CLIMATE Strategies

POLICY BRIEF

Accelerating Asia's Clean Energy Transition:

Leveraging Co-Innovation and South-South Collaboration

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Key Messages

- **Asia plays a central role to the global energy transition**, as strong economic growth continues to drive rapid increases in electricity demand, with global climate and energy security implications.
- **Coal remains deeply embedded in many Asian power systems**, even as the deployment of renewable energy and other clean technologies accelerates, creating structural challenges for decarbonisation.
- **The redirection of discounted Russian fossil fuels to Asia raises carbon lock-in risks**, potentially delaying investment in coal phase-down, renewables and system flexibility.
- **Cleantech manufacturing and innovation capacities are unevenly distributed across the region**, with China dominating global value chains and the Association of Southeast Asian Nations (ASEAN) countries still largely positioned in lower-value segments and dependent on imports.
- **Co-innovation, including South-South and EU-South collaboration, has a potential to accelerate the transition** that is just and beneficial for all, enabling ASEAN economies to enhance their energy security, build industrial capacity, and strengthen their influence in cleantech global value chains.

Introduction

Asia is home to more than half of the world's population, and it is the planet's most economically dynamic region. Even though its Gross Domestic Product (GDP) growth rates have moderated in recent years, they remain markedly higher than those of the West: in 2024 China's GDP expanded by 5%, India's – by 6.5%, Indonesia's – by 5%, and Vietnam's – by 7.1%, versus 0.9% for the Euro area and 2.8% for the United States.[1] This growth is driving an unprecedented surge in electricity demand, while the region's existing energy mix heavily relies on fossil fuels. The large size of Asian economies, combined with their still robust expansion, means that economic, social, and environmental developments in the region have global consequences.

These structural challenges are further compounded by the geopolitical realignments triggered by Russia's invasion of Ukraine in 2022, and subsequent sanctions from the West, which redirected large volumes of discounted Russian fossil fuels from Europe toward Asian markets, increasing the risk of long-term carbon lock-in. At the same time, many Asian economies face significant disparities in technological capabilities and access to finance, while others are particularly exposed to shifting geopolitical and energy-market dynamics.

In this context, coordinated regional energy transition efforts coupled with a stronger emphasis on co-innovation – a joint development of technologies, policies and business models across borders – can become a decisive catalyst for a just and rapid transition that supports economic development. In particular, many ASEAN economies have the potential to move beyond peripheral roles and become active contributors to clean energy value chains, ensuring that the transition reflects their development priorities and delivers broad-based, inclusive benefits.

The Dynamics of Asia's Energy Transition

Asia's energy transition is marked by persistent structural challenges, most notably the difficulty of phasing down coal, while also displaying remarkable progress in renewable energy deployment in several countries, though renewables so far supplement rather than transform the region's established power systems.

China plays an exceptional role in the energy transition not only in Asia, but in the whole world, producing over 70% of global equipment in virtually all clean technology sectors: polysilicon, solar PV cells, modules, and wafers, nacelles for wind turbines, nickel sulphate, cobalt sulphate and lithium, as well as key lithium-ion battery components: cells, cathodes, anodes, electrolytes and separators. Even in electrolyser production, where its dominance is somewhat less pronounced, it still produces slightly more than 50% of global output. Between 2022 and 2024, China boosted its global share of clean-tech manufacturing by at least 5 percentage points across six clean energy value chains.[2] The country has likewise established itself as the leading global investor in clean energy, allocating $625 billion in 2024, which represents approximately 31% of the worldwide total of $2.03 trillion.[3]

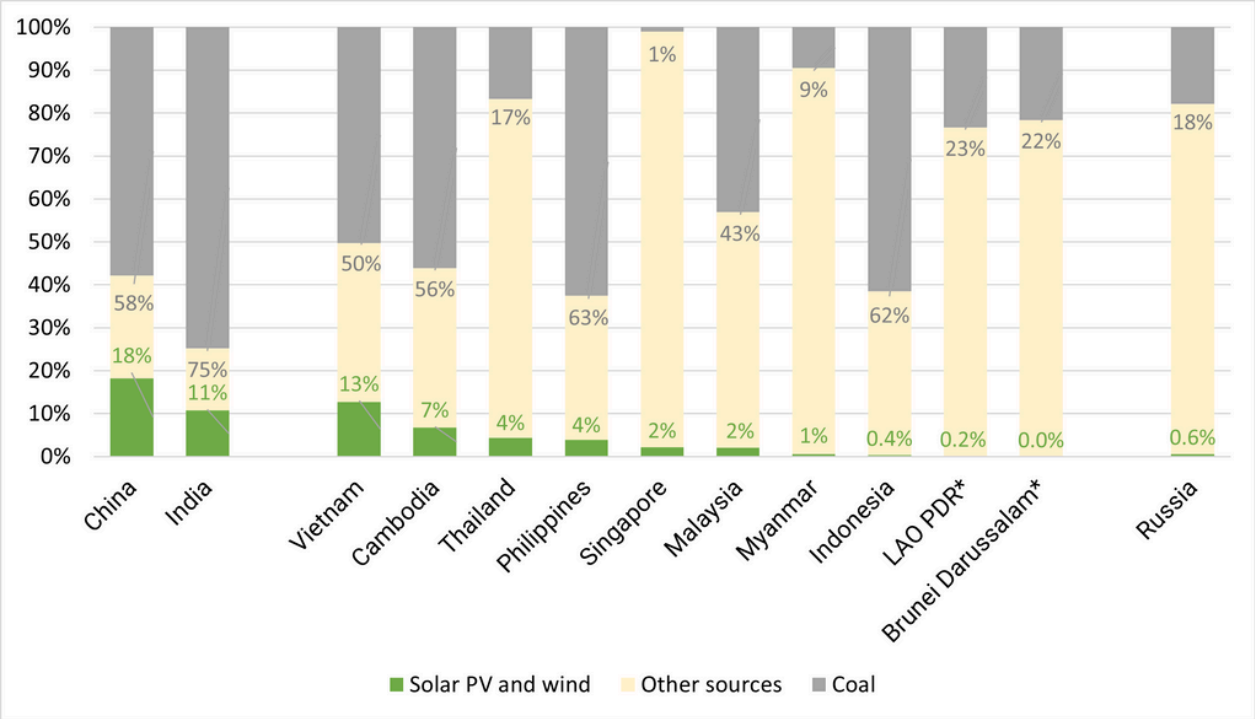
At the same time, other emerging economies, including Southeast Asian countries, are pursuing strategies to build up local clean-tech manufacturing. **Malaysia, Vietnam and Thailand** have already emerged as important clean-tech equipment manufacturers, though mostly for export, and for local solar PV projects they prefer to import equipment from China due to its lower costs.[4]

China and **India** are also important Asian leaders in renewables deployment. In 2024, China generated 18% of its electricity from solar PV and wind, while India reached 11% (Figure 1). China is the undisputed global leader in installed wind and solar PV capacity, accounting for more than one-third of global installations and adding each year more new capacity than all other countries combined. In the first quarter of 2025, China's combined wind and solar PV installed capacity overtook its thermal (coal- and gas-fired) capacity for the first time, accounting for roughly 23% of the nation's total electricity consumption.[5] India also achieved an important milestone in 2025: its installed electricity capacity from non-fossil fuel sources (wind, solar PV, hydropower, biomass and nuclear) surpassed a 50% share.[6]

Vietnam stands out within the ASEAN, with wind and solar PV accounting for roughly 13% of its electricity generation. In contrast, most other ASEAN members register far lower contributions; a handful of countries generate less than 1% of their power from solar PV or wind (Figure 1). The main reason for ASEAN's low solar PV and wind penetration is that long-term power purchase agreements favour fossil fuel plants, and fossil fuel subsidies and existing infrastructure further reinforce their system-level cost advantage over renewables.

Russia has been historically treating solar PV and wind as peripheral options rather than potential significant contributors to its power mix, and their share in the generation is still below 1% (Figure 1). Despite possessing some of the world's largest technical solar PV and wind potentials, Russia has not meaningfully integrated these technologies into its national power mix. This structural neglect became even more evident following Russia's invasion of Ukraine in 2022, which disrupted fossil-fuel export routes and highlighted the country's continued reliance on conventional thermal generation.[7]

Figure 1. Shares of solar PV and wind vs coal in the power mixes of China, India, ASEAN countries and Russia in 2024



Source: Ember (2025). Electricity Data Explorer. URL: https://ember-energy.org/data/electricity-data-explorer/?entity=Lao&metric=pct_share.
* Data is only available for 2023.

Nevertheless, coal remains entrenched in the energy systems of many Asian economies. China, India and Indonesia are the top 3 global coal producers accounting for more than 70% of the global output in 2023.[8] Heavy coal use in these countries is combined with ongoing or newly planned coal projects. Almost 500 GW of new coal-fired power plants (equivalent to 40% of total installed coal-fired capacity) are at various stages of implementation (from announcement to construction) in China, almost 120 GW (50%) – in India, and 17 GW (30%) – in Indonesia.[9] Even in places where renewable energy is expanding quickly, industrial growth and rising living standards continue to push energy demand upward, making fossil fuels difficult to displace in absolute terms.

Coal will continue to play a central role in many Asian power mixes for years and even decades to come. Nonetheless, in several Asian countries, particularly China, variable renewables combined with energy storage have a potential to shift from a supplementary, demand-covering function to a transformative force that fundamentally reshapes the overall generation mix.

The Changing Role of Russian Fossil Fuels in Asia

The beginning of the Russia-Ukraine war in 2022 triggered a rapid reshaping of global energy markets. Russia became the most heavily sanctioned country in the world and started to swiftly lose the high-margin, reliable European customer base that had underpinned its fossil-fuel export revenues for decades. The European Union has now pledged to phase out all Russian oil, gas and coal by the end of 2027,[10] rendering the loss of these markets effectively irreversible.

China has emerged as the dominant buyer of Russian coal, increasing imports by roughly two-thirds in 2024 compared with 2021; now it is absorbing around half of Russia's coal exports. It has also become the largest destination for

Russian crude oil, accounting for about 45% of exports in 2024. India has significantly expanded its purchases of Russian coal from a low base, and its share of Russian crude oil exports rose sharply – from around 2% in 2021 to approximately 36% in 2024 – making it the second largest buyer of Russian crude oil after China.[11]

Rerouting Russian natural gas exports from Europe to Asia has proven far more challenging, At present, the only operating gas pipeline connecting Russia and China is the Power of Siberia, which carries gas from eastern Siberian fields. Russia is actively pursuing the construction of a second pipeline, designed to transport gas from western Siberian fields that previously supplied European markets. However, real progress remains uncertain, as China is pressing for lower gas prices and appears reluctant to deepen its dependence on Russian gas.[12]

Liquefied natural gas (LNG) exports offer Russia greater flexibility, but their expansion has been constrained by Western sanctions and financing challenges. Europe remains the largest buyer of Russian LNG, followed by China, although this situation is expected to change as EU restrictions tighten toward 2027.[13]

Asian buyers are largely treating discounted Russian fossil fuels as a short-term opportunity to enhance energy security and, in some cases, geopolitical leverage. At the same time, they are accelerating diversification, developing alternative fossil fuel supply routes and expanding domestic renewable energy capacity.

These market dynamics are compounded by Russia's climate obstructionism.[14] Beyond supplying discounted fossil fuels that risk locking Asian economies into carbon-intensive development pathways, Russia promotes climate-sceptical narratives,[15] portraying renewables as unreliable, and framing Russian natural gas as an environmentally benign and affordable solution. This strategy creates a dual risk: the immediate appeal of inexpensive energy, and the longer-term danger of coordinated disinformation that undermines domestic climate policies, delays renewable energy investment, and weakens regional cooperation on emissions reduction.

Co-Innovation as an Accelerator of Asia's Clean Energy Transformation

Given that many Southeast Asian countries are only beginning to build domestic capacity in clean energy technologies, unlike other Asian economies, such as India and China, new approaches to accelerate their energy transformation may be required. Collaborative innovation, or co-innovation, offers a promising and forward-looking pathway for this purpose.

Co-innovation goes beyond traditional technology transfer from a technologically advanced country to a recipient. It involves joint development, shared experimentation, and mutual learning among countries, industries, research institutions, and communities. This approach is more inclusive: it may integrate not only the expertise of collaborating organisations but also feedback from users, local stakeholders, and civil society, helping to build trust and ensure that solutions respond to real needs.

Importantly, joint development creates opportunities for upstream and mid-stream participation and thus may help include new emerging economies in energy transition value chains. Apart from traditional technology transfer where new emerging economies often become part of value chains only at assembly or deployment stages, collaborative innovation opens access to higher-value segments through participation in R&D, cooperation on design and adaptation of technologies, component manufacturing, as well as testing and

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demonstration projects. A positive side effect of this is local capacity-building. At the same time, countries with less progressive technologies become more interested in projects and are ready to provide administrative support, since they regard themselves as more equal partners.

Solar PV and wind components manufacturing, battery value chain development, grid modernisation, regional power interconnection, harmonisation of certification frameworks and different rules, as well as coal phase-down mechanisms are among the most promising areas for co-innovation. This could also reduce dependence on single-country supply chains cantered around China while supporting job local creation and industrialisation.

Cooperation among Global Majority countries – often called South-South cooperation – is essential for overcoming the development and financing challenges that the energy transition poses.[16] By pooling technical expertise, policy experience and financial resources, emerging economies can address barriers that would be difficult to tackle alone. Collaborative approaches enable the sharing of lessons on coal phase-down, power grid integration, renewable energy and energy storage deployment, manufacturing equipment for clean technologies, while allowing countries to jointly mobilise investment and negotiate financing terms. This has a potential to not only speed up capacity building, but also strengthen energy security and economic resilience of participating countries.

To unlock its full promise, co-innovation needs to be based on just transition principles that put people at the centre of every technological shift. This means pairing R&D and technology deployment activities with coordinated programmes for skill building, job placement and livelihood diversification, so that former coal miners can move into clean energy sector without losing their income. It also requires early-stage participation of affected workers, Indigenous peoples and local communities (including women and youth) in the design, siting and governance of projects. When co-innovation is coupled with these participatory principles, it has a potential to strengthen local ownership and empower historically marginalised groups.

An appealing way to swiftly bring clean technologies to emerging economies can be local content requirements, which aim to promote domestic manufacturing by mandating local sourcing or tying subsidies to locally produced inputs. These policies have been used by Russia for over a decade[17] and by Indonesia, although Indonesia significantly relaxed them in 2024.[18] These measures failed to achieve significant outcomes: the share of solar PV and wind in the power mixes of both countries is significantly below 1%, and neither has managed to emerge as a major exporter of clean tech equipment. Although local content mandates can temporarily stimulate domestic assembly activities, they frequently increase costs (due to small production volumes), compromise input quality, and stifle research collaboration.

Voluntary co-innovation offers a more sustainable path, allowing firms from multiple countries to jointly develop and validate technologies while exchanging knowledge, building capabilities, and accessing higher-value segments of the clean tech industry. Voluntary clean technologies localisation can also be supported by national and regional governments.

Recent developments in Europe highlight the opportunities this approach can create. For instance, in December 2025, Italy awarded over 1.1 GW of solar capacity in its first “Not Made in China” auction, explicitly prioritizing non-Chinese equipment. Notably, the average price resulting from this auction was only 17% higher than this at the previous auction, which placed no restrictions on equipment origin. This auction was among the first in the EU to apply non-price criteria related to the EU Net-Zero Industry Act (NZIA), aimed at enhancing supply chain resilience and reducing dependency on low-cost imports from China.[19] Auctions of this type could provide emerging economies, including those in ASEAN, with opportunities to engage in co-innovation, such as in partnership with European companies, and to strengthen their participation in global clean technology value chains.

Finally, by deepening collaboration, especially through harmonised energy transition strategies, increased domestic investment in clean technologies, and the development of scientific and industrial capacity via co-innovation, emerging Asian countries can position themselves to play a more influential role in global energy transition governance. At present, they remain largely underrepresented in international decision-making bodies. As global frameworks evolve, a stronger voice for developing economies will help ensure that policies, rules and standards reflect their economic realities, development priorities and long-term energy security needs, while avoiding the pitfalls of climate obstructionism.

Conclusion

Asia stands at the heart of the global clean energy transition. While robust economic growth continues to drive unprecedented electricity consumption in its economies, the loss of reliable European markets for Russian fossil fuels (and the accompanying influx of discounted hydrocarbons) has provided short-term price relief for Asia while creating long-term lock-in risks. At the same time, the region's capacity to manufacture clean-technology components remains uneven, and many Asian economies still lack the technical and financial depth needed to scale renewable deployment. In this context, the most viable pathway to a resilient, low-carbon future lies in coordinated South-South and EU-South co-innovation, which pools expertise, financing, and policy experience across borders and enables emerging economies to move from peripheral assemblers to active participants in high-value R&D, design, and manufacturing stages.

Integrating co-innovation into national and regional strategies can simultaneously diversify supply chains, reduce dependence on any single exporter (especially China), and strengthen the bargaining power of Asian countries in global energy governance, where they remain underrepresented. By linking joint technology development with transparent financing mechanisms, harmonised standards, and robust domestic capacity-building programs, Asian states have a potential to accelerate coal phase-down, expand renewable generation and storage, and safeguard energy security against future geopolitical shocks.

Policy Options

Developing concrete instruments to foster collaborative innovation in cleantech in Asia, and identifying technological sectors where such potential is already emerging, requires further research and dedicated, multi-stakeholder collaboration. This work should involve think tanks and universities from ASEAN countries, China, India, and the EU, alongside companies, policymakers, national innovation agencies, civil society organisations, local communities, Indigenous Peoples, and trade unions. Several policy directions to support co-innovation can be identified, helping to lay the ground for further research and cooperation towards a more inclusive and resilient energy transition.

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1. Integrate co-innovation into ASEAN energy and industrial strategies

ASEAN governments can embed joint research and development, pilot projects, and cross-border industrial partnerships into regional energy planning frameworks. This may include the harmonisation of standards and rules to streamline cross-border relations and reduce duplication, and facilitate knowledge and expertise transfer to strengthen regional innovation mechanisms

2. Link policies aimed at transitioning away from coal with regional development and employment goals

Coal phase-down strategies can be coordinated with cleantech manufacturing, grid infrastructure investment, and renewables deployment, to support coal-dependent regions and livelihoods and reskill the workforce. This may include creating and developing inclusive stakeholder platforms at the provincial level, which would engage coal miners, Indigenous groups, women's organisations and civil-society, to ensure the implementation of retraining programmes and community-owned renewable projects.

3. Prioritise voluntary localisation of clean technologies and regional value chains over rigid local content rules

Rather than imposing strict localisation mandates, governments can incentivise joint ventures, regional supply-chain cooperation, and technology partnerships that enable ASEAN firms to move into higher-value segments.

4. Prioritise just transition measures that place people at the centre of co-innovation

Mechanisms should include comprehensive reskilling and upskilling initiatives, support for workers and local livelihoods, and the active participation of communities affected by coal-phase down in project and policy co-development. Governments can develop clear metrics and measurable indicators for the inclusion of historically marginalised stakeholders (including women, Indigenous Peoples, migrant workers) in energy transition and co-innovation initiatives. Participatory processes and inclusive consultations can play a central role in enabling community-owned renewable energy projects and local manufacturing, enhancing local ownership and capabilities.

5. Mobilise finance and incentivise investment to support co-innovation and early-stage technology development

Meeting Asia's clean energy investment needs requires a multi-dimensional and multi-level coordination approach between policy, institutions, civil society, private sector, industry, and communities. To deliver locally-owned solutions, governments can prioritise the establishment of cross-border and regional financing mechanisms to de-risk early incubated and locally-led innovations. Leveraging blended finance instruments, collaboration with the private sector and aligning public finance with clear climate policy signals can support cross-border scaling and mobilise investment for co-innovation.

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