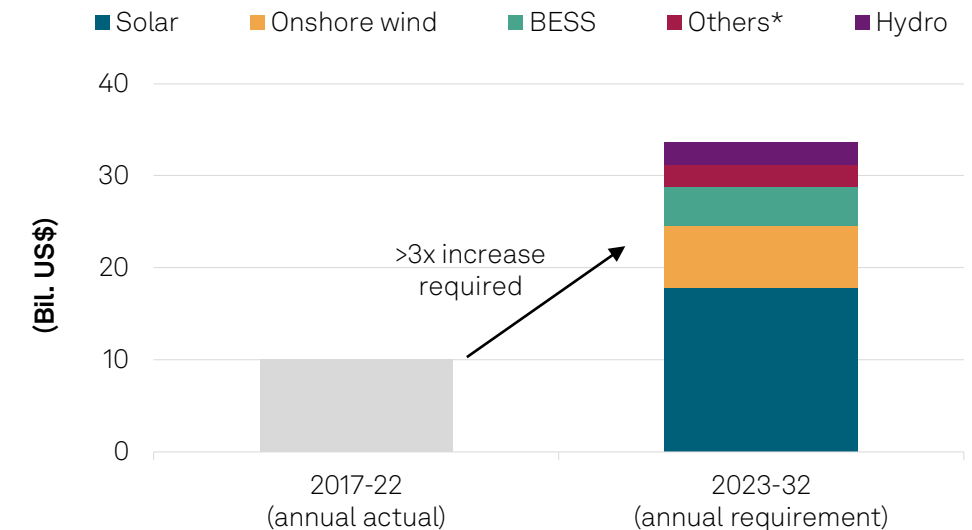
India | Massive Investments Will Keep Capital Expenditure High

- The private sector will drive investment in power generation, while public utilities such as Power Grid will support grid investments. Required increase in annual renewables investment by more than 3x to meet renewables targets will keep generators' leverage high.
- Close to 40% of total investments will go toward grid strengthening. Assured returns under the regulatory framework or comparable returns under the bidding projects should support the credit profile of transmission companies amid heavy spending requirements.

Total investments of US\$545 billion required over 2022-2030 and at least US\$2.5 trillion over 2031-2050



Annual average renewable investments need to rise significantly



*Include nuclear, offshore wind, pumped storage and biomass etc. BESS--Battery energy storage systems. Sources: Central Electricity Authority. National Electricity Plan 2022-2032. BloombergNEF Economic Transition Scenario.

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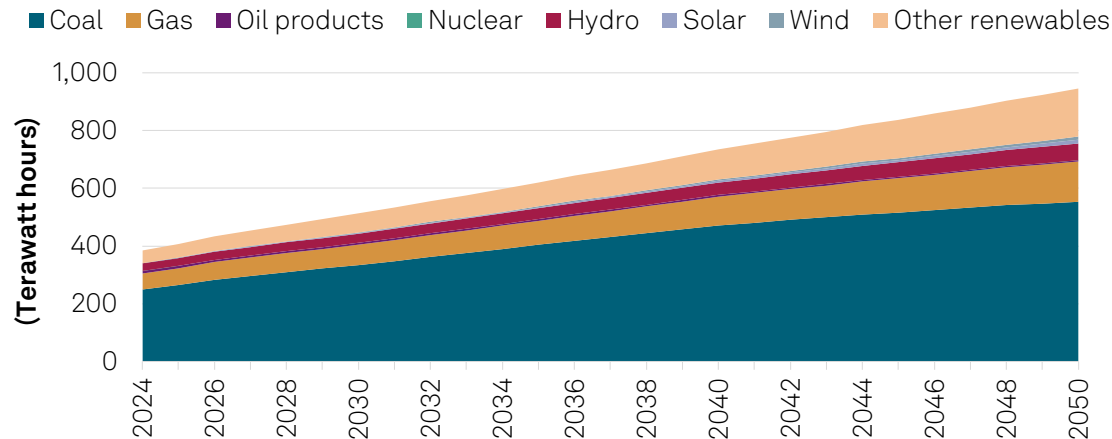
Indonesia

Who Will Pay For The Massive Investment?

Indonesia | Who Will Ultimately Pay For The Massive Investment?

- Indonesia's revised energy transition plans rely on a sharp increase in solar and gas capacities with some nuclear capacity to replace coal. These plans are yet to be achieved at scale in the country.
- Indonesia's policies will need to tackle subsidized power, the lure of cheap coal, and government reluctance to increase tariffs.
- Which parties pay how much (the government, PLN, consumers) will determine the credit rating impact on utilities.
- Funds committed under the Just Energy Transition Partnership (JETP) account for just a fraction of the total investment required for the transition goals of the Indonesian power sector. However, it can accelerate structural reforms to catalyze private investment.

Likely evolution of electricity mix



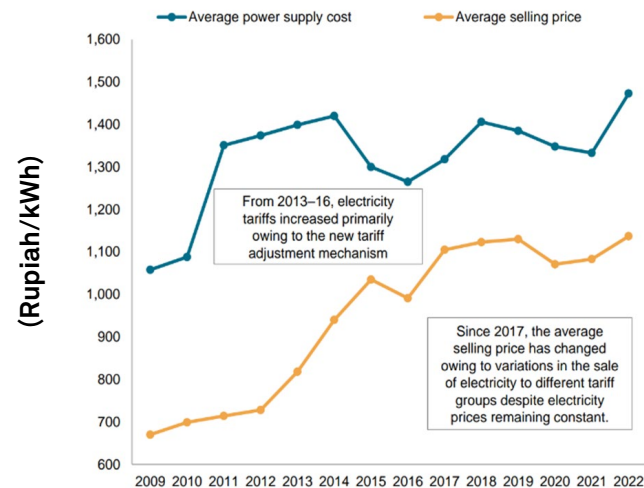
ETS--Emissions trading system. PLN—Perusahaan Perseroan (Persero) PT Perusahaan Listrik Negara. Sources: S&P Global Commodity Insights. Global Integrated Energy Model February 2024 Reference Case. S&P Global Ratings.

Policy	Target
Net zero	2060 or sooner.
2030 emissions commitment	Lower emissions by 43.2% below the business-as-usual scenario, with 11.3% conditional on support from developed countries.
Renewable energy	Proposal to lower 2025 target to 17%-19% from 23%; and the 2030 target to 19%-21% from 26%.
Coal phase-out	Policy aim to gradually retire 1.7 GW of coal capacity through to 2040, and to retire or repurpose the all coal plants by 2050.
Carbon tax	Under development, target implementation in 2025. Previously set to begin in 2022 at a proposed rate of US\$2.1/ton of carbon dioxide on coal plants, but was postponed.
Carbon ETS	Under development, launched a voluntary carbon trading platform in 2023. Demand has been low, with a price of ~US\$4.50 per ton of carbon dioxide. Initial phase only covers coal-fired plants connected to PLN's grid.

Indonesia | Regulatory Policies Don't Create Incentives For Transition

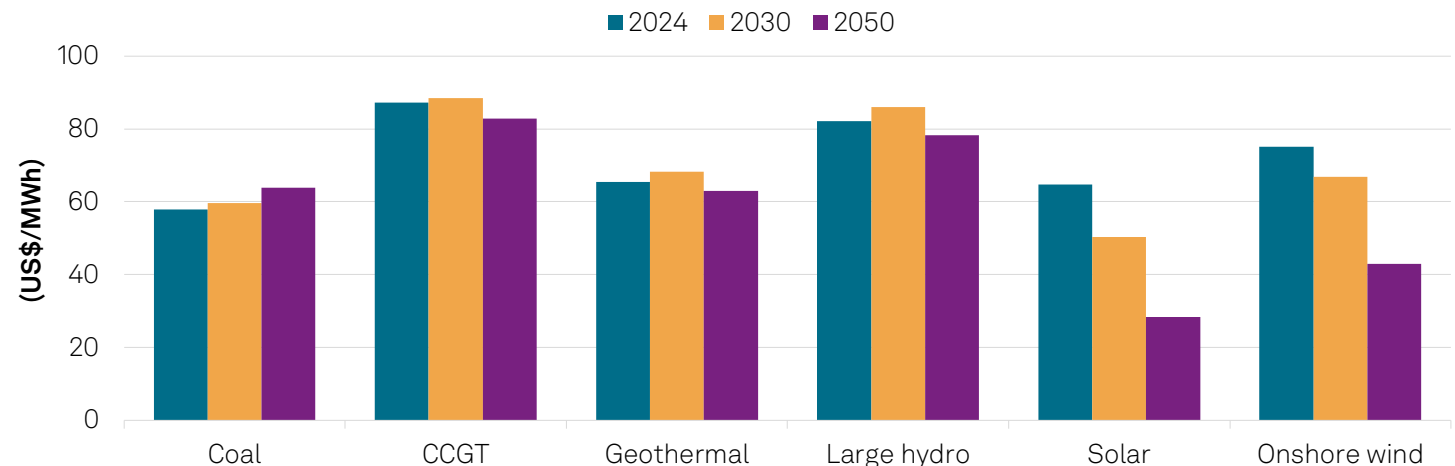
- Price caps on coal artificially lowers the cost of coal-fired generation and makes renewables less competitive.
- Electricity tariffs have remained largely unchanged since 2017 (and will likely stay flat till 2029) due to sociopolitical considerations.
- Fixed-price ceilings and inadequate cost-passthrough in renewable tariffs create a misalignment in incentives for energy transition.
- Loose caps for coal-fired plants, low carbon pricing, and a deferred use of carbon taxes will reduce the urgency to hit transition goals.

Selling price is 23% below power supply costs, on average*



*Per S&P Global Commodity Insights. kWh--Kilowatt hour.
Source: S&P Global Commodity Insights.

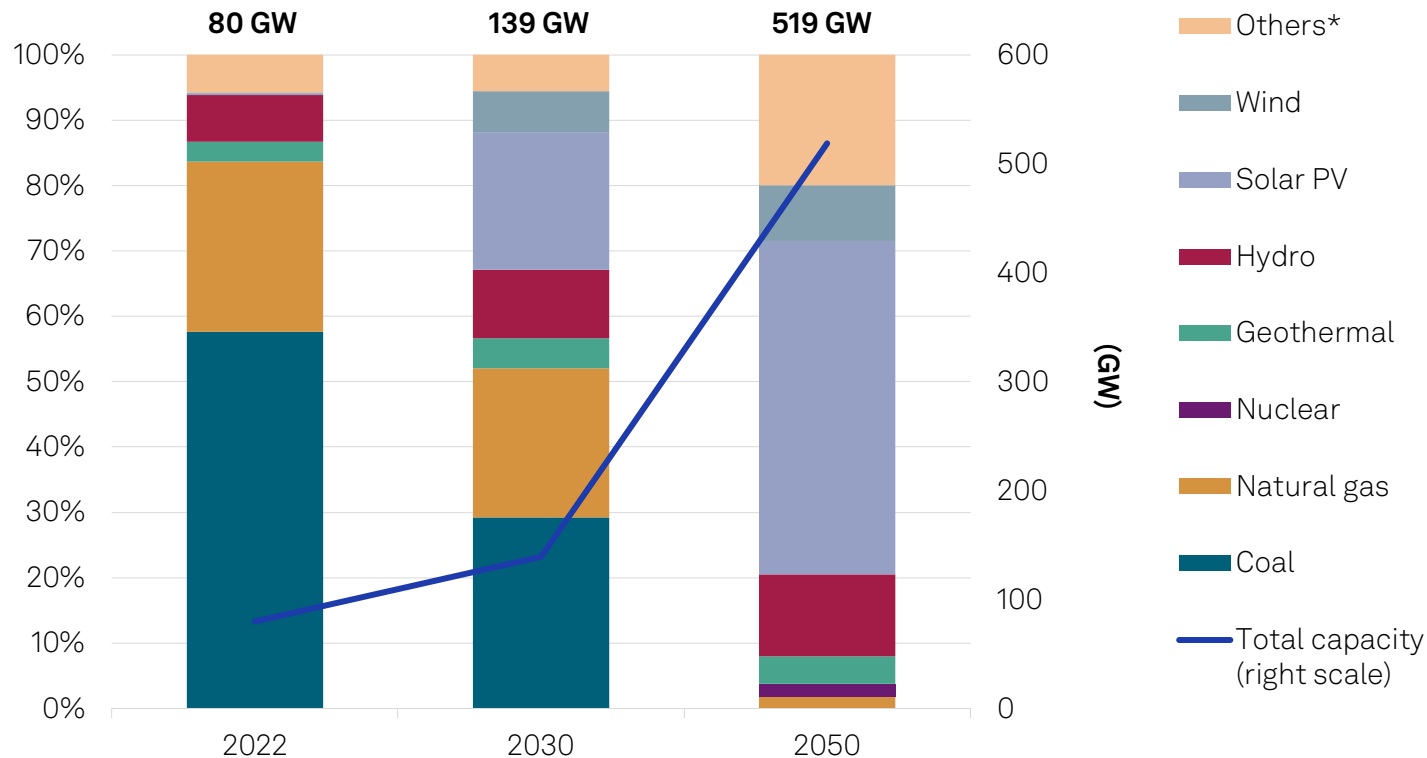
A reduction in the LCOE of renewable power supply will be needed to accelerate energy transition



LCOE--Levelized cost of electricity. CCGT--Combined cycle gas turbine. MWh--Megawatt hour. PV--Photovoltaic.
Source: S&P Global Commodity Insights.

Indonesia | Transition Targets Depend On Ending Coal Dependence

Capacity contribution plan includes major contributions from solar



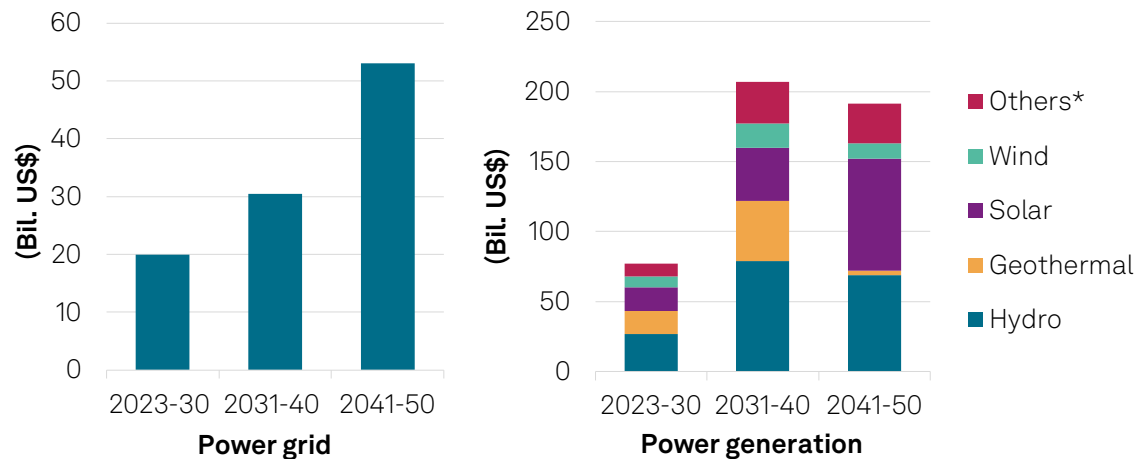
*Others include oil, bioenergy, hydrogen-based fuels and storage. CIPP--Comprehensive Investment and Policy Plan. GW--Gigawatt. JETP--Just Energy Transition Partnership. Sources: CIPP. JETP Secretariat and Working Groups 2023.

- Indonesia's challenge is growing capacity (1.5x by 2030, 6.5x by 2050) while changing the resource mix.
- Subsidized coal makes renewables less attractive.
- Solar capacity addition has yet to take off in Indonesia, unlike in India.
- Increase in hydro and geothermal capacities can help with baseload power but will lead to elevated construction risks and longer lead times.
- Apart from execution challenges, the vast distances between demand/supply centers for hydro would require significant grid investments.
- Targets also depend on sizable use of other technologies such as hydrogen, batteries, etc.

Indonesia | Massive Funding Needs May Strain Creditworthiness

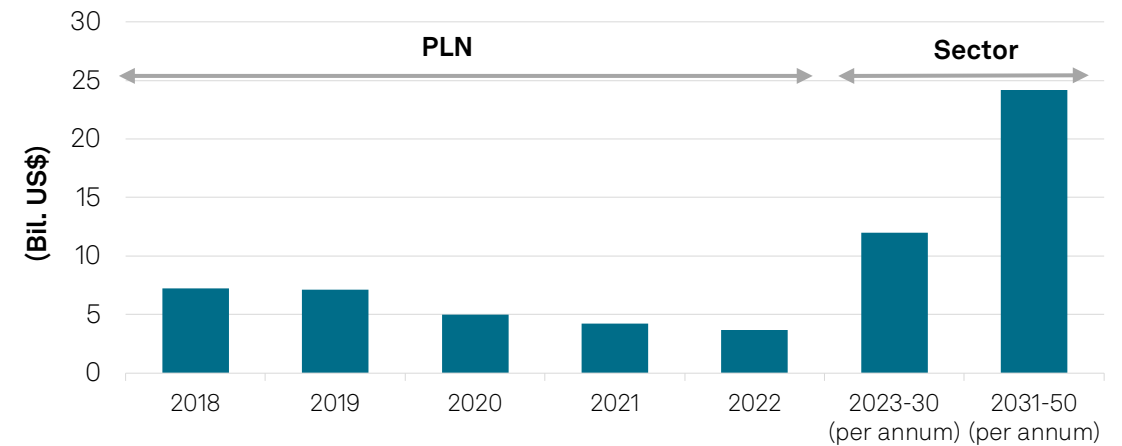
- US\$97.3 billion of power sector investments is required till 2030 and about US\$485 billion during 2031-2050. These are significant compared to the GDP of US\$1.3 trillion (2022).
- JETP's US\$20 billion commitments are conditional on reforms, include limited grants (about US\$300 million) and half the funding will be at market rates.
- Significant grid investments for inter-island renewables integration will only pick up after 2030, to be executed by PLN.
- Tariff caps below power supply costs and high capex needs may put pressure on PLN's financials without government support.

Investment requirements for the power sector



*Include storage, bioenergy and early retirement/phase-out of coal plants. CIPP--Comprehensive Investment and Policy Plan. JETP--Just Energy Transition Partnership. Sources: CIPP. JETP Secretariat and Working Groups 2023.

Actual PLN capex versus sectoral expectations



PLN—Perusahaan Perseroan (Persero) PT Perusahaan Listrik Negara. CIPP--Comprehensive Investment and Policy Plan. JETP--Just Energy Transition Partnership. Sources: CIPP. JETP Secretariat and Working Groups 2023.

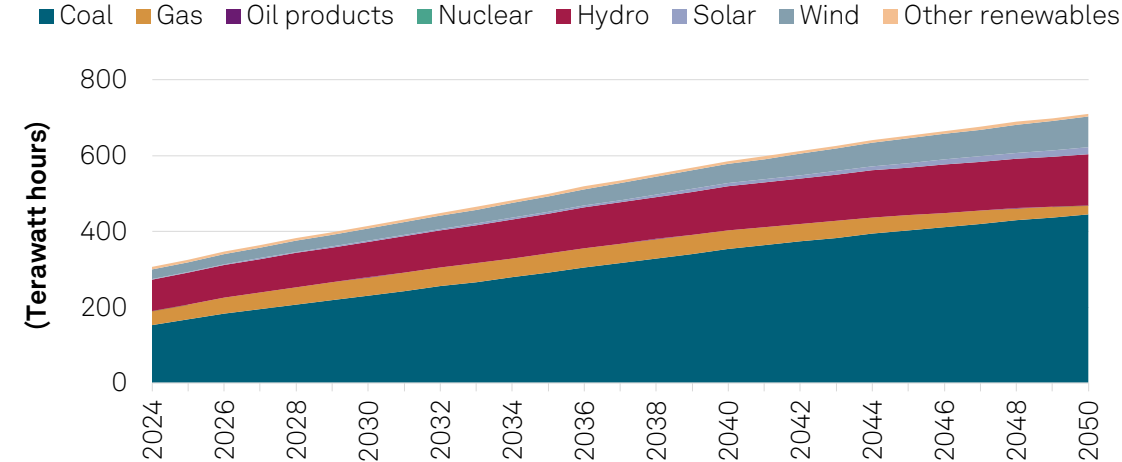
Vietnam

A Delayed Start To Tackling Ambitious Targets

Vietnam | A Delayed Start To Tackling Ambitious Targets

- An ambitious net-zero target becomes more challenging with changes in policy focus (gas/wind over coal/solar till 2030) and under-investment in grid.
- Delays to the finalization of the Power Development Plan (PDP) 8, continuing grid shortages and a lack of integrated policy measures to attract private-sector investments also make progress uphill.
- Lack of minimum offtake for new gas-fired plants, existing weakness in power-purchase agreements (PPAs) for curtailment risk and termination payments are key issues adversely affecting bankability and funding access.

Likely evolution of electricity mix

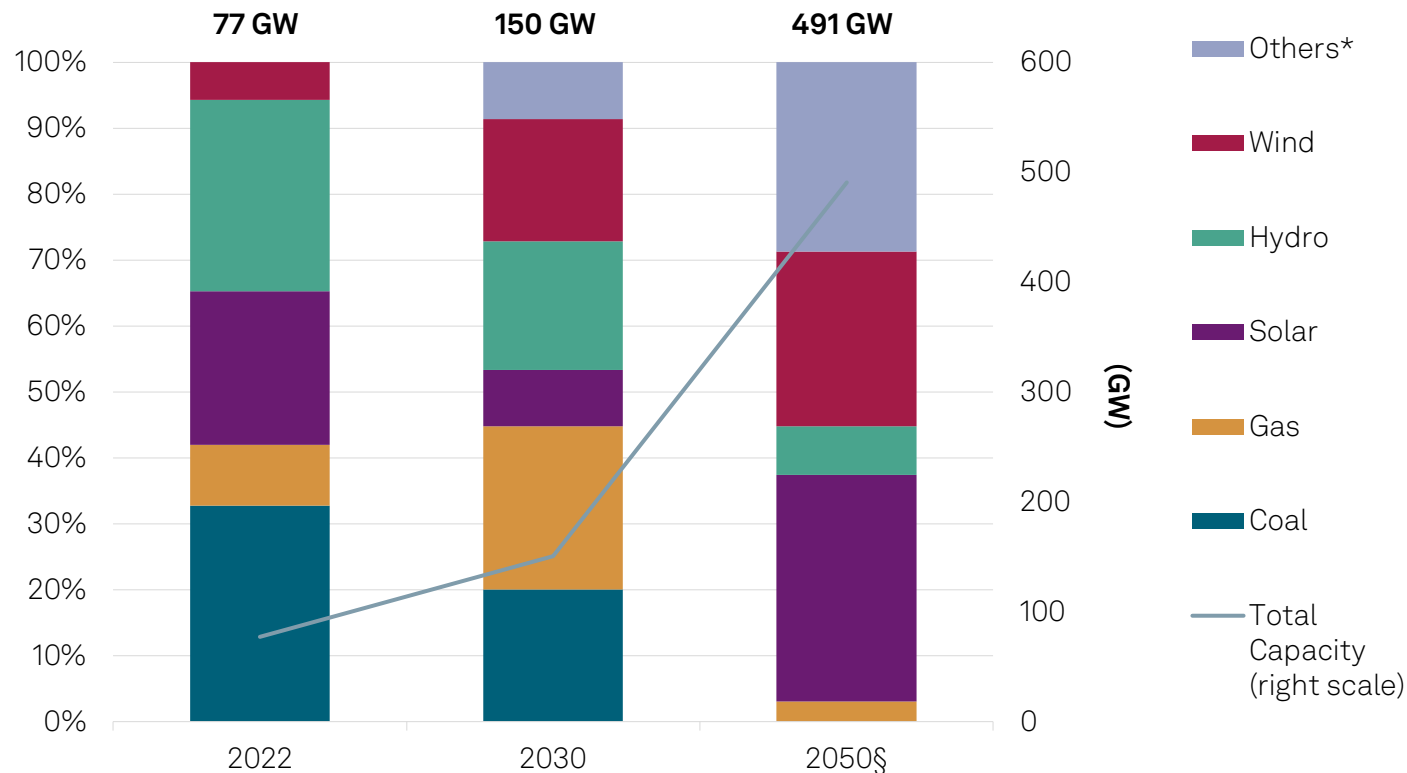


ETS--Emissions trading system. Sources: S&P Global Commodity Insights. Global Integrated Energy Model February 2024 Reference Case. S&P Global Ratings.

Policy	Target
Net zero	2050.
2030 emissions commitment	Lower emissions by 43.5% below business-as-usual scenario, with 27.7% conditional on support from developed countries.
Renewable energy	PDP 8 targets 30%-39% of electricity generation from renewable sources (excluding hydropower) by 2030.
Coal phase-out	PDP 8 outlines the slow retirement of coal fleets, with remaining coal capacity to be converted to 100% biomass or ammonia combustion by 2050.
Carbon tax	None established.
Carbon ETS	Under development to pilot ETS in 2025, with official operations to begin in 2028.

Vietnam | Transition Will Further Magnify Grid Shortfall

Capacity contribution plan includes major contributions from gas and wind



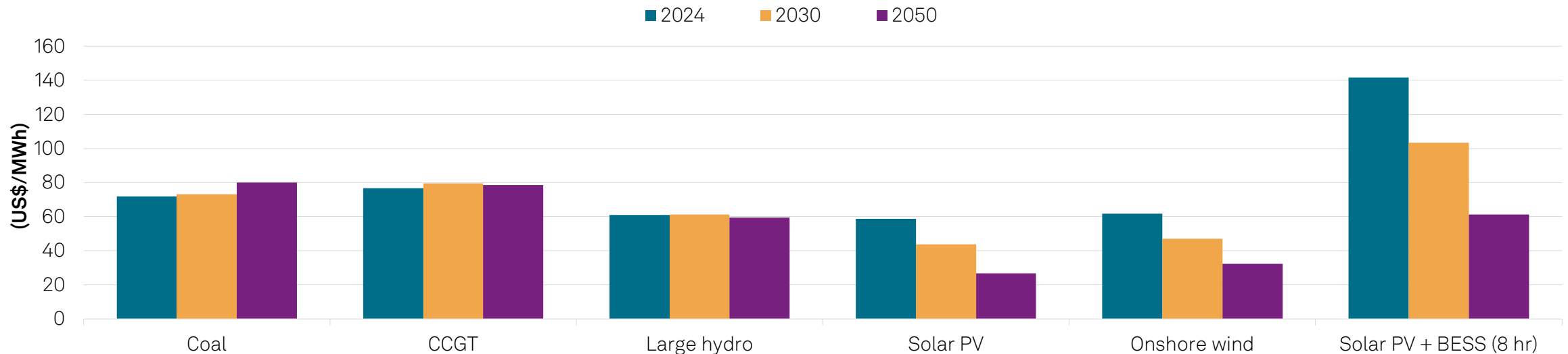
*Others include hydrogen, battery storage, flexible technology etc. §Lower capacity scenario. GW--Gigawatt. PDP--Power development plan. LNG--Liquified natural gas. Sources: PDP 8. S&P Global Ratings.

- Vietnam's main challenge is growing capacity needs even within existing grid shortfalls. 2x by 2030, 6x by 2050.
- Addressing existing challenge of relatively weaker PPAs and grid shortfall remain key to any solutions.
- Intent of higher gas/wind mix for more stable/greener power than coal/solar is clear. The path to achieving such plans, however, is not clear.
- New gas fields or LNG terminals will be required to support plans for additional gas-fired plants.
- Land access, permitting, reasonable tariff and evacuation infrastructure are required for offshore wind. World Bank estimates it will require five to 10 years of grid construction to absorb offshore wind.

Vietnam | Curtailment Risk Alters Competitive Dynamics

- In Vietnam, solar and wind tariffs are already lower than those for coal- and gas-fired power, even in the absence of carbon taxes.
- Grid shortages (which in some cases have impacted solar plants with 20%-40% curtailment) clearly changes the dynamics in Vietnam while on the face there is clear economic incentive to build renewables.
- Solar and onshore wind projects take six to 18 months for commissioning, while transmission projects take between 2.5 years to four years. Unless transmission is planned and executed ahead, new generation capacity will also face curtailment risk.

Vietnam: LCOE Outlook

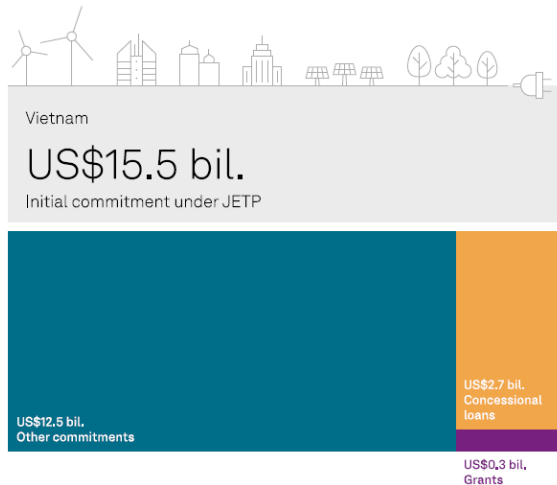


BEES--Battery energy storage systems. CCGT--Combined cycle gas turbine. hr--Hour. LCOE--Levelized cost of electricity. MWh--Megawatt hour. PV--Photovoltaic. Source: S&P Global Commodity Insights.

Vietnam | Massive Funding Needs, Vast Capacity Constraints

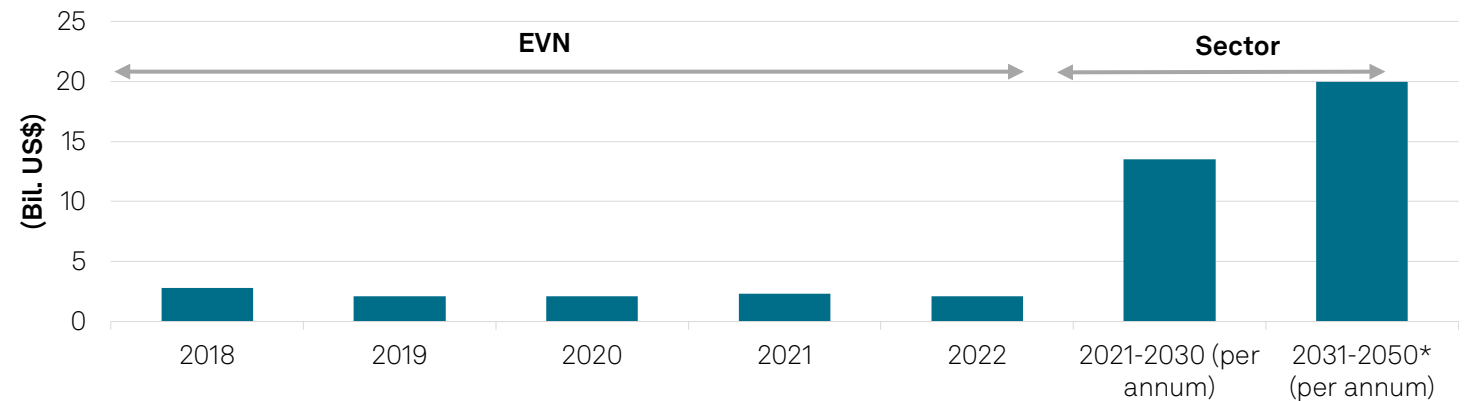
- Investment need of US\$135 billion over 2021-30 and US\$400 billion over 2031-2050 are massive, in context of US\$409 billion GDP (2022).
- JETP US\$15.5 billion financial commitments are conditional on reforms, include limited grants; half the funding will be at market rates.
- EVN capex has been limited by delays in financial closure, land acquisitions and/or the implications of COVID-19.
- Inadequate cost-passthrough from tariffs, massive capex needs may further strain EVN's financials.
- Government support for reforms, a robust PPA framework, strong grid and timely payments by EVN will be crucial for investments.

JETP: Mix of funds



JETP--Just Energy Transition Partnership. Sources: JETP, S&P Global Ratings.

Actual EVN capex versus sectoral expectations



*Lower capacity scenario. EVN--Vietnam Electricity. PDP--Power development plan. Sources: EVN, PDP 8, S&P Global Ratings.

Appendix

Long Way To Go Before Ambitious Energy Targets Can Be Met

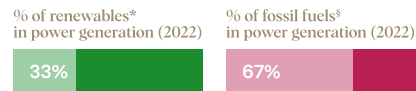
Australia

Renewable energy target

Large-scale renewable energy target of 33,000 GWh of additional renewable electricity generation each year between 2020-2030

Coal phase out

AEMO forecasts coal-fired power plants to be retired by 2038



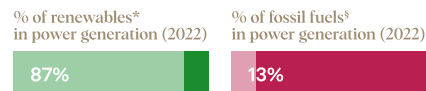
New Zealand

Renewable energy target

100% generation from renewables by 2030 (normal hydrological conditions)

Coal phase out

2037 for industrial thermal use (earlier for electricity generation)



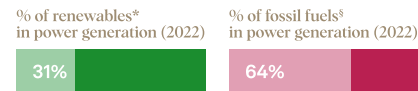
China

Renewable energy target

Wind and solar capacity to reach 1,200 GW by 2030. To add 80 GW hydro during 2021-2030

Coal phase out

Commit to phase down



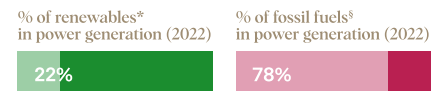
Philippines

Renewable energy target

35% generation from renewables by 2030 and 50% by 2040

Coal phase out

No target date



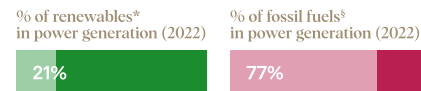
India

Renewable energy target

500 GW of renewable capacity by 2030/32†

Coal phase out

Commit to phase down



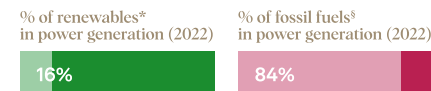
Thailand

Renewable energy target

Proposed PDP aims to boost renewable energy's share in power generation to 50% by 2037, from 30%

Coal phase out

No target date



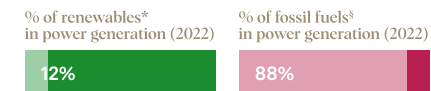
Indonesia

Renewable energy target

Proposal to lower 2025 target to 17%-19% from 23%, and 2030 target to 19%-21% from 26%

Coal phase out

Gradually retire 1.7 GW of coal capacity through 2040; retire or repurpose entire fleet by 2050



Vietnam

Renewable energy target

PDP 8 targets 30%-39% of power generation from renewable sources (excluding hydropower) by 2030

Coal phase out

PDP 8 outlines slow retirement of coal fleet, with remaining coal capacity to be converted to 100% biomass or ammonia combustion by 2050



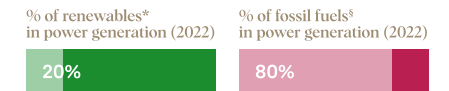
Malaysia

Renewable energy target

31% of total capacity from renewables by 2025 and 70% by 2050

Coal phase out

Close to fully phase out coal-fired power plants by 2050



*Includes hydropower and excludes nuclear energy. §Includes coal, natural gas and oil. †According to a parliamentary announcement in early 2024, that target will be moved to 2032 from 2030. GW--Gigawatt. GWh--Gigawatt hour. PDP--Power Development Plan. Sources: Statistical Review of World Energy 2023. IEA. Indonesia Ministry of Energy and Mineral Resources, Philippines Department of Energy, S&P Global Commodity Insights, S&P Global Ratings.

Related Research

- [China Gas Distributors Can Overcome Hit To Connection Revenues](#), April 15, 2024
- [China's Energy Transition Will Be Powered By Debt](#), April 15, 2024
- [Indian Renewables: A Deep Dive Into Operating Performance](#), March 7, 2024
- [Assessing Project Finance As Way To Unlock India's Renewables Potential](#), Feb. 22, 2024
- [Is Project Finance The Way Forward For Australian Renewables?](#) Feb. 22, 2024
- [Industry Credit Outlook 2024: APAC Utilities](#), Jan. 10, 2024
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- [Sustainability Insights: Indonesia And Vietnam's Energy Transition Investments Could Pressure Utilities](#), Dec. 12, 2023
- [China's Coal Power Producers Will Benefit From Tariff Reform](#), Nov. 14, 2023
- [Sustainability Insights: China's IPPs Can Speed Energy Transition As Power Demand Tapers](#), Nov. 7, 2023
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- [China Gas Distributors To Squeeze Out A Recovery In 2023](#), Sept. 14, 2023
- [Profit Turnaround Will Support China IPPs' Ambitious Transition Plans](#), Sept. 12, 2023
- [Energy Transition Puts Australian Gas Distributors On Track For A Managed Decline](#), Sept. 4, 2023
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- [Asia-Pacific's Different Pathways To Energy Transition](#), March 30, 2023

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