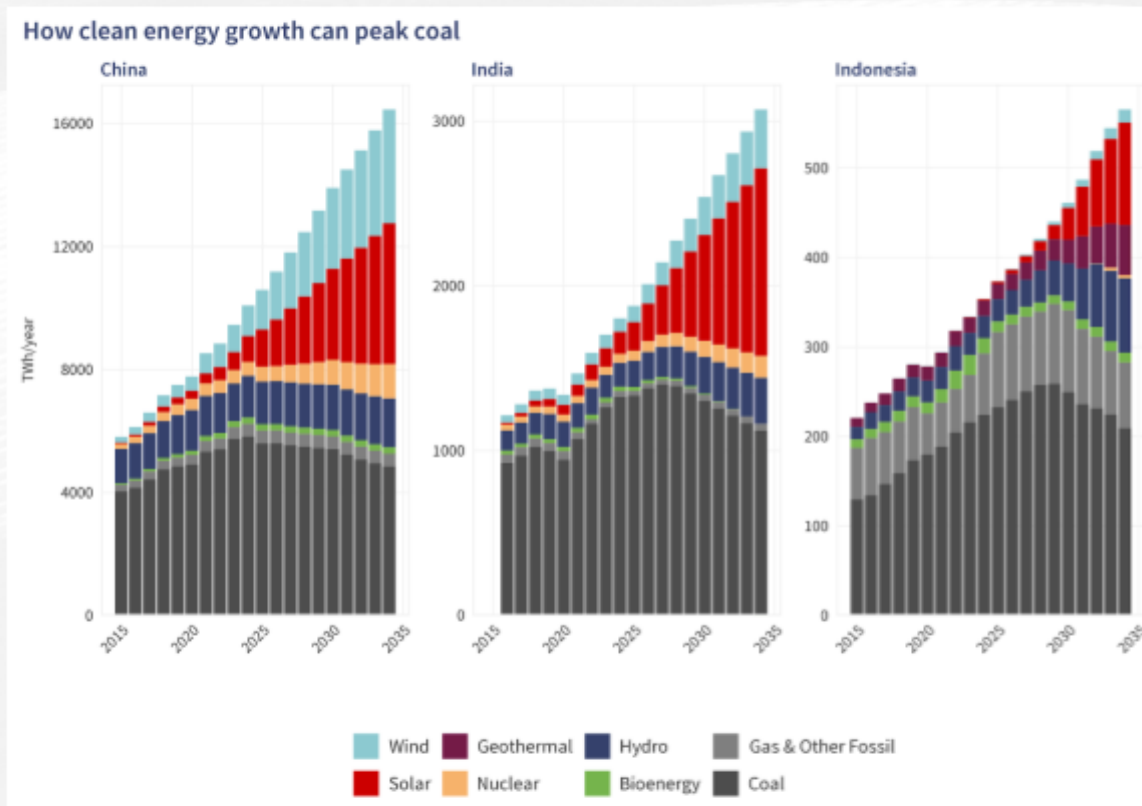


China, India, and Indonesia: The world's top coal growth markets can all peak emissions by 2030

Lauri Myllyvirta, Katherine Hasan, Manoj Kumar, Nadine Zahiruddin, Qi Qin



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Authors

Lauri Myllyvirta

Katherine Hasan

Manojkumar N

Nadine Zahiruddin

Qi Qin

Editor / Designer

Jonathan Seidman

About CREA

The Centre for Research on Energy and Clean Air (CREA) is an independent research organisation focused on revealing the trends, causes, and health impacts, as well as the solutions to air pollution. CREA uses scientific data, research, and evidence to support the efforts of governments, companies, and campaigning organisations worldwide in their efforts to move towards clean energy and clean air, believing that effective research and communication are the keys to successful policies, investment decisions, and advocacy efforts. CREA was founded in Helsinki and has staff in several Asian and European countries.

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China, India, and Indonesia: The world's top coal growth markets can all peak emissions by 2030

Summary

- China, India, and Indonesia could peak power sector coal use and emissions by 2030, a global breakthrough given that these nations have been the three largest growth markets for coal and largest sources of increased CO₂ emissions in the decade since the Paris Agreement.
- China's power sector emissions have been falling since early 2024 and will continue to decline if the country continues its current clean energy growth. India's power sector emissions will peak if the country meets its 2030 non-fossil energy target and continues adding clean energy at similar rates thereafter; in Indonesia, achieving President Prabowo's 100 GW solar goal will peak emissions from power generation.
- If successful, these countries would join several other BRICS nations (Brazil, South Africa, UAE, Ethiopia) in having peaked their power sector emissions, putting the bloc in a perhaps surprising position to claim climate leadership.
- Clean energy expansion is driven by improved economics, opportunities to attract manufacturing and investment, as well as energy security and energy access goals.
- Common challenges that have to be overcome to realise and sustain the clean energy booms in all three markets include the major changes needed to power grid operation, opposition from fossil fuel operators, and continued buildout of coal and gas-fired power generation, as well as fossil fuel extraction capacity.
- A common key concern in these three countries is the lack of roadmaps for coal phase-down after peaking. A rapid phase-down versus a drawn-out plateau could mean a difference in global emissions equivalent to 500 large coal-fired power plants by 2035.

How clean energy growth can peak coal

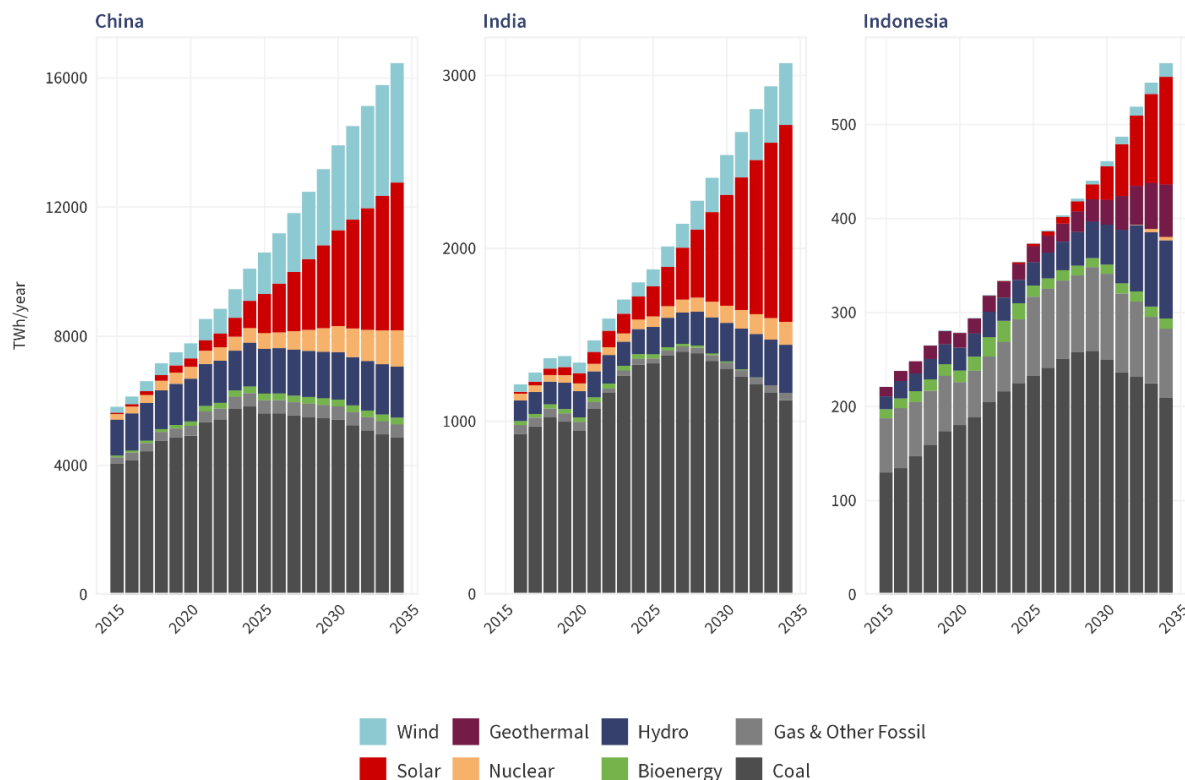


Figure 1 — Projected power generation by source under current clean energy trends and targets, in China, India and Indonesia, 2015 to 2034

The current rate of clean energy additions can cover all power demand growth and peak coal power imminently in China, and targeted rate of clean energy additions can do this before 2030 in India and Indonesia. Demand growth projections from China's State Grid, India's Central Electricity Authority (CEA) and Indonesia's RUPTL 2025-34.^{1,2,3} Clean energy growth projections for China from China Photovoltaic Industry Association, China Wind Energy Association and for nuclear based on a continuation of the recent pattern of approving 10 new reactors per year.^{4,5,6} For India, projections from the CEA, with the capacity additions in the last projection year extended to future years. Indonesia's clean energy growth based on the RUPTL, adding the effect of completing the 100 GW solar programme over 10 years. Ember historical data up to 2024.⁷

¹ 中国能源报 (China Energy News). (2025, August 25). 电力系统低碳转型走向攻坚期 ["The power system's low-carbon transition enters a critical phase"]. 中国能源报. https://paper.people.com.cn/zgnyb/pc/content/202508/25/content_30099920.html

² Central Electricity Authority. (2023). Report on optimal generation capacity mix for the year 2029-30 (Version 2.0). Government of India. https://cea.nic.in/wp-content/uploads/irp/2023/05/Optimal_Mix_Report_2029_30_Version_2.0_upload.pdf

³ Kementerian Energi dan Sumber Daya Mineral [Ministry of Energy and Mineral Resources]. (2025, May 26). RUPTL PT PLN (Persero) tahun 2025-2034: Meningkatkan ketahanan dan keberlanjutan energi nasional [Enhancing national energy resilience and sustainability]. https://gatrik.esdm.go.id/assets/uploads/download_index/files/b967d-ruptl-pln-2025-2034-pub.pdf

⁴ 中国光伏产业协会 [China Photovoltaic Industry Association]. (2025). 2024-2025 年中国光伏产业发展路线图 [2024-2025 Roadmap for Development of China's Photovoltaic Industry]. <https://www.scribd.com/document/836847377/2024-2025%E5%B9%B4%E4%B8%AD%E5%9B%BD%E5%85%89%E4%BC%8F%E4%BA%A7%E4%B8%9A%E5%8F%91%E5%B1%95%E8%B7%AF%E7%BA%BF%E5%9B%BE-%E4%B8%AD%E5%9B%BD%E5%85%89%E4%B8%9A%E5%8D%8F%E4%BC%9A>

⁵ 北极星风力发电网 [Polar Star Wind Power Network]. (2025, February 11). 五年一遇，新一轮风电抢装潮一触即发！ <https://mp.weixin.qq.com/s/ej9ganFFn-BDzZRpNa2DWA>

⁶ World Nuclear News. (2025, April 28). Ten new reactors approved in China. <https://www.world-nuclear-news.org/articles/ten-new-reactors-approved-in-china>

⁷ Ember. (2025). Yearly electricity data. <https://ember-energy.org/data/yearly-electricity-data/>

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Clean energy growth can peak fossil power soon in China, India, and Indonesia

China, India, and Indonesia – the three countries responsible for the largest increases in CO₂ emissions and in coal-fired power generation in the decade since the Paris agreement was negotiated (Figure 3) – now have a path to peaking power sector emissions thanks to their realised clean energy growth and ambitions. China’s clean energy growth could keep emissions below their 2024 level, while India and Indonesia can peak before or around 2030.

Without the emissions growth in China, India, and Indonesia, global energy sector emissions would have already peaked and begun to decline before 2020. Coal consumption increased 15% in China, 42% in India, and 150% in Indonesia from 2015 to 2024, while consumption in the rest of the world fell 23%. The prospect of peaking power sector coal use and emissions in all three countries is nothing short of a global breakthrough, as they accounted for 73% of global coal consumption in 2024.⁸

Coal use and emissions in the power sector will peak when **growth in clean power generation systematically exceeds the average growth in power demand**. This section outlines the current situation, targets, and policy frameworks in each of the three countries, and describes their potential path to the emission peak.

⁸ Author calculation from the spreadsheet accompanying Energy Institute (2025), *Statistical Review of World Energy 2025*. Energy Institute, London. <https://www.energyinst.org/statistical-review/home>

Clean vs total power generation

Year-on-year change

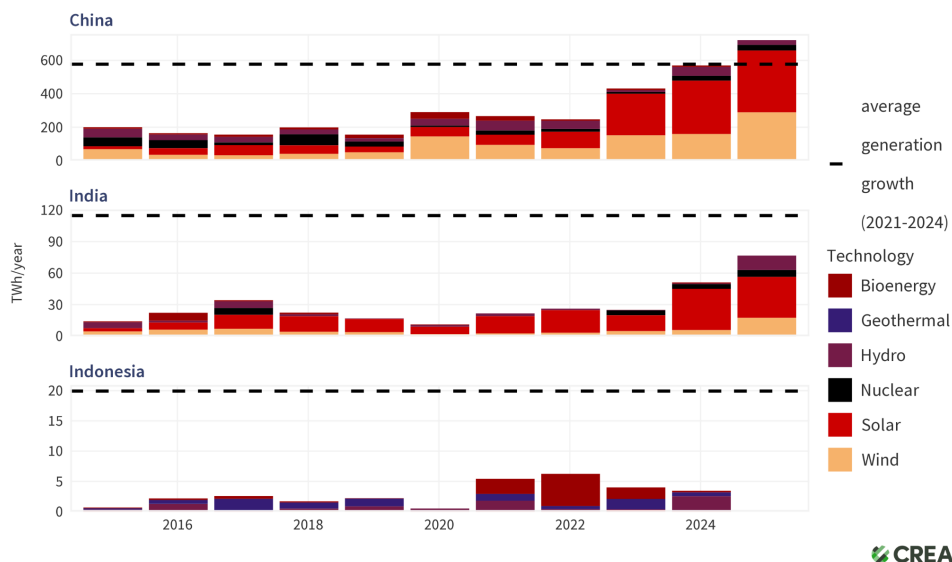


Figure 2 — Annually added power generation from non-fossil energy sources compared to average growth in power generation, in China, India and Indonesia, 2015 to 2025

Note: Newly added power generation is calculated as added capacity multiplied by average capacity factor of each technology in each country. Sources: China Electricity Council, India's Central Electricity Authority, Ember.

Countries with largest increases in energy CO₂ emissions

from 2015 to 2024

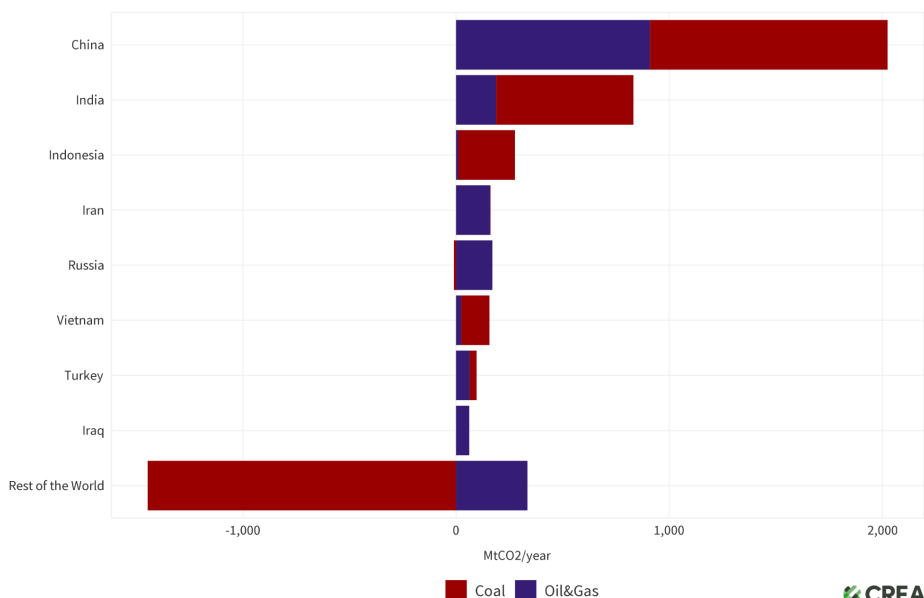


Figure 3 — Countries with the largest increases in energy sector CO₂ emissions: From the adoption of the Paris Climate Agreement in 2015 to 2024

Source: Statistical Review of World's Energy⁸.

China: Emissions fall as clean energy meets energy demand growth

China has already achieved the milestone of adding enough new clean electricity generation to cover all of electricity demand growth — and power sector coal use and emissions have been falling since 2024 as a result. Enough non-fossil power capacity was added in 2023 to generate 450TWh of electricity per year. This rose to 580 TWh in 2024, exceeding the average annual increase of power demand of around 500 TWh (Figure 2). Clean energy additions in 2025 are expected to again top the previous record.⁹

The clean energy growth was led by solar, with 216 GW added in 2023, 277 GW in 2024, and 212 GW just in the first half of 2025. Wind made the second-largest contribution, with 80 GW added in 2024 and over 100 GW expected in 2025. Nuclear power plant permitting has also picked up, with 10 reactors greenlighted every year from 2022 to 2025.⁶

The country's clean energy growth accelerated rapidly after 2020, when President Xi Jinping announced the “dual carbon goals”, committing to peak emissions before 2030 and achieving carbon neutrality before 2060. These goals provided the high-level mandate, and just as real estate investment was peaking, making local governments and investors look for new growth sectors. The result was an unprecedented boom in manufacturing and deployment of clean energy technologies.

The expansion of solar manufacturing has enabled and driven deployment by providing supply and pushing costs down.

The groundwork for this expansion was laid by systematic industrial policy and renewable energy policy starting in the 2000s. More recently, the 13th five-year plan introduced the concept of gigantic “clean energy bases”, designated areas for large-scale solar and wind parks in deserts and other economically marginal land types, facilitating permitting, transmission planning, and investment along with other aspects of project development.

The deployment of distributed solar has been driven by the “whole county solar” policy, where a single auction is carried out to cover a targeted share of the rooftops in a county with solar panels in one fell swoop. Under this model, the developer negotiates with building owners and arranges contracts with the grid, financing, procurement, contracting

⁹ Myllyvirta, L. (2025, May 15). *Analysis: Record solar growth keeps China's CO2 falling in first half of 2025*. Carbon Brief. Retrieved September 2, 2025, from <https://www.carbonbrief.org/analysis-record-solar-growth-keeps-chinas-co2-falling-in-first-half-of-2025/>

and installations. This model – which could be described as centralised development of distributed solar – has enabled rooftop solar deployment at a vast scale.

While the speed of the clean energy boom significantly exceeded the government's targets and expectations, President Xi importantly [took credit](#) for it in April 2025: "Since I announced China's goals for carbon peaking and carbon neutrality five years ago, China has built the world's largest and fastest-growing renewable energy system as well as the largest and most complete new energy industrial chain".

However, current government targets are not yet sufficient to sustain clean energy growth at this level. Xi recently announced China's 2035 climate targets under the Paris Agreement, including a 3,600 GW target for solar and wind capacity. This target would mean adding 200 GW of wind and solar per year, down from 360 GW in 2024, a rate of additions that would not be sufficient to cover demand growth and push fossil power generation, unless said growth slows markedly. China has a history, however, of exceeding solar and wind capacity targets by a wide margin.

China has made commitments to reduce coal consumption during the 15th five-year plan period, covering 2026–30, to peak CO₂ emissions before 2030 and to reduce total net greenhouse gas emissions by 7–10% "from peak levels" by 2035. These commitments limit the space for increases in power sector emissions, but electrification and emission reductions in other sectors could allow power sector emissions to plateau or even inch up over the next decade. Emission reduction pathways aligned with the Paris Agreement, in contrast, require steep reductions in power sector emissions over this period.

Outside of China, Xi's prior pledge to halt Chinese financing for new coal power projects overseas solidified China's shift toward clean energy leadership on the global stage, ensuring that both domestic and international policy signals align with the clean energy pivot.

India: clean electricity takes off after slow progress, laying path for peak power emissions

India's clean energy growth has taken off in 2024–25, after slow progress to the country's 2030 targets. A total of 29 GW of non-fossil power-generating capacity was added in 2024, a new record. The first half of 2025 saw a 69% increase in newly added clean capacity year-on-year from those record levels, with 25 GW added in six months. Meeting the

government's 2030 target of 500 GW non-fossil generating capacity requires the addition of 50 GW per year in the next five years.¹⁰

Meeting the 500 GW target is enough to peak India's power sector's CO₂ emissions from coal and gas within a few years. The country has already surpassed the 50% mark well ahead of its 2030 deadline, supported by strategic tenders and policies.¹¹ This places India on a strong trajectory to peak its power sector emissions within the next few years, even as electricity demand continues to grow, driven by rapid economic and population growth. India's energy transition strategy becomes a critical balancing act between development and climate action.

Clean energy growth in India is powered by a robust national policy architecture focused on measurable, ambitious targets that effectively mobilize investment and guarantee market certainty. India's national target of deploying 500 GW of non-fossil fuel capacity by 2030 is the key policy driver. This goal is realised through clear, competitive reverse auctions (tenders) that ensure developers are committed to the necessary clean energy capacity. Critically, this policy framework positions clean energy to meet all new growth in electricity demand, making it the primary factor enabling the power sector's emissions to peak despite India's rapid economic and population expansion.

India has also made significant headway in establishing a domestic solar manufacturing sector, with production capacity of 118 GW/year of solar modules and 27 GW/year of solar cells as of mid-2025. Projections suggest that by 2027–28, India's solar module capacity could reach 200 GW/year and cell capacity 100 GW, potentially outpacing domestic demand.¹² This rapid scale-up is transforming India into a major solar manufacturing hub, reducing import dependence and positioning the country for export growth, while reinforcing its clean energy transition goals.

Indonesia: National clean energy vision contradicted by near-term fossil buildups

Indonesia's policy framework presents a stark contrast between high-level ambition and slow execution. While president Prabowo Subianto has voiced a powerful vision for a clean energy future, including **calls for a full fossil fuel phaseout, 100% renewable energy by**

¹⁰ NITI Aayog. (Undated). *India Climate and Energy Dashboard*. <https://iced.niti.gov.in/energy/electricity/generation/capacity>

¹¹ Aggarwal, A., & Myllyvirta, L., Sivalingam, N. (2025, September 18)). *Analysis: India's power-sector CO₂ falls for only second time in half a century*. Carbon Brief. <https://www.carbonbrief.org/analysis-indias-power-sector-co2-falls-for-only-second-time-in-half-a-century/>

¹² Sudheer, P.S. (2025, September 24). *India's solar module manufacturing capacity to outpace demand in 3 years*. Business Standard. https://www.business-standard.com/economy/news/india-solar-module-cell-capacity-2027-125092400571_1.html

2035¹³, and a massive 100 GW solar programme,¹⁴ the current national power plan remains focused on a near-term increase in fossil fuels. The real policy opportunity lies in translating this presidential vision into a concrete delivery roadmap that positions clean energy to dominate new capacity additions. By capitalizing on its vast geothermal and solar resources, Indonesia can attract critical investment, modernise its grid, and leverage its nickel reserves to become a strategic player in the global battery and clean energy supply chain.

The 100 GW solar plan, estimated to cost about USD 100 billion, aims to build **80 GW of village-level solar systems** equipped with 320 GWh of Battery Energy Storage Systems across 80,000 villages, as well as **20 GW of centralized large-scale projects**.

Yet, **Indonesia—the largest and one of the fastest-growing economies in Southeast Asia—faces a significant challenge.** Its clean energy growth has fallen very far below its own targets and has thus far only covered a very small fraction of electricity demand growth. The most recent grid electricity plan for the next 10 years, *Rencana Usaha Penyediaan Tenaga Listrik* (RUPTL 2025-2034), deprioritises rapid clean energy additions. The plan outlines a major increase of coal and gas use in the next five years, and pushes back clean energy additions later to early 2030s. Furthermore, planned clean energy projects are dominated by hydropower and geothermal, large one-off projects, with very minimal additions of vital, cost-effective wind and solar power planned.¹⁵

The village-level projects will be managed by the recently established *Koperasi Desa Merah Putih* scheme, or village cooperatives. Concerns have been raised about the significant risks associated with large-scale lending and potential corruption that could undermine the delivery of the programme unless strict transparency measures and proper oversight are in place.¹⁶

Previous policies have limited new rooftop installations and reduced incentives for households and businesses to adopt solar, particularly the highly restrictive annual quota system created in 2024.¹⁷ Some other earlier steps by the Ministry of Energy and Mineral

¹³ Kurniawati, H. (2025, August 15). *Target of 100% renewable electricity in 10 years requires concrete plans and policies, IESR says*. Institute for Essential Services Reform. Retrieved September 2, 2025, from

<https://iesr.or.id/en/target-of-100-renewable-electricity-in-10-years-requires-concrete-plans-and-policies-iesr-says/>

¹⁴ Tumiwa, F. (2025, August 7). *100 GW solar power plant for Indonesia's energy self-sufficiency and economic revival* [Press release]. Institute for Essential Services Reform.

<https://iesr.or.id/en/100-gw-solar-power-plant-for-indonesias-energy-self-sufficiency-and-economic-revival/>

¹⁵ Hasan, K., & Myllyvirta, L. (2025, June 12). *Indonesia's RUPTL outlines faster growth in fossil fuel use, downgrades ambition for clean energy*. Centre for Research on Energy and Clean Air. Retrieved September 2, 2025, from

<https://energyandcleanair.org/publication/indonesias-ruptl-outlines-faster-growth-in-fossil-fuel-use-downgrades-ambition-for-clean-energy/>

¹⁶ Center of Economic and Law Studies (CELIOS). (2025, June). *Ko Peras Desa Merah Putih*.

<https://celios.co.id/wp-content/uploads/2025/06/Kopdes-Merah-Putih-Report-CELIOS.pdf>

¹⁷ Ministry of Energy and Mineral Resources (MEMR) - Kementerian ESDM. (2024). *Permen ESDM No. 2 Tahun 2024*.

<https://jdih.esdm.go.id/common/dokumen-external/Permen%20ESDM%20Nomor%202%20Tahun%202024.pdf>

Resources (MEMR), such as lowering local content requirements¹⁸ and enabling greater use of water bodies for floating solar,¹⁹ have paved the way for solar development.

Some recently announced clean energy developments include a Memorandum of Understanding between Indonesia and Singapore targeting 3.4 GW of green electricity exports by 2035, and a joint venture between France's TotalEnergies and Singapore-based group Royal Golden Eagle to develop large-scale solar farms and battery storage to deliver 1 GW of firm power – or power available at all times during a guaranteed commitment – starting in 2029. Indonesia is also starting to develop green finance mechanisms, including a Green Taxonomy,²⁰ which serves to guide investment towards sustainable economic activities, and using the country's sovereign wealth fund, Danantara,²¹ to pool and manage transition finance.

International financing for clean energy development remains a critical pillar of Indonesia's energy transition, with initiatives such as the Just Energy Transition Partnership (JETP) and China's accelerating investment in hydropower, solar, and the crucial electric vehicle (EV) battery supply chain,²² as well as investment by the United Arab Emirates (UAE) in the Cirata Floating Solar Plant and green hydrogen projects.²³ Although these developments and international financing initiatives show promising signs of progress, they still represent the early stages of what needs to be a broader and more coordinated effort to realise Indonesia's energy transition goals.

President Prabowo's statements reflect much more ambition than current targets, and clearly, his administration has yet to outline a concrete plan to deliver on this vision. With ongoing domestic challenges, presenting a positive agenda and a clear clean energy strategy could be a key priority. Realizing the recently announced 100 GW solar programme over the next decade would be transformative, providing enough clean power to peak and significantly reduce coal and other fossil fuel use.

¹⁸ Ministry of Energy and Mineral Resources (MEMR) - Kementerian ESDM. (2024). *Permen ESDM No. 11 Tahun 2024*. <https://jdih.esdm.go.id/common/dokumen-external/Permen%20ESDM%20Nomor%2011%20Tahun%202024.pdf>

¹⁹ Ministry of Public Works and Public Housing - Kementerian PUPR. *Permen PUPR No. 7 Tahun 2023*. <https://peraturan.bpk.go.id/Details/257268/permen-pupr-no-7-tahun-2023>

²⁰ Indonesia Financial Services Authority - Otoritas Jasa Keuangan (OJK). (2025, March). *Indonesia's Taxonomy for Sustainable Finance [TKBI] Version 2*. <https://iru.ojk.go.id/iru/news/detailnews/13523/indonesias-taxonomy-for-sustainable->

²¹ Indonesia Business Post. (2025, September). *Danantara prepares 33 strategic projects, waste-to-energy as key*. <https://indonesiabusinesspost.com/5160/corporate-affairs/danantara-prepares-33-strategic-projects-waste-to-energy-as-key>

²² Eco-Business. (2025, September). *Chinese energy projects take off in Indonesia as western financing falters*. <https://www.eco-business.com/news/chinese-energy-projects-take-off-in-indonesia-as-western-financing-falters/>

²³ Masdar. (2024, May). *Masdar Reinforces Commitment to Indonesia's Energy Transition at World Water Forum*. <https://masdar.ae/en/news/newsroom/masdar-reinforces-commitment-to-indonesias-energy-transition-at-world-water-forum>

What drives the clean energy ambition

One aspect that China, India, and Indonesia all have in common is that **clean energy goals have been formulated into a national mission by nationalistic leaders**. Such a programme is clearly a good fit to their policy priorities and the profiles they want to build as leaders, involving cutting-edge technology, large-scale manufacturing and infrastructure investments, domestically-controlled power generation boosting energy security, and tangible improvements to quality of life through electricity access and improved air quality.

What's more, the rapid improvement in the economics of clean tech has made solar and wind competitive against power generation from existing coal and gas power plants. The next frontier is solar, with storage outcompeting coal and gas during the hours after sundown.

The fall in cost and increase in supply have been driven by China's clean tech manufacturing boom. The cost of solar panels fell 60% from 2022 to mid-2025,²⁴ and the cost of battery electricity storage by 50% from 2022 to 2024,²⁵ as production volumes of solar cells and batteries in China grew three-fold and six-fold from 2022 to mid-2025, respectively.²⁶

In China and India, policy mechanisms were designed to make renewable energy directly attractive to investors and ratepayers. China's policies ensured solar and wind were paid the benchmark price for coal power plants, a price level that drove unprecedented expansion without costing ratepayers more than coal-fired power. Meanwhile, in India, bids for solar and wind come in well below tariffs paid to coal-fired generators, accelerating the transition purely on cost competitiveness by leveraging auctions.

Indonesia has higher residential electricity prices than e.g. China and India despite the Domestic Market Obligation (DMO) which provides Perusahaan Listrik Negara (PLN), Indonesia's state-owned power company, with artificially cheap coal. This, combined with the country's excellent solar resources, has the potential to make solar power attractive to consumers.

²⁴ Ember (2025, August 12). *China solar cell exports grow 73% in 2025*.

<https://ember-energy.org/latest-insights/china-solar-cell-exports-grow-73-in-2025/>

²⁵ Colthorpe, A. (2025, February 5). *Behind the numbers: BNEF finds 40% year-on-year drop in BESS costs*. Energy Storage News.

<https://www.energy-storage.news/behind-the-numbers-bnef-finds-40-year-on-year-drop-in-bess-costs/>

²⁶ Qin, Q. (2025, July 16). *China energy and emissions trends: July 2025 snapshot*. Centre for Research on Energy and Clean Air.

<https://energyandcleanair.org/china-energy-and-emissions-trends-july-2025-snapshot/>

A key factor in the attractiveness of clean energy in all three countries is the **newfound economic significance of the industry**. Capacity additions and manufacturing volumes have made ambitious clean energy programmes a major opportunity to attract investment in power generation and upstream and downstream manufacturing.

Clean energy technology has become a key factor both in China's economic growth and in meeting economic targets. In 2024, clean energy sectors made up more than 10% of China's GDP, for the first time, and drove a quarter of GDP growth.²⁷

Facing the Carbon Border Adjustment Mechanism (CBAM) and the growing pressure of carbon compliance in global supply chains, many export-oriented Chinese companies are showing a clear shift toward cleaner electricity use. Export-oriented industries concentrated in China's coastal provinces, such as solar manufacturing, aluminum, battery, and steel, are increasingly seeking cleaner sources of electricity, like building their own solar projects or purchasing green power.

India's efforts to build up its domestic solar manufacturing have also begun to come to fruition in the past year, improving the availability of domestically-produced modules and reducing costs to project developers. Similarly, in Indonesia, Trina Solar, LONGi, Thornova Solar, and SEG Solar have built a combined total of 7 GW of solar module production capacity,²⁸ with the potential to supply a significant share of the solar modules needed to realise the country's targets for installed capacity. Indonesia is also developing a fully integrated EV battery ecosystem, involving major global players like CATL and LG, supported by the country's nickel industry.²⁹ However, it's critical to note that nickel smelting in Indonesia relies heavily on purpose-built, captive coal power plants.³⁰

Moreover, **clean energy critically supports energy security goals of both China and India**. By being heavily dependent on imported fossil fuels, both countries are exposed to

²⁷ Myllyvirta, L., Qin, Q., Qiu, C. (2025, February 19). *Clean energy contributed a record 10% of China's GDP in 2024*. Carbon Brief. <https://www.carbonbrief.org/analysis-clean-energy-contributed-a-record-10-of-chinas-gdp-in-2024/>

²⁸ Heynes, G. (2024, November 19). *Thornova Solar begins solar module production in Indonesia*. PV Tech. <https://www.pv-tech.org/thornova-solar-begins-solar-module-production-in-indonesia/>

SEG Solar. (2025, May 16). *SEG Solar's first high-efficiency N-type solar cell rolls off the production line at Indonesian industrial park*. SEG Solar Newsroom. <https://www.segsolar.com/press/news/129>

PR Newswire. (2025, June 24). *LONGi launches strategic solar panel manufacturing project in Indonesia*. Macau Business. <https://www.macaubusiness.com/longi-launches-strategic-solar-panel-manufacturing-project-in-indonesia/>

Kendal Industrial Park. (2025, June 19). *Indonesia's first integrated solar panel factory, Trina Mas Agra Indonesia officially fully operates in KIP*. Kendal Industrial Park News. <https://www.kendalindustrialpark.co.id/post/index/644/indonesias-first-integrated-solar-panel-factory-trina-mas-agra-indonesia-officially-fully-operates-in-kip>

²⁹ Tech in Asia. (2025, June 3). *Indonesia to build \$7 b EV battery ecosystem by June 2025*.

<https://www.techinasia.com/news/indonesia-to-build-7b-ev-battery-ecosystem-by-june-2025>

³⁰ Hasan, K., & Hummer, L. (2024, November 8). *Indonesia's captive coal on the uptick: Capacity tripled in five years, on track to cost USD 20 billion in public health burden* [Report]. Centre for Research on Energy and Clean Air; Global Energy Monitor. Retrieved September 2, 2025, from https://energyandcleanair.org/wp/wp-content/uploads/2024/11/EN-CREA_GEM_Indonesia-Captive_2024.pdf

geopolitical and market risks such as price volatility and supply chain disruptions. Estimates by CICC suggest that, under current production and technological conditions, China's coal reserves could be depleted within roughly three decades.³¹

Deployment of clean energy directly displaces the need for fossil imports. Beyond this, the localisation and expansion of clean technology manufacturing ensures sufficient domestic supply of components, reducing supply chain dependence. In addition, clean energy transition offers a clear path to lower, more predictable long-term costs, ultimately strengthening China and India's energy sovereignty.

Common challenges

One major obstacle common across China, India, and Indonesia is the continued addition of new coal-fired power plants and mining capacity. The new clean energy infrastructures being built in each country creates powerful resistance from the coal industry, which will only intensify once coal demand begins to contract. This political and economic inertia threatens to slow the clean energy transition and lock in high-carbon energy systems in these countries for decades to come, making a rapid post-peak decline in emissions far from guaranteed.

China has 230 GW of coal-fired power under construction,³² and the Indian government has announced plans to add around 100 GW of new coal capacity by 2035.³³ This raises serious concerns and risks creating overcapacity. India's Central Electricity Authority (CEA) projected that only 27 GW in coal capacity would be needed by 2030,³⁴ and a recent CREA analysis suggests that existing and under-construction capacity is sufficient to meet future demand,³⁵ yet new coal projects continue to be awarded. Indonesia's recently announced RUPTL 2025–34, meanwhile, targets 16.6 GW of new coal and gas.

³¹ CINDA Securities (2025, July 22). *Coal 2025 Mid-term Strategy*.
https://pdf.dfcfw.com/pdf/H3_AP202507221713728843_1.pdf?1753219633000.pdf

³² Global Energy Monitor. (2025). *Global Coal Plant Tracker Summary Tables*.
<https://globalenergymonitor.org/projects/global-coal-plant-tracker/summary-tables/>

³³ Baruah, R. (2025, April 30). *King Coal keeps its crown, with 100 GW more of thermal projects on way*. Mint News.
<https://www.livemint.com/industry/coal-fuelled-power-project-electricity-thermal-hydro-cea-deloitte-bhel-general-electric-electric-veh-icles-11745920761902.html>

³⁴ Central Electricity Authority. (2023, May 18). *National Electricity Plan (Volume I Generation)* [Notification]. Central Electricity Authority. Retrieved October 16, 2025, from https://cea.nic.in/wp-content/uploads/document_upload/2023/06/NEP_2022_32_FINAL_GAZETTE.pdf

³⁵ Manojkumar, N. (2025, May 23). *Record renewables capacity in FY24-25 signals India's path beyond coal* [Brief]. Centre for Research on Energy and Clean Air. Retrieved October 16, 2025, from https://energyandcleanair.org/wp/wp-content/uploads/2025/05/CREA_Record-renewables-capacity-in-FY24-25-signals-Indias-path-beyond-coal.pdf

If these expansions in coal-fired capacity are realised, there will be a ferocious resistance to rapid clean energy growth from the coal industry in those countries once coal demand begins to contract in absolute terms.

It's extremely important to note that while China and India are on the brink of peaking their power sector emissions, neither of these countries nor Indonesia have concrete roadmaps for a rapid and sustained coal power phase down or clean energy buildout beyond the peak. In fact, messaging from both Chinese and Indian governments suggests that the current record-setting pace of clean energy buildout may not be maintained. Indonesia does not even have a roadmap to sustaining the peak.

The position of **coal-fired power as the historical mainstay of power generation is entrenched in all three countries**, giving coal structural advantages over clean energy sources.

In China, India, and Indonesia, coal projects are all supported by long-term power purchase contracts that create a structural preference for fossil fuel generation, despite the growing availability of cheaper renewable options. While these arrangements ensure financial security for thermal operators, they also distort market signals by locking in costly, inflexible generation. Over time, this structural lock-in both burdens consumers and reduces system flexibility, slowing the shift toward affordable and clean energy sources.

In China, coal-fired power plants benefit from capacity payments that do little to incentivise flexibility or high availability. The operation of coal plants continues to be inflexible, limiting the space for clean energy in the grid, despite the policy of coal power plants moving to a “supporting” role.³⁶

Similarly, in India, the minimum technical load for thermal power plants is currently 55%.³⁷ To integrate more renewable energy and maximise its benefits, plans call for gradually reducing this minimum load to 40%.³⁸ Lowering it to 40% would enable coal plants to operate flexibly, ramping down their output during peak renewable generation times like midday solar surges, thereby avoiding curtailment of clean energy.

The design of Indonesia's electricity system creates a significant barrier for clean energy. The DMO requires coal miners to sell to PLN and other power generators below market

³⁶ Qin, Q., & Shearer, C. (2025). When coal won't step aside: The challenge of scaling clean energy in China. Centre for Research on Energy and Clean Air and Global Energy Monitor.

https://energyandcleanair.org/wp/wp-content/uploads/2025/02/CREA_GEM_China_Coal-power_H2-2024_FINAL.pdf

³⁷ Central Electricity Authority. (2023, January). *Flexible operation of thermal power plant for integration of renewable generation* [Report]. Central Electricity Authority. https://cea.nic.in/wp-content/uploads/2020/04/flexible_operation.pdf

³⁸ Central Electricity Authority. (2023, February). *A roadmap for achieving 40% technical minimum load* [Report]. Central Electricity Authority. https://cea.nic.in/wp-content/uploads/tprm/2023/03/Report_21022023.pdf

prices, cross-subsidising coal-fired power. Furthermore, PLN is both the grid operator and a major coal power plant operator, and has entered into very long-term contracts with independent coal plant operators. This creates a **major vested interest in protecting coal-fired power from competition from clean energy**.

Consequently, PLN has been blocking distributed solar so far, seeing it as a risk to the company's coal power business, and their opposition would need to be overridden to realise the solar target. There is no space for 80 GW of off-grid solar, making the ability to sell the surplus to the grid a precondition for realizing Prabowo's solar target, and this requires that village co-operatives and other operators of distributed solar plants are able to contract with PLN.

Another major challenge is modernising the way power grids and thermal power plants are operated. China, India, and Indonesia all lack electricity spot markets or other incentives for fossil power plants and transmission lines to operate flexibly to accommodate variable renewable energy. The required changes to grid operation are strongly opposed by thermal power plant operators and especially in Indonesia, where the grid operator, PLN also owns and operates a large fleet of thermal power plants.

Policy priorities between China's central and provincial governments are not always consistent. Provinces often seek to reduce their dependence on imported electricity by expanding local thermal power, which they view as necessary for supporting renewable integration and securing peak-load supply. Meanwhile, in northern China, combined heat and power plants operate inflexibly during the heating season, driven by heating load and limiting the space for non-fossil energy in the grid.

In India, delays in grid expansion have hindered renewable power evacuation, leading to curtailment, especially in renewable energy rich states like Rajasthan and Tamil Nadu.^{39,40,41} Accelerating transmission development and ensuring stronger coordination between generation planning and grid upgrades are essential to fully harness India's renewable potential.

³⁹ Nagaraj, B.S. (2025, September 15). *Transmission System Delay Stalls Evacuation of 8.1 GW Renewables in Rajasthan*. Mercom clean energy insights. <https://www.mercomindia.com/transmission-system-delay-stalls-evacuation-of-8-1-gw-renewables-in-rajasthan>

⁴⁰ The Times of India. (2025, September 9). *CPUs delay transmission projects, 25% renewable energy goes waste*. The Times of India News. <https://timesofindia.indiatimes.com/city/jaipur/cpus-delay-transmission-projects-25-renewable-energy-goes-waste/articleshow/123773065.cms>

⁴¹ Guruvannikanathan, S. (2025, May 28). *TN grid curtailment wastes 70 million units of renewable energy amid falling demand, rising RPO targets*. New Indian Express News. <https://www.newindianexpress.com/states/tamil-nadu/2025/May/28/tn-grid-curtailment-wastes-70-million-units-of-renewable-energy-amid-falling-demand-rising-rpo-targets>

In all three countries, electricity peak loads are rising rapidly, especially due to worsened heatwaves and increasing prevalence of air conditioning. Grid planners see additions of thermal power capacity as necessary to cover these peak demands, despite the fact that other solutions exist. The cost of electricity storage has come down and all countries have a lot of potential to reduce the need for building new, costly dispatchable capacity by making grid operation smarter and more flexible.

Post-peak crossroads: Sustained decline or long plateau?

Peaking emissions in the power sector is only the first step towards the carbon neutrality goals set by China and India, and towards coal phase-out and net zero as targeted by Indonesia.

Once annual clean energy additions reach the level required to start pushing down power generation from fossil fuels, sustaining this level requires major policy steps, such as reforming power systems to accommodate a rapidly increasing share of solar and wind, and starting to close down fossil fuel-fired power plants to make space for clean technologies.

In all three countries, both a rapid phase-down post-peak and a long, drawn-out plateau or even a rebound in coal use are distinct possibilities.

To show the difference between these two futures, we sketch out two scenarios below — one with strong clean energy growth and another with stagnant growth. The difference between these two scenarios amounts to the total emissions from 500 large coal-fired power plants by 2035, which is equivalent to India's total CO₂ emissions in 2019. Figure 4 presents the trajectory of power generation from fossil fuels in these two scenarios.

The continuing coal and gas power capacity additions in all three countries seem to point to a plateau. Capacity is not destiny, however – CREA's analysis of 26 countries that had peaked coal-fired power generation in the 2000–24 period showed that power generation from coal peaked in most cases first, well before capacity.⁴² Drivers such as clean energy additions, slower power demand growth, or a combination of the two, led to a drop in utilisation, discouraged further investment, and began pushing capacity out of the market.

⁴² Qin, Q., & Myllyvirta, L (2025, August 12). *Why China is still building new coal – and when it might stop*. Carbon Brief. <https://www.carbonbrief.org/guest-post-why-china-is-still-building-new-coal-and-when-it-might-stop/>

Long, drawn-out plateaus were not common – most countries saw significant reductions in coal-fired power generation after the peak.

Another critical question in all three countries is whether the power sector emissions peak will mark the peak for total emissions as well. This is highly likely to be the case in China, as industry, transportation, and buildings are already electrifying their energy use rapidly, reducing emissions outside the power sector. India and Indonesia, meanwhile, need to accelerate electrification to peak total emissions. Furthermore, all three countries have sectors where emissions are growing outside power generation: coal-to-chemicals in China;⁹ steel and cement in India;¹¹ and metal smelters in Indonesia.³⁰ Policy action in these sectors is essential for putting each country on track to achieve their respective energy transition and climate targets.

If China, India, and Indonesia are successful in transitioning to clean energy over the next few years, these countries would join several other BRICS nations (Brazil, South Africa, UAE, and Ethiopia) in having peaked their power sector emissions, putting the bloc in a perhaps surprising position to claim climate leadership. The power sector emissions of BRICS countries are shown in Figure 5.

Policy decisions made in the next few years will determine whether each of the three countries seizes this opportunity to reduce reliance on fossil fuels or ends up putting off their clean energy transition.

Table 1 – Two scenarios for clean energy growth in China, India, and Indonesia

Strong clean energy growth	Stagnating clean energy growth
China	
Solar power capacity additions continue to grow along the “optimistic” scenario of the China Photovoltaic Industry Association, and wind power capacity additions continue at the level forecast for 2025–26 by the China Wind Energy Association; 10 new nuclear plants per year are permitted and built. The power market and grid reforms required to accommodate this level of clean energy growth are implemented with	The growth of solar and wind power capacity falls to the minimum level of 200 GW per year required by China’s 2035 climate targets. Grid bottlenecks and favoritism of newly built coal power plants cause the market for new solar and wind to wither. Coal-fired power generation plateaus or inches up over the next decade—China’s emission target for 2035 is met by reducing

determination. With the large-scale rollout of zero-carbon industrial parks, a significant share of wind and solar power is being consumed locally. A coal power overcapacity reduction programme is implemented to make space for clean energy and electricity storage in the power system.	emissions in other sectors, particularly through electrification, but this leaves the country facing a much more challenging and abrupt transition to carbon neutrality in the following years.
India	
The additions of non-fossil energy continue beyond 2030 at the rate achieved in FY2029–30. Grid reforms, measures to increase the flexibility of coal power plants, and increased investment in transmission and storage are implemented to enable the power system to absorb the growth in solar and wind.	Non-fossil energy growth stagnates after a spurt to achieve the 500 GW target in 2030, falling back to the FY2024–25 rate. Coal-fired power generation rebounds after a short-lived drop before 2030. Grid bottlenecks lead to increased curtailment and limits on solar and wind power growth.
Indonesia	
The 100 GW solar programme is realised, with the target achieved by 2035, and the growth of other clean energy follows the targets in the RUPTL 2025–34. Annual targets for contracts with distributed solar installations and strict supervision ensure that PLN follows through on the plan. The power development plan (RUPTL) is updated to reflect the boom in distributed solar power generation and electricity storage, reducing the need for coal and gas-fired capacity. The implementation of the coal phase-out target will start in earnest before 2035.	The 100 GW solar programme is not realised, as PLN sabotages the programme and the administration doesn't follow through with annual targets, tracking, or accountability; the growth of solar and other clean energy follows the modest targets in the RUPTL 2025–34 instead. Concerns of corruption within <i>Koperasi Desa</i> schemes are not addressed, as strong accountability and transparency mechanisms remain absent, resulting in clean energy projects that continue to be hindered by corruption and mismanagement. Clean energy development remains confined to large one-off projects and

The required investments in grid modernisation and improved grid operations are realised through domestic reforms and successfully leveraging international and regional partnerships.

Indonesia's reliance on coal- and gas-fired power generation increases through 2035.

Power generation from fossil fuels, two scenarios

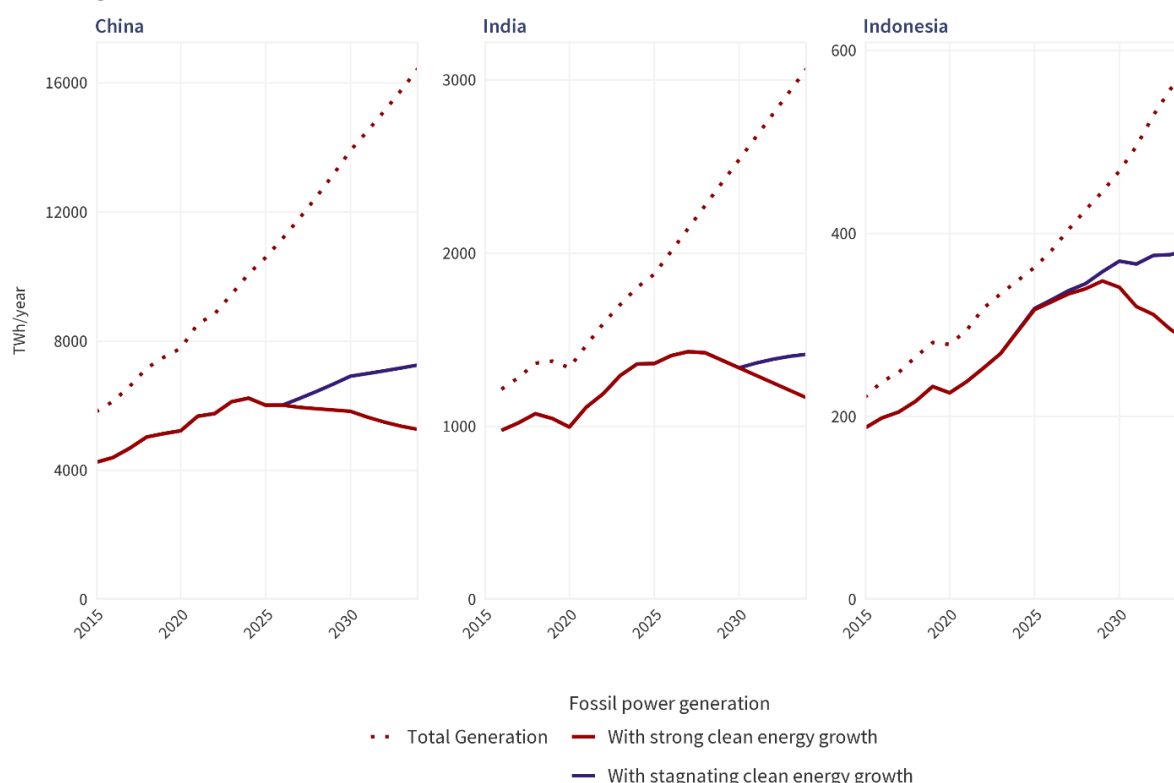


Figure 4 — Two scenarios for power generation from fossil fuels in China, India and Indonesia: Strong clean energy growth following current trends and targets, and stagnating clean energy growth

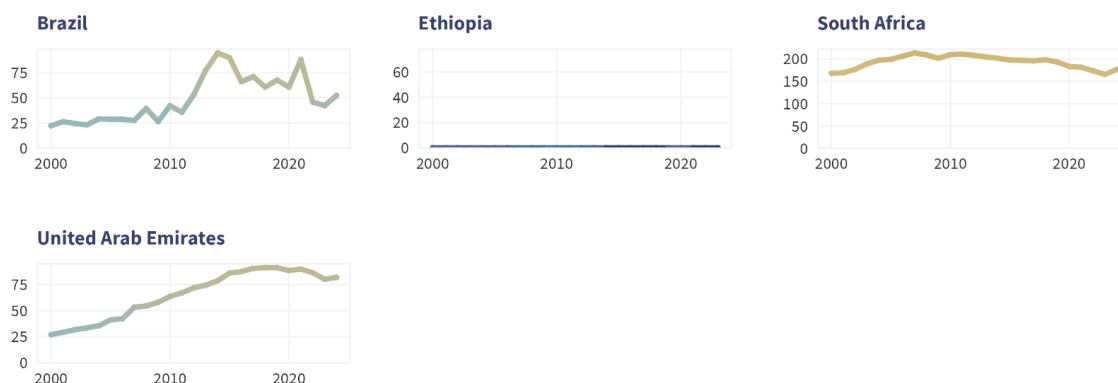
Note: the “strong clean energy growth” scenario follows the sources and assumptions in Figure 1, while the “stagnating clean energy growth” scenario assumes that Indonesia’s 100 GW solar programme is not realised, India’s clean energy additions fall back to the FY2024-25 rate after the completion of the 500 GW target for 2030, and China’s clean energy additions drop to the government’s ‘above 200 GW per year’ target.⁴³

⁴³ 国家能源局 [National Energy Administration]. (2025, January 6). 电力系统调节能力优化专项行动实施方案 (2025—2027 年) 政策解读 [Interpretation of the “Special Action Plan for Optimizing Power System Regulation Capacity (2025–2027)”]. <https://www.nea.gov.cn/20250106/741c84c8cce04799b1561d6a45126b01/c.html>

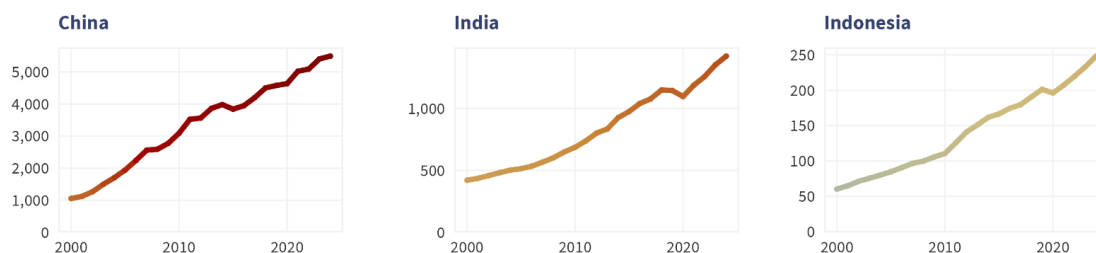
CO2 emissions from power generation

In BRICS member countries, 2000-2024 (MtCO₂-eq/year)

Peaked or clean already



Can peak before 2030



Not peaked yet



Figure 5 — CO₂ emissions from power generation in BRICS member countries: 2000 to 2024

Source: Ember⁷