Zero Carbon Analytics

Briefing · November 2024

Opportunities for Asia's coal phase-out

Key points:

- Coal-powered electricity continues to dominate Asia's energy mix, though rising renewables contributions are slowly eroding its market share. A more rapid phase-out of coal is necessary to reach the 1.5°C Paris Agreement goal.
- Prioritising no new coal is key to unlocking energy transition opportunities in Asia. If no new coal is added to the system, 90% of coal plants will be over 20 years old by 2040, making it easier to retire these facilities since they are likely to have recovered their investment costs.
- Technical studies on innovative financing mechanisms to make the coal-to-clean transition financially viable offer new transition models, with case studies in Asia. First movers of these models can secure a strong competitive edge.
- Tests of co-firing to reduce emissions of existing coal plants have delivered only marginal emissions cuts while proving expensive, creating environmental risks and efficiency losses.
- Addressing local impacts and supporting coal-dependent communities through concessional and multilateral financing from developed countries supports a balanced top-down, bottom-up strategy necessary for a just transition.

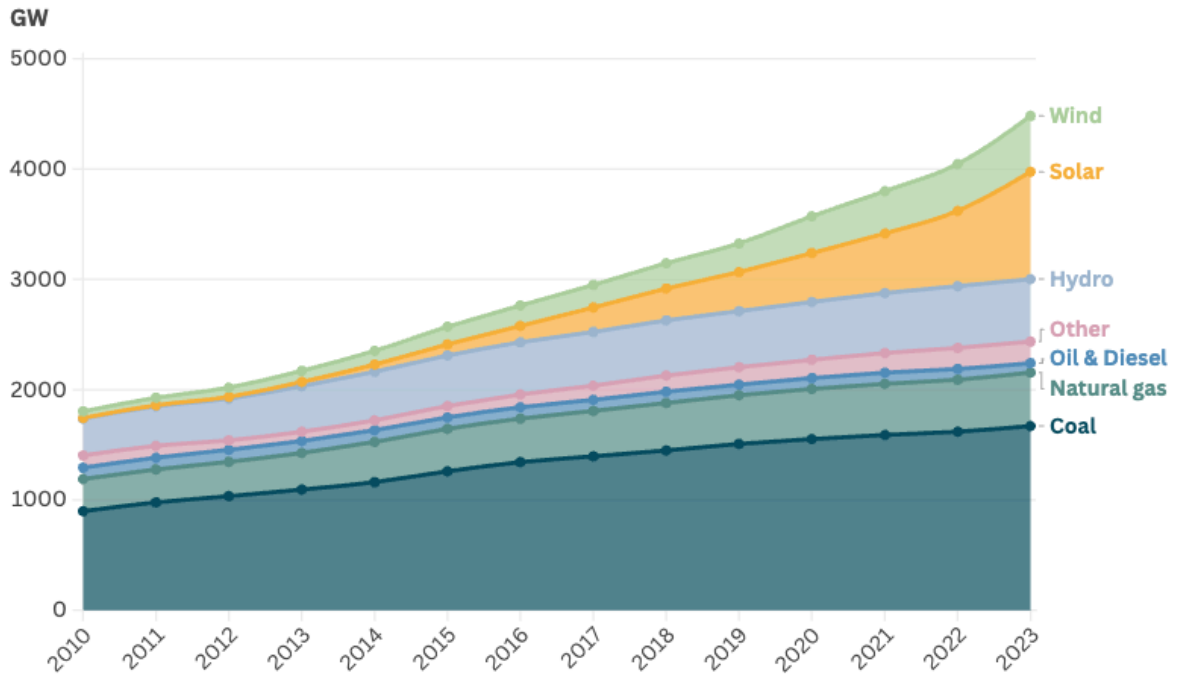
Asia's coal dilemma

Coal has historically dominated the global energy mix and maintains a strong presence in Asia's generation profile.[1] As Asia Pacific's energy needs grow, installed capacity has increased across all energy technologies, more than doubling cumulative capacity from 2010 to 2023. However, the pace at which each technology has grown varies greatly, which is starting to reshape the region's energy mix.

Although coal generation has grown over the last two decades – and still represents the largest part of Asia's cumulative installed capacity – its share of the energy mix has fallen from 50% in 2010 to around 40% in 2023, above the global average of 25%. Coal's market share has been eroded primarily by the rapid growth of wind and solar power. Solar has grown, on average, at 50% year-on-year from 2010 to 2023, reaching 21% of installed capacity in 2023, according to data from BloombergNEF (figure 1).

[1] In this briefing Asia largely refers to East Asia. Southeast Asia and South Asia except when noted otherwise.

Fig. 1: Cumulative installed capacity in Asia by technology (2010-2023)



Source: BloombergNEF data, Research Unit analysis. BNEF (2024) Capacity and Generation dataset • Other includes geothermal, marine, nuclear and biomass and waste.
BNEF's categorisation for Asia includes the sub-regions, East Asia, South East Asia, South Asia, Central Asia, Melanesia, Micronesia, and Polynesia.

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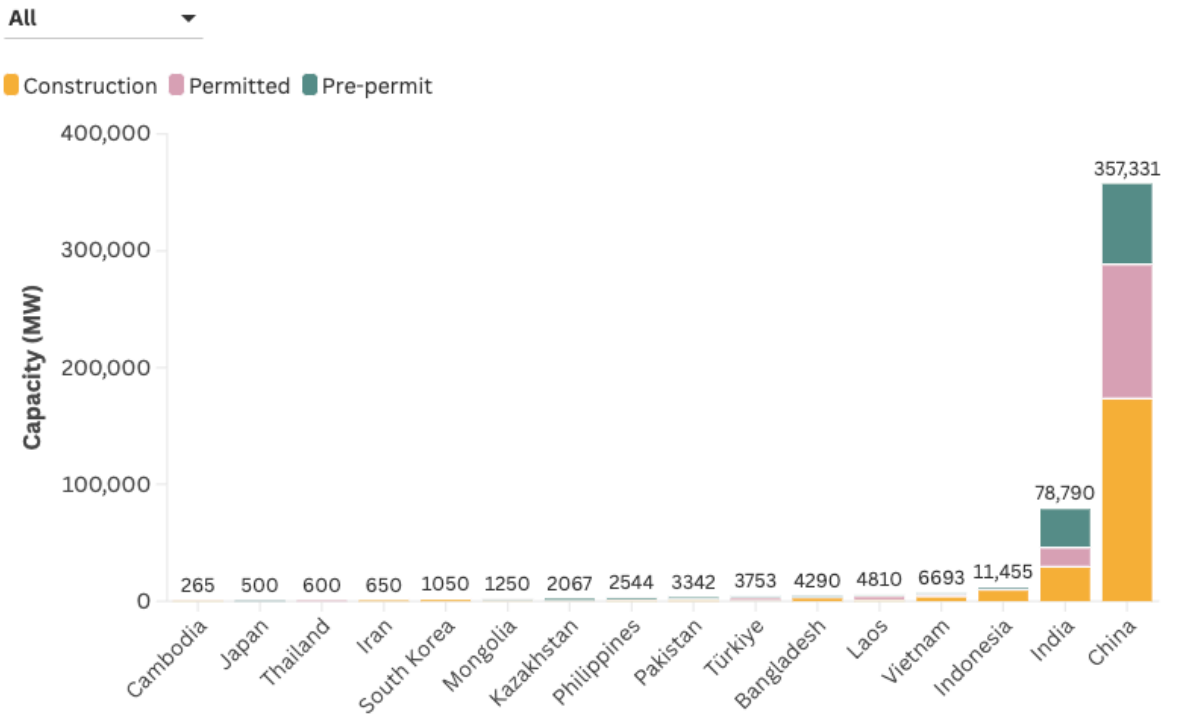
Despite the growing use of renewable power in Asia, the continuing expansion of coal – the most carbon-intensive fossil fuel – is concerning. The Intergovernmental Panel on Climate Change (IPCC) has assessed that to reach the 1.5°C Paris Agreement goal, Organisation for Economic Cooperation and Development (OECD) countries must phase out existing coal plants by 2030 and non-OECD countries by 2040. This will require a rapid phase-down across Asia.

New coal keeps coming

New coal plants continue to be added to the pipeline, especially in countries with strong growth of power demand such as China and India (figure 2). China and India also represent the majority of coal capacity currently in operation, with much of this provided by young plants commissioned within the last 20 years, roughly the amount of time it takes for a coal asset to recoup its initial investment costs (figure 3).

Fig. 2: Coal plants in the pipeline in Asia



Source: Global Energy Monitor: Global Coal Plant Tracker • Data was last updated in July 2024.
GEM's definition of Asia includes the sub-regions East Asia, Southeast Asia, South Asia and Central Asia.

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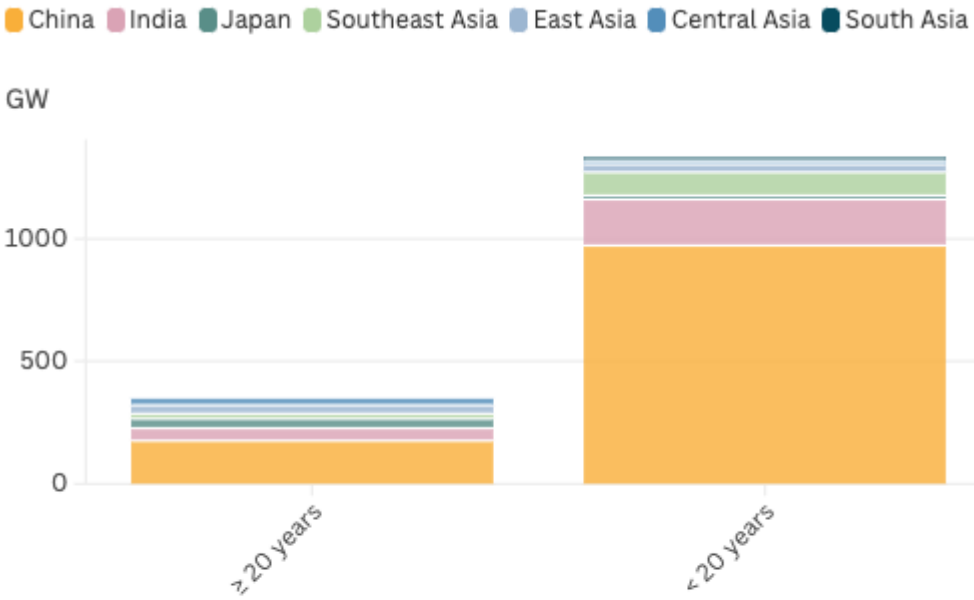
Fig. 3: Operating coal plants in Asia in 2024 by age group



Source: Global Energy Monitor: Global Coal Plant Tracker • Data was last updated in July 2024
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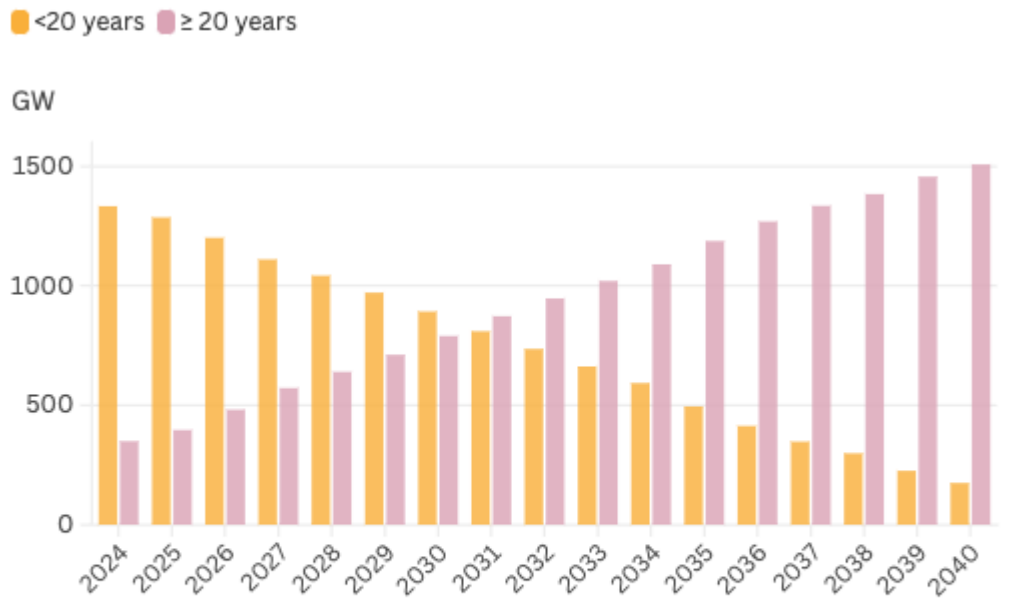
Prioritising no new coal

The age of a country's coal fleet is important to its transition planning because it impacts the financing needed to decommission assets. In general, it becomes cheaper to retire a coal plant once the initial investment of a coal plant has been recouped, though some studies have shown that the details of coal-to-clean transactions can impact this dynamic. The average time it takes to recover this capital is up to 20 years, after which the cost of retiring a coal plant depends mostly on system reliability as well as supply and demand dynamics and any power purchase agreements.[2]

Using 20 years as the average payback period, if no new coal is added to Asia's existing coal fleet, by 2040, 90% of the fleet would be older than 20 years and can be feasibly retired, based on data from the Global Energy Monitor.

Fig. 4: Age of coal plants in Asia 2024-2040 if no new coal is added to the system



Source: Global Energy Monitor: Global Coal Plant Tracker • Data was last updated in July 2024.
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However, if the coal plants currently in the pipeline (pre-permit, permitted and under construction) come online, then the proportion of coal plants that are younger than 20 years by 2040 will increase from 10% to 30%. This greatly raises the cost of transitioning from coal to clean energy. Many governments have already recognised this, leading to steps such as the G7 banning or limiting public funding for coal power, but further measures are required to support the transition away from coal globally, especially in emerging economies where financial support is paramount.

The priority for governments in Asia should be to target the coal plants in the pipeline to reduce reliance on coal. Innovative strategies that integrate the early retirement of coal

[2] Other papers have also looked into the payback period for China and India.

plants with development of low-cost wind and solar and balancing services will ensure green growth is coupled with energy security.

Co-firing rather than retiring for coal plants brings risks

Many Asian countries, keen to hold onto coal plants that are still relatively young, have tested co-firing with other fuels, such as ammonia or biomass, as a way to reduce the plant's emissions. Such efforts were called out by the UK and Canada for encouraging extended coal use at the G7 in 2023.

- **Ammonia co-firing:** The most technically feasible ammonia co-firing rate being tested is 20%, which means 80% of coal emissions remain. This is estimated to require an 11% premium in capital expenditure and a 10% premium in operating expenditure, while causing a relative thermal efficiency loss of 12%, according to BloombergNEF interviews with Japanese manufacturers.[3] Burning ammonia also produces harmful nitrogen oxides which pose a safety risk and would need to be controlled at co-firing plants.
- **Biomass co-firing:** Biomass co-firing shares similar risks with ammonia, with added risks of deforestation and biodiversity loss. This is because the time it takes for new trees to absorb the carbon emitted by trees harvested to burn is between 44 and 104 years and could be even longer. Woody biomass is also carbon intensive, and can emit 30% more carbon per unit of energy than coal. In 2021, over 500 scientists and economists warned that laws that treat biomass as carbon neutral would "create a model that encourages tropical countries to cut more of their forests". Indeed, in Indonesia, using wood to replace 10% of the coal used by the country's largest power plants could result in deforestation 35 times the size of Jakarta.

Initial tests have shown that these nascent technologies will require new supply chains and expensive retrofits and reduce plant efficiency while cutting emissions far less than mature renewables would at the same cost. Looking ahead, although retrofits may ease short-term capital losses from early coal plant retirement, early retirement brings long-term benefits. Declining storage, solar and wind costs mean that replacing the entire coal fleet with clean energy could result in USD 105 billion in net annual savings by 2025, according to a 2020 report by Rocky Mountain Institute (RMI). By the end of the century, this is estimated to accumulate to a net gain of USD 78 trillion in benefits from avoiding the damage caused by climate change.

The flurry of announcements around co-firing testing initiatives has shown strong supply-led signals, but the demand signals are uncertain and pose significant risks. This can lead to inflated expectations as seen with the 'hydrogen hype' cycle – where hydrogen was touted as the next new low-carbon fuel but lacked binding off-takers due to higher-than-expected project costs that led many developers to cancel projects, including a renewable hydrogen project in Germany, a green hydrogen-to-methanol in Denmark and a blue hydrogen project in Norway.

[3] BNEF (2022) Japan's Costly Ammonia Coal Co-Firing Strategy, available via BNEF platform, accessed on 24 October 2024.

Technical studies find early coal retirement in Asia is financially viable

A number of studies have addressed ways to make the early retirement of coal plants financially viable. The following are summaries of two studies by the Institute of Energy Economics and Finance (IEEFA) and Griffith Asia Institute addressing Asian examples of how this would work.

1. IEEFA looked at how to structure coal-to-clean transition transactions that replace private coal power-purchase agreements (PPAs) with renewables and energy storage PPAs. The model ties the construction of new renewables capacity to the decommissioning of a coal facility so that renewables are phased in as coal is phased out over a discrete period of time. The transaction is structured to cover the costs of this transition, including the remaining equity value of the coal plant, meaning all parties are adequately compensated. The study found that while each deal must be tailored to local circumstances, the general structure required, at most, a small initial philanthropic investment and no or low subsidies. Coal plants best suited for these PPAs meet the following conditions:

    - Built before 2015, preferably between 1990 and 2010
    - At least 1-GW capacity preferable
    - Countries without onerous PPA legislation and subsidies to power plants
    - Clarity about debt holders
    - Existing IPP framework
    - Coal IPP owners demonstrating an interest in disposing of their coal assets
    - Able to be linked or bundled
    - Countries where power demand will grow
    - Countries that import coal and/or gas

    This report indicates there could be as many as 800 coal units globally with the right conditions to make this switch, a number of which are located in Southeast Asia. The study looked at five case studies where this model could be deployed with immediate effect. One of these is the 2.6-GW Mae Moh coal plant in Thailand. The new PPA deal would include 13.8 GW of solar PV capacity with battery storage enabling the plant to retire by 2026 and prevent 21 million tonnes of carbon dioxide emissions on an annual basis.

2. Griffith Asia and its partners conducted a study modelling the enterprise values of six Chinese-sponsored coal-fired power plants in Vietnam and Pakistan. Enterprise value calculations were based on discounted cash flows. This was done under three financing models (shown below) and three future geoeconomic scenarios to model external impacts such as fuel prices.

    - **Baseline** where the plant operates until the end of its PPA.
    - **Asset refinancing** where the plant raises refinancing and is retired upon maturity or on the last payment year of its refinanced debt.
    - **Renewables bundling** where the plant raises refinancing and reinvests net proceeds into renewables. The plant is then retired on the last payment year of its refinanced debt.

    Plant-by-plant analysis showed that (1) early coal retirement increases enterprise value through refinancing for all plants; (2) refinancing combined with renewable energy investments more than triples the enterprise value compared to the value

under the original PPA, and (3) younger plants can be retired relatively earlier as younger plant has more operating years that can be shaved off.

A key reason that coal-to-clean transition transactions are financially viable is the falling capital requirement of renewables. Analysis from RMI has shown that the upfront costs of solar will be lower than coal before 2030 for Vietnam and India, further incentivising no new coal. This is significant as, for many developing countries, the up-front cost of new infrastructure is a key obstacle and access to capital is limited.

The International Energy Agency also found that in Southeast Asia, growing the share of low-cost renewables in the energy mix will mean the average cost of electricity will fall from around USD 120 per megawatt hour (MWh) today – above the global average – to just under USD 100 per MWh by 2035 and to USD 80 per MWh by 2050.

For Asian countries to embrace this opportunity, resources should not be wasted on co-firing, which will require investment in new supply chains, is costly and can lead to mass deforestation for biomass. Co-firing will deliver only marginal emissions cuts that will not be ambitious enough to achieve the 2040 coal phase-out deadline for non-OECD countries. For a fair phase-out, developed nations must lead the way – with actions such as the UK closing its last coal plant in September 2024 – and deliver concessional, multilateral financing to support coal-dependent developing countries facing rising power demands to phase-out coal in line with global decarbonisation objectives.

Support needed for a just transition

Governments of coal-dependent countries, particularly those that are classed as developing, require sufficient access to finance – either concessional or multilateral – to enable their energy transition. Steps have been taken through initiatives such as the Energy Transition Mechanism and the Just Energy Transition Partnership (JETP) designed to support the coal- to- clean transition in South Africa, Indonesia and Vietnam. However, progress is slow and no material funding has been deployed so far under the JETP deals secured in 2022 by Indonesia and Vietnam.[4]

Combining bottom-up and top-down approaches is key to a just coal phase-out. The Carbon Trust has provided principles to mitigate potentially negative socioeconomic effects on workers and local communities from early retirement of coal plants while embracing the benefits of moving to cleaner sources of energy:

- **Governance:** guidance on establishing dedicated institutions, structures, and funding processes to drive and be accountable for the just transition. For instance … stakeholder forums and social dialogue processes.
- **Livelihoods:** guidance on and tools to assess impacts on direct, indirect and induced employment. It features practical ways … for examining how workers might transfer to new livelihoods and options for other forms of support. For instance, this could include jobs and livelihoods impact assessment that considers worker ages and retirement plans to inform closure plans and minimise redundancies.
- **Community and environment:** tools to assess the social, economic and environmental risks to the wider community. It also includes guidance on mitigating these risks, investing in diversifying and strengthening the local economy, investing

[4] BNEF (2024), Asia Pacific's Energy Transition Outlook, available via BloombergNEF platform, accessed 1st November 2024.

in sociocultural projects and prioritising regional revitalisation. For instance, this could include community ownership of renewable energy projects".

Beyond meeting the 2040 coal phase-out target, retiring coal plants needs to be a just and managed process. This can be achieved through concessional/multilateral financing, as well as leveraging new innovative contracts that integrate renewable investments with the phasing-out of existing coal assets. First-movers of these models can set a replicable standard. By 2040, most existing coal plants in Asia will have recouped their initial investment costs. Prioritising smart solar and wind investments – which provided 500 TWh out of 600 TWh of demand growth in 2023 – rather than new coal plants will enable green growth in Asia.