Accelerating the **Indo-Pacific Energy Transition**

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By 2050, the Indo-Pacific region will drive most of the global energy demand. A just energy transition will deliver climate-compatible economic growth to the region's 4.3 billion people. Sensitive diplomacy and proactive multilateral cooperation are essential to bridge knowledge and technology gaps, attract low-cost finance and strengthen supply chains to unlock the Indo-Pacific's potential for clean and affordable energy.

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Executive Summary

The Indo-Pacific is home to 4.3 billion people – more than half of humanity, and by 2050, is expected to drive most of the global energy demand. To achieve climate-compatible economic growth and meet the aspirations of its people, the Indo-Pacific, which has 7 of the top 10 coal consuming countries, needs to rapidly transition to clean, affordable and reliable sources of energy. Studies indicate that the Indo-Pacific could meet ~90 percent of its power demand using renewables such as solar and wind, but this needs a clear and defined vision for its energy future.

Five challenges must be addressed for the Indo-Pacific countries to achieve this energy transition. **First**, bridging the energy access and development disparity across regions to enable a just transition; **second**, unlocking the funds, which remain concentrated in the developed world, to drive this energy transition; **third**, aligning and streamlining the disparate approaches of public and private actors that curtails local manufacturing capacities; **fourth**, converting the competition for critical minerals that restricts – and in the long run could seriously hamstring – renewables production, into constructive collaboration; and **fifth**, alleviating geopolitical tensions and domestic socioeconomic challenges that hinder rules-based trade partnerships.

The Indo-Pacific countries need sensitive diplomacy and proactive multilateral cooperation to usher in the energy transition by overcoming socioeconomic, climate and geopolitical risks.

This report focuses on six Indo-Pacific countries – Bangladesh, India, Indonesia, Kenya, Singapore, and Viet Nam, which collectively house a quarter of the world's population, as they transition to cleaner energy through distinct but interdependent pathways. Each country has ambitious climate targets, but needs significant transition finance to phase down fossil fuels and leverage renewable energy resources by bridging knowledge and technology gaps and strengthening supply chains.

This report examines the transition challenges faced by these six countries, explores the gaps in existing multilateral processes, and notes the critical requirements to accelerate the Indo-Pacific energy transition, including **planned policymaking** – domestic and regional – for the Indo-Pacific energy sector to improve energy interdependencies and address key vulnerabilities; **improved project facilitation**, risk pooling and innovative mechanisms to attract and generate transition finance; **enhanced supply chain resilience** through diversification and collaboration between producer and consumer countries to improve energy security, increase renewables uptake and boost local manufacturing; **a strong emphasis on technology co-development** and sharing and liberalised Intellectual Property (IP) regimes between technology-rich and resource-rich countries for broader uptake of green technologies; and a **sharp and steady focus on the ecological imperative** for this energy transition.

A unified Indo-Pacific energy narrative could transcend sub-regional groupings, accelerate the region's energy transition, and enhance overall energy security while defining a new developmental paradigm. For the people of the Indo-Pacific, this would mean more than a mere shift in energy sources. It would mean **fulfilled aspirations for jobs, growth and sustainability** through improved energy services and economic resilience.

CEOSpeak

> "There is a pressing need to recognise that among the challenges the Indo-Pacific is facing, sustainability is as urgent and strategic as the security agenda."

Rémy Rioux
CEO, AFD

Strengthening the development agenda in the Indo-Pacific is needed and matters for two reasons and offers one key principle that the report we have produced with CEEW illustrates.

The first reason is that the Indo-Pacific concept lacks a development concept as the spotlight is mainly on the strategic and security agenda. There is a pressing need to recognise that among the challenges the Indo-Pacific is facing, sustainability is as urgent and strategic as the security agenda. The region is on the frontline of climate change impacts, and there is a crucial need to bolster its ability to adapt to warming temperatures while preserving its natural resources. It is time to recognise that the region's weight in the global economy – 60 per cent of global GDP – and share of world population – two-thirds – make it crucial in achieving a global green transition. Countries in the region will simultaneously have to address the social challenges and the setback that the pandemic has caused to the journey towards the 2030 Agenda for Sustainable Development. More than any other stakes, the energy transition is the heart and core of this development agenda.

The second reason is that energy transition in the Indo-Pacific has more at stake than anywhere else. Indo-Pacific produced 16.75 billion tons of carbon dioxide in 2020, has 7 of the 10 biggest coal consumers as well as 6 of the 10 most vulnerable countries in terms of natural disasters. The WWF expects the Indo-Pacific to face the most adverse impacts of pollution. By 2040, 88 per cent of growth in electricity demand will come from emerging markets; of these, the fastest growing economies of the Indo-Pacific are expected to consume 44 per cent of the world's energy by 2050. With solar and wind emerging as the cheapest options for new power facilities in most parts of the world, accessing clean, affordable, reliable and secured energy sources is imperative to addressing the challenges of energy poverty and energy security through a comprehensive energy transition.

As a responsible public development bank keen to drive coordinated action, I take **one principle** from this report. We are looking forward to seeing all of us — banks, think tanks, financial institutions, universities — joining the effort to put this development agenda into action. AFD and India Exim Bank organised the Sustainable Finance in the Indo-Pacific (SUFIP) in February 2022 as a first step to build a common and sustainable agenda. SUFIP has fully recognised the strategic importance of the Indo-Pacific region to deal with global challenges such as global health, climate change, biodiversity and the protection of oceans. Over 500 delegates from 27 countries attended the meeting this year, demonstrating the importance of these issues for the region.

Moreover, even in other platforms we have created, especially the Finance in Common Initiative (FICS) and the International Development Finance Club (IDFC), public development banks and development financial institutions have committed to play key roles in delivering sustainable and high-quality projects in the specific context of Indo-Pacific, keeping in mind the needs of partner countries and ensuring lasting benefits for local communities. I am really looking forward to seeing this principle infuse in the minds of our enlightened readers through the meaningful insights in this report.

I would like to take the opportunity to warmly thank CEEW and my dear colleague, Dr Arunabha Ghosh for the quality of the report, and I am sure, the many discussions that will follow.

CEOSpeak

> "A just energy transition will require strong and empowered domestic institutions and bilateral and plurilateral regional cooperation to manage the deeper integration of emerging economies into international energy markets."

Dr Arunabha Ghosh
CEO, CEEW

Emerging markets – like those in the Indo-Pacific – are key to the energy transition. Between 2019 and 2040, emerging markets are expected to drive 88 per cent of growth in electricity demand. If they do not leapfrog to renewables, there will be no global clean energy transition.

Regional partnerships can enable the shift to renewable power. As each country balances competing domestic priorities with regards to energy access, economic growth, social stability, and environmental sustainability, it could also explore collaborations and interdependence with other countries in the region, for technology, investment, shared business models, policy learnings, and even tap renewable energy resources in several geographies.

Meanwhile, the energy transition must also account for the net benefits and costs associated with jobs and livelihoods, government revenue, and implications for stranded assets. In a shifting geopolitical landscape, countries also need reliable partners to secure energy supplies from cleaner sources for the long run. In addition to resilient supply chains, robust infrastructure, and advanced technologies, countries also need access to lower cost finance, with de-risked investments.

A new 'Indo-Pacific multilateralism', anchored in strong regional networks can enable the energy transition. A shared energy development agenda can attract cross- and intra-regional finance, facilitate technology co-development, bridge regulatory gaps to improve power interconnections, and forge Indo-Pacific supply chain resilience.

I believe that a just energy transition will require strong and empowered domestic institutions and bilateral and plurilateral regional cooperation to manage the deeper integration of emerging economies into international energy markets. Building these institutions will demand that energy diplomacy demonstrate a quest for variety, both in clean energy technologies as well as their suppliers, moving beyond bilateral transactions to build long-term resilience through sustained regional energy engagements.

I congratulate the research teams at CEEW and AFD for taking on a substantial agenda. I hope the partnership between the two institutions will strengthen and this report will serve as a first foray into deeper engagement in the Indo-Pacific region for a just, secure and sustainable energy transition for all.

Indo-Pacific:
At the crossroads of energy security and development

The goal of the energy transition is not to transform energy systems, but to reorient human lifestyles. Today, the ability to harness energy at the touch of a switch drives the modern economy and is fundamental to the lives and lifestyles of billions. But existing planetary resources cannot sustain this emissions-intensive era of technology powered development. Countries have therefore chosen to embark upon a global energy transition to create a sustainable economy.

This shift from fossil fuels to low-carbon energy requires profound technological and societal changes – going beyond electricity to change how we produce, build, and travel; to how we plan our cities, food systems and our lifestyles. Not only does the transition involve a fundamental shift in existing energy consumption and production, but also sustainably bring the comforts of modern living to all.

Figure : The Indo-Pacific spans three continents. Source: AFD Groupe

The Indo-Pacific is home to 4.3 billion people – nearly 60 per cent of humanity. The rapid deployment of the energy transition in this region will determine the success of the climate and development agenda of the rest of the world.

On the human and political front, this vast population carries – and coexists – with millennia of diverse cultural and traditional norms, while facing the challenges of strained borders, internal conflicts, rising migration, and modern political competition.

On the energy front, the Indo-Pacific has 7 of the top 10 coal consuming countries. The world's second-largest oil chokepoint – the Malacca Straits – runs through the Indo-Pacific and is a crucial transit route for a third of global maritime oil trade. But, renewables could serve up to 90 per cent of its power demand (Tong, et al. 2021).

This regional concentration of energy, mineral, human and military resources has attracted economic powerhouses. China and the United States (US) are vying for strategic dominance of the Indo-Pacific, though mindful that any geopolitical disruption would upend global trade and energy markets. Rising political and military competition, along with economic and strategic significance, implies that the Indo-Pacific will be at the heart of global power-politics for the rest of this century (Saha 2022).

Energy security, sustianability and growth in the Indo-Pacific

The coming decades need more than a shift from one set of fuels to another. The Indo-Pacific needs a clear and defined vision for a clean energy future.

By 2040, 88 per cent of electricity demand growth will be in emerging markets (Bond, et al. 2021). Within that decade, **by 2050, the Indo-Pacific region will drive most of the global demand for energy**, as fastest growing economies are expected to consume 44 per cent of the world's energy by 2050 (Bowen 2022). Indo-Pacific countries also face disproportionate risks of climate-change-led hazards compared to their developed counterparts despite historically lower emissions and lower per capita energy consumption. Extreme weather events such as heat waves, floods, rising sea-levels and intensifying storms are already hampering the developmental pathways of these countries, and scientific projections indicate a deepening crisis (IMCCS 2020).

One scenario of restricting global temperature increase to 1.5C by the end of this century requires a double deal of no new coal units being built henceforth, and by 2050, the global share of RE rising to 90 per cent of the power supply while catering to 3 times more demand (IRENA 2021). Moreover, the Nationally Determined Contributions (NDCs) of 153 countries, including several Indo-Pacific countries, at COP26 in Glasgow to support decarbonisation by delivering 5 billion tonnes of greenhouse gases (GHGs) emission reduction by 2030 will need annual global clean energy outlay of about USD 14 trillion – a tripling of investments by the end of this decade (Glasgow Climate Pact 2021).

Beyond fuels and emissions, the energy transition is about access to technology and resources.

Redrawing the energy map of the world's most populous region while balancing climate and development imperatives requires that countries have access to critical mineral resources and associated processing technologies, as well as the manufacturing and industrial capabilities to build RE systems.

Also, decarbonisation is not, by default, a clean and sustainable process. For example, the extraction of the building blocks of RE technologies like nickel, cobalt, copper, lithium, etc., is emissions intensive, negatively impacts natural landscapes, consumes high volumes of already-scarce clean water, and generates hazardous waste (IEA 2021). Decarbonisation, therefore, needs policy, regulatory and technological interventions across all industries and all processes, which are not often widely available or diligently applied.

Managing the intricacies of international energy markets for the transition requires empowered domestic institutions and strong bilateral, multilateral and plurilateral cooperation. Such institutions need adept energy diplomacy in their quest for variety of energy sources and their suppliers to build long-term resilience through sustained international energy engagements (Ghosh 2015).

The Indo-Pacific region is critical to the energy transition effort, with **clean, affordable and reliable sources of energy being the key to sustainably unlocking the aspirations of its people**. Today, despite high renewable energy (RE) deployment, hydrocarbons are the main fuels of the Indo-Pacific economic engine, with China, India, Indonesia and Viet Nam ranking among the highest coal consumers in the broader Asia-Pacific (BP 2022). However, being blessed with topographic diversity and a part of the "sunshine belt", this resource-rich region offers a vast opportunity for the clean energy transition. **Regional and global cooperation could make these solutions available where they are most needed.**

Five challenges slowing the Indo-Pacific's energy transition

The vast differences between the geographies, topologies, populations, policies, societies, economics, resources, energy mixes, and geopolitical strategies of the Indo-Pacific countries make aligning their energy transition priorities a tremendous challenge. Five major challenges stand out:

First, Indo-Pacific countries need to bridge their energy access and development gaps. The Indo-Pacific has some developed economies like Australia, Japan and Singapore, who have the resources to mobilise their transitions. However, much of the region comprises developing and least developed countries which have energy operations instabilities due to a lack of resources, infrastructure and/or capacity, compounded by extreme weather events. Also, apart from South Africa, Mauritius and the Seychelles, electricity access hovers below 80 per cent for most African Indian Ocean rim countries (IRENA 2022) - compared to, for instance, an average 99 per cent for five of the six countries in this study, namely Bangladesh, India, Indonesia, Singapore and Viet Nam (71 per cent for Kenya). However, even among these six, power supply is inconsistent due to operational instabilities, directly impacting the qualities of lives and livelihoods of their citizens.

Second, emerging markets in the Indo-Pacific need investments to fund their transitions. State-backed capital has largely paid for Southeast Asia's hydro, coal and gas power infrastructure, but will not suffice to meet Southeast Asia's climate goals and growing energy demand, which needs investments of USD 190 billion annually till 2030 (IEA 2022). Meanwhile, energy demand in East Africa is expected to soar by 2030 with a projected 10 per cent annual growth rate, creating 95 million new grid connections (AfDB 2019). Catering to Southern and East Africa's energy demand will need capital investments of almost USD 200 billion by 2030, particularly for the Indian Ocean rim countries (ibid).

But the funds to unlock the energy transition remain concentrated in the developed world. In 2019-2020, energy transition asset finance plummeted by 10 per cent in Emerging Market Economies (EME), but jumped 34 per cent in developed countries – underscoring the transition gap (BNEF 2022). Regional efforts to rally transition finance have also been inadequate. For instance, the African Development Bank (AfDB) launched a "New Deal on Energy for Africa" for RE-based universal energy access, but has only been able to raise USD 12 billion for its 2030 goals (AfDB 2019). Annual clean energy investment in Southeast Asia is a fifth of the amount channelled towards RE in advanced economies (IEA 2022).

To fund global infrastructure investments, the G7 launched a USD 600 billion Partnership for Global Infrastructure and Investment (PGII) (White House 2022), but the terms of delivery are unclear. The G7 is also pitching the Just Energy Transition Partnership (JETP) to Africa and the Indo-Pacific as an alternative to the unfulfilled USD 100 billion climate promise made during the Copenhagen Accords (EC 2021). South Africa has joined the JETP to transition from coal to cleaner energy, with France's AFD and Germany's KfW offering EUR 300 million in concessional financing to its National Treasury. Indonesia has also joined the JETP with USD 20 billion allocated to accelerated transition, while Viet Nam is in negotiations. Overall, developing economies are demanding transition finance with equity investment, technology co-development and mutually agreeable terms, rather than conditional handouts, which calls for a rethinking of multilateral investments.

Third, a lack of cohesion between private and public actors is obstructing the energy sector. The 2022 Sustainable Finance in the Indo-Pacific (SUFIP) Conference hosted by AFD and India Exim Bank noted that local manufacturing capacities need to be promoted in developing and least developed countries for them to achieve self-reliance. The key to fostering collaboration and collective investment in the energy transition from the public and private sectors is foresighted, transparent and inclusive policies and regulatory mechanisms. This collective approach requires enhanced cooperation between national authorities, development finance institutions, multilateral and private banks, and industry.

Fourth, secured supply chains of critical minerals are integral to scaling up the RE-based energy transition. The quest for energy security in a decarbonised world is leading to a desperate race for access to critical minerals such as lithium, nickel, copper, cobalt and rare earths, some of the critical building blocks of solar panels, wind turbines, electrolysers, batteries, high voltage transmission lines and electric vehicles. China dominates supply chains for critical minerals, with 90 per cent refining capacity in rare earth minerals, 70 per cent in cobalt and 55 per cent in lithium (IEA 2021).

Table 1 *shows the policy measures being taken by some major economies in response to China's dominance of critical minerals supply, moving the needle further towards head-on competition for resources. Indonesia has recently mooted the idea of an OPEC-style critical minerals supply group. However, the policy, financing, technology and resource interdependencies of the energy transition will need partnerships and collaboration between countries, instead of muscular competition, to develop the refining and recycling technologies for secure and sustainable clean energy supply chains.*

Table 1: Critical minerals policies of some major economies

Country	Policy	Year	Priorities
Japan	Strategy for ensuring stable supplies of rare metals	2009	• Minimising risks from dependence on Chinese supply • Sponsoring development of new suppliers in other countries • Maintaining stockpiles • Promoting recycling and use of alternative materials
United States	Critical minerals and materials strategy	2010	• Ensuring smooth energy transition • Strengthening supply chain, and research • Developing international partnerships
India	Critical non-fuel mineral resources for India's manufacturing sector: A vision for 2030	2016	• Supporting growth of the manufacturing industry • Promoting local processing • Upgrading institutional capacity • Developing international partnerships
Australia	Critical minerals strategy	2019	• Attracting investment • Developing supporting infrastructure • Contributing to international value chains • Spurring innovation

Source: Bowen 2022

Fifth: Indo-Pacific countries need to manage their geopolitical, domestic and climate risks while driving the energy transition. The energy transition can help transform regional relations, but also raises new issues. The COVID-19 pandemic exposed the vulnerability of supply chains to trade friction, while the Russia-Ukraine conflict has upended the global energy system by compelling NATO countries and their allies to scramble for energy partners based on political factors instead of market forces.

The world needs renewed, innovative and strengthened multilateralism to restore a rules-based order to crumbling global systems and establish new equations in the emerging multi-polar milieu to prevent a few financially and militarily strong countries from exerting undue control over their less privileged counterparts. This is especially important for the Indo-Pacific which houses half the world's population in developing and least developed countries, and needs multilateral support for the energy transition.

Indo-Pacific countries will also need to manage domestic risks as the pressure mounts to reduce their outlays and subsidies for fossil fuels to fund their transitions, exposing themselves to the knock-on effects of rising inflation, and consequently, political and socioeconomic unrest. This may compel countries to embark on more competitive quests for energy security, instead of investing in building reliable interdependencies with potential partners.

Mapping the Indo-Pacific energy transition: **Six countries in focus**

This paper focuses on the clean energy transition in **six Indo-Pacific countries: Bangladesh, India, Indonesia, Kenya, Singapore and Viet Nam**, chosen for their varying energy mixes; high exposure to climate risks; geographic, demographic, economic and geopolitical diversities; and their distinct but interdependent transition pathways. These countries comprise 70 per cent of the Indo-Pacific's and a quarter of the world's population (UN Population Division 2020) but account for just 5.6 per cent of global gross domestic product (GDP) (World Bank 2020). **Table 2** provides a snapshot of the energy markets of these six countries.

Table 2: Energy markets overview

Country	Electrification (%) 2020-21	Electricity Consumption per capita 2020	Total Electricity capacity 2020	Non - renewable capacity (MW) 2020	Renewable capacity (MW) 2020	Share of RE (%) 2020	Fossil Fuel Subsidies (million USD) 2020	Net energy imports as% of supply 2018	Emissions per capita (tonnes) 2019
Bangladesh	100	489	23615	23100	515	2	1424	17	0.6
India	99	940	452308	318051	134257	30	23771	48	1.8
Indonesia	99	939	70387	59833	10554	15	6881	23	2 .30
Kenya	71	170	2998	807	2191	73	*220 (2021)	26	0.4
Singapore	100	8,900	12621	12073	548	4	NA	680**	8.3
Viet Nam	100	2,200 in 2010	69355	33706	35649	51	271	23	3.5

Singapore is an export hub for refined petroleum.
Source: CEEW analysis; World Bank.

Bangladesh could transition about 19 per cent of its power mix if it is able to meet its RE targets by 2030 – crucial for a country facing regular blackouts. **India** will need to add a staggering 10.5 MW of RE capacity almost every hour up to 2030 to meet its goal of 500 GW of power capacity from non-fossil sources by 2030. **Indonesia** also faces looming deadlines – it needs to double its current RE supply by 2025 (23% solar by 2025, 66% RE by 2036- 40), cut carbon emissions by 29 percent by 2030, and cap new coal capacity between 2026 and 2030.

Kenya is on track to attain its promised net-zero by 2030, with RE accounting for almost 90 per cent of electricity generation in 2020 – with the caveats of its low electrification rate of 75 per cent, low per capita power and transport fuel consumption, and consequently low emissions. It will need additional renewables, including tapping into its large reserves of geothermal energy, to deliver universal energy access to its growing population. The highly developed Singapore is heavily reliant on energy imports and lacks land space to deploy sufficient renewables to meet its current demand. To compensate, **Singapore** intends to raise its carbon tax to USD 50-80/tCO2e by 2030. **Viet Nam** has already crossed the half-way mark in deploying RE and intends to phase-out coal by 2040, but will need international support to raise its emissions reduction target from the self-attainable 9 per cent to 27 per cent.

Table 3: Nationally Determined Contributions (NDC), COP27

Country	Renewables / clean energy	Other commitments	Net Zero Year
Bangladesh	~4 GW of RE by 2030 with international support	6.73% emissions reductions below Business as Usual (BAU) by 2030; could rise to 15.12% with international support	-
India	50% installed power capacity from non-fossil fuel sources by 2030	45% reduction in carbon intensity from 2005 levels	2070
Indonesia	23% solar by 2025; 66% RE by 2036-40	No additional coal capacity after 2030	2060
Kenya	-	32% emissions reduction by 2030 over BAU of 142 MtCO2e	-
Singapore	~2 GW solar capacity by 2030	Carbon tax to rise to ~USD 36.90 - 59 per tonne CO2 by 2030	2050
Viet Nam	-	Coal phase out by 2040	2050

Source: Nationally Determined Contributions (NDC) Registry, UNFCCC

Table 4 showcases the main challenges and dependencies faced by each of the six countries, highlights the most effective RE policies, provides estimates of the climate finance needed for the energy transition and how each country is working to raise these funds. It also makes certain policy recommendations based on the detailed analysis of the energy market and transition policies of each country available in **(Annexure I).**

Country	Challenges	Energy Dependencies	Key RE Policies
Bangladesh	• Power consumers are vulnerable to spot price-fluctuations. • Low power utilisation rate of 42 per cent. • Low RE potential and land availability.	• LNG imports (mainly from Qatar and Oman) help Bangladesh meet ~24-26 per cent of consumed gas needs. • Power imports include 1160 MW from India (UNB News 2021) and will import 700 MW from Nepal (SASEC 2021).	• Proposed clean energy target of 25 per cent by 2030 (Nicholas 2022). • Mujib Climate Prosperity Plan: Decade 2030 lays a pathway for Bangladesh's green development. (Mujib Plan 2021). • In 2021, a Draft National Solar Energy Action Plan was presented, (Shinde and Skowron 2021).
India	• Overreliance on imports for natural gas. • Stranded coal assets in an energy transition scenario. • Highly indebted state electricity boards are a financial challenge. • India's RE sector depends on 100 per cent imported critical minerals.	• Crude oil imports (mainly from UAE, Saudi Arabia and Iraq) cover 85 per cent of India's demand (Ministry of Commerce 2022). • Up to 70 per cent of India's natural gas demand is met via imports from Qatar, UAE, and the USA (Sönnichsen 2021).	• Net-zero by 2070. • Non-fossil fuel based installed power capacity of 50 per cent by 2030. • Power purchase obligations and guarantees for renewables. • Green energy corridors. • Establishment of Khanij Bidesh India Ltd. (KABIL) to source critical minerals.
Indonesia	• RE power capacity is too low for short-term targets (IESR 2021). • Reliance on hydrocarbon revenues (CNA 2022). • Unstable policy landscape. • No indigenous processing capacity for domestic critical mineral reserves.	• Imported crude oil from Malaysia, Saudi Arabia and UAE serves 23 per cent of energy demand (Sulaiman and Suroyo 2022). • Energy subsidies went up by USD 23 billion in 2022 due to global priceshocks.	• Private solar power is 10 - 15 per cent cheaper than the state electric company (IESR 2021). • Local-content requirements to reach 60 per cent for EVs by 2024 and 100 per cent in battery manufacturing. • Carbon tax of USD 2.1/kg CO2 has had little impact.

Table 4 continued:

Financing Needs	Raising transition finance	Recommendations
Bangladesh needs needs USD 76.18 billion for its 2030 goals as per the Mujib Climate Prosperity Plan (Mujib Plan 2021).	As per the Mujib Plan, the following fiscal measures will be taken to boost transition efforts: • Leveraging carbon markets to raise the equivalent of 1 per cent of its GDP by 2030. • Phase-out fossil-fuel subsidies by 2030. • Credit enhancement, low-cost refinance. • Creating an ancillary service market for transmission and distribution equipment.	• Curb transmission losses and improve power utilisation rates. • Invest in maximising RE capacity and storage to improve reliable energy access. • Power imports from neighbours pose a lower risk than gas imports.
India needs USD ~10 trillion in aggregated investments for its net-zero targets (Singh and Sidhu 2021).	India could use investment to finance clean energy for its net-zero goals, as follows: • Low-cost capital of USD 223 billion for infrastructure (BNEF 2022). • Financial support of USD 1.4 trillion or an annual USD 28 billion (Singh and Sidhu 2021). • Greater public support for clean energy development whether through subsidies or purchase guarantees (CEEW 2022).	• India needs to invest in better and smarter infrastructure (grid, RE production and storage, and green hydrogen) to enable last mile connectivity, curb inefficiencies and increase demand. • A comprehensive energy transition strategy can help India meet its net-zero goals. • De-risking mechanisms can help bring down the cost of capital and ease the flow of finance (Ghosh and Harihar 2021).
Indonesia needs USD 150 - 200 billion for its low-carbon development initiative and net-zero goals (Bappenas 2021).	Indonesia is tapping into domestic sources for transition finance (Bappenas 2021) (OECD 2021): • Phase-out fossil fuel subsidies, phase-in carbon pricing to raise the equivalent of 2 per cent of GDP by 2030. • Expand coverage of Green Sukuks that helped raise USD 2 billion in 2018. • Provide more subsidised interest rates via instruments such as the Kredit Usaha Rakyat – People's Business Credit. • The Energy Transition Mechanism (ETM) is a unique instrument that acts as a disbursal mechanism between internal sources of climate finance for specific projects.	• A national transition strategy could provide a clear net-zero pathway, clarify the position on RE exports and signal a stable regulatory environment. • Indonesia's RE transition plans should enable a complete coal phase-out.

Country	Challenges	Energy Dependencies	Key RE Policies
Kenya	• Energy access inequity, with low access particularly in rural areas (MoE 2022). • No available alternate to transition away from heavily subsidised transport and cooking fuel (Takase, Kipkoech and Essandoh 2021). • High risk-perception that deters investment.	• Fuel imports made up 20 per cent of Kenya's import bill in 2021 (MoE 2022). • Refined petroleum imports from the UAE, Saudi Arabia, India, Netherlands and Kuwait cost Kenya USD 3.48 billion in 2022 (Kenya National Bureau of Statistics 2022).	• Non-captive RE projects benefit from a 20-year power purchase agreement (Nyabira, Muigai and Murangi 2021). • No Value Added Tax (VAT) or import duties on RE, equipment and accessories. • New target for 100 GW RE power capacity by 2040 (MoE 2022).
Singapore	• Small land-mass restricts its RE capacity. • Relies almost exclusively on natural gas imports for electricity generation (EMA 2021). • Grid-interconnection efforts remain untested.	• Nearly 70 per cent of its natural gas comes from Australia and USA, and over two-thirds of its crude oil requirements from Kuwait, Qatar, Saudi Arabia and UAE. • Intends to import 15 per cent of power demand using an undersea cable from Australia.	• Carbon tax of USD 5/ton CO2 to raise up to USD 80/ton CO2 by 2030 (Singapore's Enhanced NDC 2020). • Working towards generating half its power from green hydrogen by 2050 (MTI 2022). • Proactively issuing tenders for RE power imports and investing in grid infrastructure (EMA 2021).
Viet Nam	• Relies on coal and oil for 40 per cent of its power needs. • Grid infrastructure is inadequate for Viet Nam's growing power capacity; particularly solar. • Viet Nam's 475 GW offshore-wind power potential is untapped.	• Viet Nam imports coal from Australia, Russia, Indonesia and Singapore. • Viet Nam imports hydroelectric power from China, Lao PDR and Cambodia.	• Robust Feed-in-Tariffs (FiT) helped solar deployment skyrocket from 86 MW in 2018 to 16.5 GW in 2020. • Direct Power Purchase Agreement for projects under 1000 MW. • The latest Power Development Plant (PDP VIII) anticipates RE capacity additions of 64.8 GW by 2030.

Financing Needs	Raising transition finance	Recommendations
Kenya needs USD 65 billion between 2020 – 2030 for its planned climate action (National Treasury and Planning 2021).	• Kenya's efforts to generate climate finance have been not met with the intended success. • In 2018, Kenya was only able to generate half the transition finance (USD 2.4 billion) needed to meet its NDCs (National Treasury and Planning 2021).	• For a just and equitable energy transition the remaining 60 per cent of the population that uses biomass for cooking must get cost-effective clean energy access. • Transition plans should factor in growing demand – both through increased access and high per capita consumption. • Proactive engagement with global partners, multilateral and private financiers could curtail risk perceptions.
Singapore needs USD 72 billion in transition finance (Loong 2019).	Singapore will take the following steps to raise climate finance for its 2030 goals: • Raise the current carbon tax from USD 5/ton to USD 80/ton CO2 by 2030. • Allow businesses to use carbon credits to offset up to 5 per cent of emissions (Wong 2022). • Issue USD 35 billion in green bonds to fund public infrastructure projects.	• Invest in energy efficiency to reduce per-capita power consumption and phaseout its reliance on fossil fuels. • Fund the energy transition in its neighbourhood to ensure secure domestic power supplies.
Viet Nam needs USD 99-115 billion by 2031 to fund its transition needs (Draft PDP VIII).	To attract climate finance, Viet Nam will need to : • Make power-purchase agreements cost-competitive and cut the risks from EVN's arbitrary curtailment (IUCN 2022). • Develop a suitable debt structure, improve credit guarantee schemes and appraisal capacity-building in credit rating agencies (Nguyen, Chuc and Dang 2018). • Consider imposing a carbon tax of USD 5 per tonne on fossil fuels to generate revenue that can be ploughed back into RE investment.	• Viet Nam needs transmission and distribution infrastructure upgrades. to keep up with demand. • Overreliance on imported hydroelectric power could be an energy security issues due to climate-related water stress. • Grid integration guarantees could mitigate curtailment risk in RE projects. A first-loss guarantee could safeguard investors from curtailment risks and enable low-cost RE capacity addition (Dutt, Sidhu and Saxena 2022).

Source: CEEW analysis

Overcoming the Indo-Pacific's energy transition challenges: **Multilateral cooperation and co-financed development**

Indo-Pacific economies are tied to hydrocarbons and transitioning away will have a substantial financial cost. **Revenue losses due to less fossil fuel production and consumption**: Some countries such as India and Indonesia benefit from fossil fuel revenues. In 2019-20, India's fossil fuel revenue was about USD 84 billion, equivalent to 3.2 per cent of its GDP (Bhandari and Dwivedi 2022) , which serviced nearly 10 per cent of the Central and State government budgets. In a transition scenario, India's earnings could fall by 65 per cent (from 2019 levels) by 2050 (Koshy 2022).

For Indonesia the mineral and coal sector alone contributed 4.5 per cent of GDP in 2018 and 5 per cent in 2019. Following the COVID-19 outbreak and ensuing oil price collapse, in 2020, Indonesia's national revenue from oil and gas slumped to USD 6.5 billion from the pre-pandemic USD 13.2 billion, a 51 per cent decline. Mining and coal revenues yielded USD 2.3 billion as of August 2020, a 35 per cent year-on-year decline year (EITI 2021).

Decommissioning costs related coal mines and thermal stations: The costs of phasing down stranded assets including coal mines and thermal power plants are considerable. Decommissioning India's 130 thermal power plants would cost USD 32-48 billion, including pay-outs to promoters and debt holders (Singh and Sharma 2021). It would cost an estimated USD 37 billion to buy out all 118 coal units and associated power purchase agreements in Indonesia and retire them before 2040 (V. Garg 2022).

Disruptive and innovative clean technologies are cost prohibitive. The IEA's Sustainable Development Scenario (SDS) estimates that over 90 per cent of the annual USD 200 billion clean energy investment in 2025-30 will go into clean energy and electricity networks. Investment in renewables-based power, led by solar PV and wind, will triple to almost USD 50 billion a year, doubling electricity grid costs. Disruptive storage, energy efficiency and other technologies will add to costs. Investment in the use of renewables in buildings, industry and transport, spending increases to over USD 10 billion by 2030 for vehicle electrification.

Investments to build capacity for clean energy operations: RE employment could jump to nearly 40 million in 2030 in an ambitious energy transition scenario with front-loaded investments (IEA 2020). Almost two-thirds of all clean energy jobs would be in Asia, with China accounting for 42 per cent of the global total. India could create 3.4 million new clean energy jobs through its effort to achieve 500 GW of non-fossil fuel power capacity by 2030 (Tyagi, et al. 2021). Many of these jobs would be generated via distributed renewable energy for productive uses, thus helping mainstream rural communities by creating local employment opportunities, especially for women and youth.

Diminishing transaction and transition costs via cooperation

Co-financing brings many advantages for stakeholders dealing with large-scale projects, such as:

- Access to pools of different resources and grants
- Shared project risks comprised of financial and operational ones
- Shared strengths and facilitation of peer-to-peer exchanges
- Shared duties defined in co-financing agreements to optimise time taken to appraise projects
- Ease of compliance with global environmental and social (E&S) performance practices

Capitalising on **regional frameworks**

The Indo-Pacific energy transition needs multilateral, bilateral and regional cooperation. The starting point is through existing regional trade agreements, organisations and initiatives. **Table 5** provides a snapshot of the existing avenues for multilateral cooperation amongst the six countries.

Grid interconnectivity for energy cooperation has been explored by the South Asian Association for Regional Cooperation (SAARC), Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation (BIMSTEC) and the International Solar Alliance (ISA).

Table 5: Avenues for multilateral cooperation in the Indo-Pacific

COUNTRY	IORA	IPEF	BIMSTEC	SAARC	ASEAN	APEC	CPTPP	RCEP	APTA	ISA
Bangladesh	✓	*	✓	✓	*	*	*	*	✓	✓
India	✓	✓	✓	✓	*	*	*	*	✓	✓
Indonesia	✓	✓	*	*	✓	✓	✓	*	*	*
Kenya	✓	*	*	*	*	*	*	*	*	*
Singapore	✓	✓	*	*	✓	✓	✓	✓	*	*
Vietnam	*	✓	*	*	✓	✓	✓	✓	*	*

Source : CEEW analysis

In 2011, **BIMSTEC** Members signed a Memorandum of Understanding (MoU) to set up an interconnected grid. In 2021, the first meeting of the BIMSTEC Grid Interconnection Coordination Committee (BGICC) mentioned the MoU for the establishment of the BIMSTEC Grid Interconnection and discussed formulating policies for the transmission, trade and exchange of electricity, and tariff mechanisms (Saha and Chaudhury 2021).

BIMSTEC grid interconnection plans remain gridlocked due to grid infrastructure incompatibility challenges and India-Pakistan border issues.

In 2014, **SAARC** Members signed a Framework Agreement for Energy Cooperation (FAEC) (SAARC 2014) for cross-border electricity trade and grid interconnections (Acharya, Ray and Dash 2020) but little progress has been made beyond technical feasibility studies.

The Indo-French flagship, **ISA** is a treaty-based intergovernmental organisation with 110 signatory countries as of November 2022. It aims to promote solar and related clean-energy based development by mobilising USD 1 trillion for 1000 GW of solar power by 2030 (ISA 2022). The ISA's "One Sun One World One Grid" (OSOWOG) initiative seeks to implement grid interconnections across the Middle East, South Asia and Southeast Asia.

Underleveraged platforms such as the Asian and Pacific Energy Forum (APEF) and Indian Ocean Rim Association (IORA) could also be approached to promote energy transition partnerships.

A ministerial platform, **APEF** seeks to promote regional and sub-regional cooperation for enhanced energy security and sustainable use of energy (UNESCAP 2013). In a multipolar world, the APEF provides a less siloed platform for energy engagement.

The **IORA** was set up in 1997 for socio-economic cooperation between countries in Asia and Africa. The second IORA ministerial in 2018 in New Delhi called for cooperation amongst members on RE in the Indian Ocean littorals, a common renewable agenda, regional capacity building and strengthened partnerships (IORA 2022) (MNRE 2018). IORA could be a sub-regional engagement platform for the energy transition.

The Association for South East Asian Nations (ASEAN) and Asia-Pacific Economic Cooperation (APEC) have explored regional cooperation through common targets.

Energy cooperation in **ASEAN** is run through five-year plans. The 2025 ASEAN Plan of Action for Energy Cooperation (APAEC) seeks to expand regional multilateral electricity trade, promote clean and renewable energy integration, increase renewable energy in the ASEAN energy mix to 23 per cent by 2025, and reduce energy intensity by 32 per cent in 2025 over 2005 levels (APAEC Drafting Committee 2020). Even as ASEAN anticipates doubling energy demand by 2040, technology, finance, policy and regulations remain challenges for its energy transition (Suwanto, Ienanto and Suryadi 2021).

Focused on the Pacific Rim region, **APEC** has set twin targets of reducing energy intensity by at least 45 per cent by 2035 (from 2005 levels) and doubling the share of renewables in its energy mix from 2010 to 2030. To achieve these targets, APEC nations have explored setting uniform building codes for energy efficiency (APEC 2017) but there has been little progress since the last Energy Ministerial in 2015.

The new **Indo-Pacific Economic Framework for Prosperity (IPEF)**, launched in May 2022, is an undefined economic forum led by the United States. The IPEF includes USA, India, Japan Australia, Brunei, Indonesia, Republic of Korea, Malaysia, New Zealand, Philippines, Singapore, Thailand, and Vietnam, but there is little clarity on its terms (MEA 2022). The IPEF's promise of trade concessions, economic connectivity, supply chain cooperation and decarbonisation seeks to bend the Indo-Pacific axis towards the West-Pacific, but it remains to be seen how it evolves (Benson and Reynolds 2022).

Indo-Pacific countries can leverage their multilateral networks to define a common transition pathway. Fragmented networks can be unified to attract finance to develop infrastructure needed for the energy transition. A unified Indo-Pacific could attain regional energy security through complementary energy and resource mixes, and fair trade of critical minerals in the Indo-Pacific could foster supply chain resilience. For example, while some countries have great renewable potential, others could offer manufacturing facilities and smart technologies for large-scale deployment, or lead with knowledge sharing on policy and regulatory best practices.

A shared Indo-Pacific transition pathway, which already accounts for 60 per cent of the global economy, will help the region move beyond the politics of security to better economic prospects. This transition needs a vision for decarbonisation without deindustrialisation – one that can be crafted by weaving the region's development story with the threads of sustainability.

The way forward to a **clean energy secure Indo-Pacific**

This report examines the transition challenges faced by six Indo-Pacific countries – Bangladesh, India, Indonesia, Kenya, Singapore and Viet Nam, explores the gaps in multilateral frameworks to support their transition efforts, and offers the following recommendations to accelerate the energy transition.

Planned policymaking – domestic and regional – in the Indo-Pacific energy sector will improve energy interdependencies and address key vulnerabilities. Old and inflexible grid infrastructure leading to power leakagers, mismatched building codes, and climate vulnerabilities are common problems in the Indo-Pacific. Even where energy interdependencies could ease energy access, incompatible systems impede cross-border transmission. Clear and comprehensive national energy transition policies could drive energy efficiencies, improve grid-interoperability and ensure climate resilience, dovetailing into strong regional energy relationships.

Improved project facilitation, risk pooling and innovative mechanisms will attract and generate transition finance. To build energy infrastructure, investors need policy certainty, project preparation funds for technical assistance and feasibility studies, trained workforces, and enabling regulatory environments, including common contractual frameworks. Further, a global risk-pooling mechanism could offer project guarantees at lower rates than the market, reducing the cost of finance in developing countries (Ghosh and Harihar 2021). The Indo-Pacific could also consider adopting strategies on the lines of Singapore and Indonesia's carbon tax systems.

Enhanced supply chain resilience through diversification and collaboration between producer and consumer countries will improve energy security, increase renewables uptake and boost local manufacturing. Energy security in a transition scenario depends on consistency in deployment of RE technologies, and not merely on assured access to resources. China's dominance over the critical minerals supply in the Indo-Pacific impedes the self-reliance of other countries and endangers their energy systems to geopolitical disruptions. A diversified and reliable supply chain of equipment, finance, workforce and technology built via cooperation between producers, consumers and regions would balance domestic capability and import stability.

A strong emphasis on technology co-development and sharing and liberalised intellectual property (IP) regimes between technology-rich and resource-rich countries will encourage broader uptake of green technologies. Wealthier nations can better afford renewable alternatives, and more effectively invest in R&D for new and scalable applications. Technology co-development between technology-rich and resource-rich countries based on shared ownership of IPs will improve access (Ghosh, Harihar and Jain 2022). Fair-use and compulsory licensing norms for green technologies may considerably enhance energy security and increase the global uptake of renewables.

A sharp and steady focus on the ecological imperative is essential for the energy transition. The technologies underpinning the energy transition are extractive, energy-intensive and generates vast quantities of waste. Linear models of energy production and consumption must give way to a circular energy economy, where value chain emissions are tracked, energy use is made efficient, extracted resources are recycled, and spent mine sites are restored ecologically.

The Indo-Pacific narrative transcends sub-regional alliances

An overarching vision for Indo-Pacific energy cooperation has ramifications beyond energy security, and could help define a new developmental paradigm for the world.

The decarbonised future under construction will be vastly different from our world today. Yesterday's developing economies could be tomorrow's energy superpowers. The cartels and syndicates that defined the old-world order could be replaced. Globalisation-based trade and energy alliances may not be necessary in a circular world.

A circular world could also be more localised. While relying on components sourced globally, power generation will itself be more regional – and accessible – than ever before. With technology access, most countries will be able to use new and clean fuels – green hydrogen, synthetic and biological – to power transportation, heating (or cooling) and storage applications. Their export, by pipelines and ships, can enable and accelerate growth in geographies beyond the strength of their domestic resource reserves.

Decarbonisation needs technology access for scaled energy deployment, digital intelligence for energy efficiency, and widespread adoption of energy services by consumers. The patchwork of sub-regional alliances in the Indo-Pacific, themselves geographically and resource constrained, cannot finance or build enough new energy infrastructure.

Moreover, while regional networks and alliances could balance geopolitical tensions in a multipolar world, these alliances must go beyond local hegemons and their traditional spheres of influence, and be resilient against the oscillating interests of distant and declining powers. Energy diplomacy in a decarbonised world brings new and distinct interdependencies where dominance of resource reserves is not, by itself, enough to ensure energy security.

A unified Indo-Pacific energy narrative could transcend sub-regional groupings and accelerate the region's energy transition while enhancing energy security. For the 4.3 billion people of the Indo-Pacific, this would mean more than a mere shift in energy sources. It would mean **fulfilled aspirations for jobs, growth and sustainability** through improved education and health facilities, more abundant and resilient economic opportunities, and better lifestyles built on sustainable systems. Through cooperation, shared histories and cultural identities could help redefine aspirations in the Indo-Pacific towards sustainable prosperity.

Annexure I:
Energy transition deep-dive

Bangladesh

Bangladesh relies primarily on hydrocarbons to power its economy. Bangladesh's installed power generation capacity of 25,427 MW is split between 6.95 per cent coal, 44.56 per cent natural gas, and 29.8 per cent oil (SREDA 2022). Of its total power capacity, installed RE amounts to just about 790 MW or ~3 per cent, including off-grid installations (ibid). Solar PV accounts for 59.5 per cent of the country's RE capacity, with small-scale hydropower and biomass-biogas at 39.7 per cent and 0.8 per cent respectively (Tachev 2022) .

Bangladesh's power system is vulnerable to fuel price instability and relies on a weak grid. Due to its fossil-fuel dependence, Bangladesh's energy market is vulnerable to fluctuating global spot prices. It's weak transmission and distribution network leaves 44 per cent of power capacity remaining unutilised (Rose and Joshi 2021). Even though Bangladesh has managed electrification, its power generation challenges forced it to implement rolling blackouts in September 2022, close schools for an additional day per week, and shut down all diesel power generation plants due to the high cost of fuel (Liang 2022). These austerity measures, combined with rising fuel (and thus energy) prices, have sparked widespread protests.

Improved transmission can address some of Bangladesh's challenges. To improve grid infrastructure, Bangladesh recently accepted USD 450 million from the World Bank to build 450 km of transmission lines and 9,040 MVA of substation capacity (Rose and Joshi 2021). In 2019, the Asian Development Bank also approved a USD 300 million loan to construct another 408 km of transmission lines and 7,520 MVA of substation capacity.

Domestic policies show that Bangladesh recognises the need for more RE to boost power capacity. A draft twenty-year National Solar Energy Action Plan envisages the deployment of 40 GW of solar capacity by 2041 (Shinde and Skowron 2021) and seeks to minimise intermittency driven outage risks using storage solutions such as pumped storage and utility scale BESS (Rose and Joshi 2021). The Sustainable and Renewable Energy Development Authority (SREDA) recently proposed a new clean energy target of 25 per cent by 2030 which adds 10 GW, including 5 GW of wind power (Nicholas 2022).

Resolving energy dependencies

In 2022, high LNG spot prices impacted Bangladesh's economy, exposing the vulnerability of import-driven energy systems. Beyond sourcing 80 per cent of its LNG from domestic sources, Bangladesh needs to import LNG, mainly from Qatar and Oman, to meet power demand (Petrobangla 2021), of which 6 per cent comes from the spot market (TBS Report 2022). Fluctuating LNG spot prices increased Bangladesh's domestic gas bill by 117 per cent in October 2021. To offset the cost of imports, Petrobangla and its import subsidiary, Pupantarita Prakritik Gas Company Ltd. (RPGCL) is trying to boost domestic capacity by 5-7 per cent, exploring new reserves with ONGC Videsh Ltd (OVL), and building a terminal to reduce exposure to spot prices (Petrobangla 2021).

Without new gas discoveries, Bangladesh will have to considerably scale up its RE capacity to meet its power demand. Regional players like India, Nepal and Bhutan could export RE to Bangladesh, potentially using old multilateral grid interconnection plans under SAARC, BIMSTEC and ASEAN (Amin 2020). Bangladesh already imports 1160 MW from India (UNB News 2021) and recently signed an agreement with Nepal to import 700 MW of hydropower (SASEC 2021). Bangladesh could seek India and Myanmar's support for imports and interconnectivity but will need to raise domestic capacity to achieve its vision for 2041. A second intervention could be grid investment to improve the low power utilisation rate of just 42 per cent (Nicholas 2022).

Climate and energy finance

Bangladesh released the Mujib Climate Prosperity Plan: Decade 2030 (Mujib Plan) during COP26, identifying a financial outlay of USD 76.18 billion for its 2030 goals. (Mujib Plan 2021) The Plan includes:

- Leveraging carbon markets through the National Carbon Coordination Hub and the tax revenue potential of USD 35 per tonne of carbon to raise Bangladesh's own investment to 0.2 per cent of GDP by 2025 and 1 per cent of GDP by 2030.
- Savings of USD 1.7 billion in fossil-fuel subsidies by 2030 through a gradual phase-out by 2029.
- Steps towards credit enhancement, low-cost refinance, and labour upskilling with international partners; PPAs to underwrite support; and establishing an ancillary service market for transmission and distribution equipment.
- Funding 25 per cent of the USD 7.2 billion needed to achieve 4 GW of RE capacity by 2030.
- Plans to sources to balance financing, and concessional/de-risking finance of USD 800 million for energy efficiency, from existing partners such as Bangladesh Climate Trust Fund (BCCTF), Global Environmental Facility (GEF) and the Green Climate Fund (GCF).

Observations

- Bangladesh needs to improve its transmission to accelerate its energy transition. Curbing transmission losses and improving power utilisation rates could transform Bangladesh's economy into one where industries and consumers can trust the grid. Improving RE capacity and storage would help Bangladesh improve clean energy access and economically integrate more of its people without the high cost of subsidies.
- Power imports are cheaper and more stable than fluctuating gas import prices. Bangladesh need not be restrained by its low RE potential and needs a proactive foreign policy to leverage the potential of its neighbours such as India, Bhutan, Myanmar and Nepal.
- Policy certainty will help Bangladesh attract finance to build RE and transmission infrastructure. Bangladesh's National Solar Energy Action Plan needs to deliver on its policy promises to attract capital for the intended energy transition.

India

India is a global energy transition leader, ranked fourth globally for total installed RE capacity (118 GW), and third globally for wind (~42 GW) and solar energy (~61 GW) capacity (REN21 2022) (MNRE 2022), with another ~15 GW coming from biomass, waste-to-energy and small hydropower (CEA-CEEW 2022). The five-fold increase in installed RE capacity in India since 2010 can be attributed to supportive policies, rapid reduction in technology and implementation costs, and demand-side drivers for energy access, security and efficiency (Singh, Nair and Raja 2021) (Ghosh 2015). India's installed non-fossil fuel-based power generation capacity, including nuclear stands at about 42 per cent, with the balance met by hydrocarbons, largely coal (Ministry of Power 2022).

Favourable RE policies are helping India leverage its potential. India has an annual solar insolation of 5,000 TWh, and wind energy potential of 302 GW and 695.50 GW at 100m and 120m hub height respectively (MNRE 2022). Blessed with a long coastline of 7600 km, India also has 70 GW of offshore wind potential, predominantly in the states of Gujarat and Tamil Nadu. To reduce costs, in 2017, India abolished feed-in-tariffs in favour of reverse auctions for the wind sector (similar to solar energy projects), achieving 40 per cent lesser tariffs (Shah 2022). India also has priority sector lending for the RE sector and allows 100 per cent Foreign Direct Investment via the automatic route. Since 2018, RE subsides have fallen by 59 per cent (CEEW 2022).

In January 2022, the Government of India launched the second phase of its Green Energy Corridor (GEC) for Intra-State Transmission System (InSTS) to facilitate grid integration and power evacuation of 20 GW of RE from Gujarat, Himachal Pradesh, Karnataka, Kerala, Rajasthan, Tamil Nadu and Uttar Pradesh. Under the scheme, setting up RE power transmission infrastructure will cost USD 1.5 billion. The GEC is crucial to achieving the NDC of 50% non-fossil fuel-based power capacity by 2030.

India is investing in wind-solar hybrid projects (WSH) and storage to address RE power intermittency. The state-owned Solar Energy Corporation of India (SECI) is issuing tenders for round-the-clock power and peak power supply to push for integration of RE power generation and storage solutions and optimise the use of infrastructure, including land and transmission systems (Bridge to India 2022). SECI has commissioned three WSH hybrid projects of 1,440 MW each in the states of Rajasthan, Tamil Nadu and Andhra Pradesh in 2020; overall, India could install up to 5.5 GW of WSH projects by 2025 including investment by the private sector.

India is also expected to have 140–200 GW of battery storage capacity by 2040 (IEA 2021) and will need up to USD 136 billion to finance this potential (CEEW-CEF 2020). In 2020, private players Greenko and ReNew Power were awarded tenders to build 1200 MW of RE capacity using this model with SECI providing a 35 per cent guarantee (Barman 2020). India imposes an 18 per cent GST rate on lithium-ion batteries for storage but only 5 per cent for electric vehicles, and intends to rationalise the tax rate for non-EV batteries to boost the power sector (R. Baruah 2022).

Resolving energy dependencies

India is diversifying energy sources and suppliers to drive energy security and reduce its fossil fuels subsidy burden. India depends on imports, in particular from the Middle East, for over 85 per cent of its crude oil needs (PPAC 2022). In 2021-2022, the UAE, Saudi Arabia and Iraq provided 53.5 per cent of India's crude oil imports; while Qatar makes up 41 per cent of India's natural gas imports (Ministry of Commerce 2022). India imports 70 per cent of its natural gas (Sönnichsen 2021) but has significantly diversified its LNG trade mix to reduce one-country dependency, diversifying to include new partners such as the UAE and USA. Green hydrogen could help India leverage its RE resources if the country meets its 5 MTPA production target by 2030 (PIB 2022).

India has bilateral cross-border power trade with several neighbouring countries including Bangladesh, Bhutan, Myanmar and Nepal (Ministry of Power 2022b). Building cross-border transmission lines is time, labour and capital intensive and includes several years of political understanding and fundraising, followed by the establishment of a rules-based order for trade across the line (Taylor 2021).

The International Solar Alliance's One-Sun-One-World-One-Grid (OSOWOG) initiative could help create grid interconnections of 2600 GW by 2050. This super-grid would help reduce India's current account deficit due to fossil fuel imports while creating a new export market for Indian solar and wind power (Alam and Kumar 2020). India also has the opportunity to collaborate with other regional multilateral groups such as ASEAN whose existing transmission network could be a crucial link in the OSOWOG chain (Chaudhury 2022).

Climate and energy finance

India attracted USD 14.5 billion in clean energy investments in 2021-22 (ETEnergy World 2022). However, it needs USD 10.1 trillion in aggregated investments to achieve its net zero target by 2070 (Singh and Sidhu 2021). Some forms of the required investment could include:

- Financial support of USD 1.4 trillion averaging USD 28 billion annually (Singh and Sidhu 2021).
- Low-cost capital of USD 223 billion to build India's RE infrastructure (BNEF 2022).
- Balanced public and private investment: In 2018, out of USD 21 billion in finance, bilateral and multilateral sources were just 5 and 11 per cent respectively (Macquarie, et al. 2020).
- More transition bonds: Between 2014-2021, USD 11 billion was raised through green bonds in international bond markets by Indian developers, which refinanced 10 GW of RE capacity (Garg, Jain and Sindu 2021).

Observations

- Infrastructure investments are the key to a successful – and efficient – energy transition. India needs more and better grid infrastructure, RE production and storage, and hydrogen facilities to enable last-mile connectivity, curb inefficiencies and meet the growing demand.
- India needs a comprehensive energy transition strategy to achieve its net-zero target. India has made great strides towards the energy transition but needs an overarching global, national and sub-national vision and action plan to set and meet time-bound targets.
- A comprehensive energy strategy showcases market stability and could attract finance towards India's burgeoning RE sector. India could leverage investment de-risking mechanisms to reduce the cost of capital and ease the flow of finance (Ghosh and Harihar 2021).

Indonesia

One of the top producers and consumers of fossil fuels, Indonesia faces a more complex transition than most Indo-Pacific economies. In 2020, Indonesia's total primary energy supply was hydrocarbon-based, with 37.3 per cent coal, 35 per cent oil and 18.5 per cent natural gas . The share of RE in the primary power mix is only 11.2 per cent, far behind Indonesia's 2025 goals. Rooftop solar growth remains limited at only 21 MW, with geothermal, hydropower and bioenergy capacities at 55 MW, 291 MW and 19 MW respectively. To meet its target of 13 GW installed RE capacity, Indonesia will have to dramatically scale up its deployment .

Replacing revenues generated by fossil fuel production is another transition challenge for Indonesia. In 2021, coal production generated USD 3 billion per month from 600 million tonnes , surpassing targets under the National Energy General Plan (RUEN) of 400 million tonnes per year . Indonesia's coal revenues subsidise domestic fossil fuel consumption and are not funding the RE transition. In 2020, energy subsidies cost USD 6.8 billion and focused on coal, LPG and oil. RE received less than 1 per of all subsidy support despite Indonesia's target of achieving 23 per cent RE by 2030 .

New policies are providing incentives to enable Indonesia's energy transition. Competitive tariff structures allow private solar PV developers in Indonesia to utilise solar power with 10-15 per cent lower tariffs than the state electricity company, PT Perusahaan Listrik Negara (Persero) (PLN). A new regulation expands the scope of tariff benefits to commercial and industrial consumers and allows them to claim the benefits of every unit of electricity they produce .

Storage solutions and local manufacturing are also in focus. Indonesia has a policy to boost the uptake of storage solutions by mandating that all RE plants generate uninterrupted power . For a domestic manufacturing push, Local Sourcing Requirements (LCRs) for electric vehicles have been raised to 35 per cent (two-wheelers) or 40 per cent (four-wheelers). LCR requirements will see a staggered climb to 60 per cent by 2024, with 100 per cent local battery manufacturing. Indonesia's new carbon tax of USD 2.1/kg CO2 and planned coal levy on power plants have has limited traction.

Indonesia has significant reserves of transition-critical mineral and is taking steps to improve processing capacities. Barring lithium, Indonesia has reserves of the critical minerals necessary for EV batteries such as nickel, laterite and manganese ores . However, the country lacks processing and refining facilities and has only one Class 1 nickel producer. To address this challenge, the state-owned Indonesia Battery Corporation (IBC) is building six High-Pressure Acid Leach (HPAL) units. Pumped Hydroelectric Storage Power (PHES) systems are also under construction to address RE's intermittency challenge. Upper Cisokan (~1 GW, 2025) in West Java and Matenggeng (943 MW, 2028) in Central Java are the two first PHES plants in Indonesia .

Indonesia has laid the policy and planning groundwork to leverage its massive RE potential. Indonesia has the world's highest geothermal potential at 23.9 GW, along with 94 GW hydropower, 208 GW solar, 60.6 GW wind, 17.9 GW ocean and tidal, 32.6 GW biomass, 200,000 barrels per day biogas, and 7.3 GW of PHES potential . By 2035, PLN wants to increase RE capacity to 20.9 GW and raise the share of RE in power generation from 15 per cent to 23 per cent . PLN also plans to install at least 4.7 GW of solar PV and 4.2 GW of PHES in the next ten years.

Resolving energy dependencies

Indonesia's energy consumption far exceeds its natural fossil fuel endowment – 23 per cent of energy demand relies on imports. In 2019, Indonesia imported ~113 million barrels of crude oil from Singapore, Malaysia, Saudi Arabia and UAE. Global energy prices forced Indonesia to raise energy subsidies by USD 23 billion and ban palm oil exports to manage inflation .

For Indonesia, the first task is grid interconnection within the archipelago to improve service quality, and the second is to minimise transmission and power theft-related losses. By 2050, at least 158 GW transmission capacity needs to be built to enable power exchanges between its islands . ADB and PLN are working on grid interconnections and German, Japanese, Taiwan, Korean and Chinese companies are competing to provide smart grid technology .

Also, replacing diesel-driven power in rural areas with RE and third, generating investment to leverage massive geothermal, hydro, wind and solar potential, to potentially become a net exporter of around 6 GW with ASEAN grid interconnections . In October 2021, three agreements were made by private companies to export 8.67 GW solar power from Indonesia's Riau Islands to Singapore but their status remains unclear as Indonesia banned RE exports in July 2022.

Climate and energy finance

Indonesia will need USD 150 – 200 billion to fund its Low Carbon Development Initiative (LCDI) and meet its net zero targets. However, RE investments are falling short – only USD 2.7 billion between 2015–2020 whereas fossil fuel power generators received USD 2.5 billion Q3 2021. To close the funding gap, Indonesia could:

- Phase-out fossil fuel subsidies, phase-in carbon pricing to raise 2 per cent of GDP by 2030.
- Expand Islamic Finance instruments such as the Green Sukuk that raised USD 2 billion in 2018; or financing products such as Kredit Usaha Rakyat to provide subsidised interest rates.
- Use the SDG Indonesia One Fund to support guarantee schemes aimed at de-risking.
- The Energy Transition Mechanism (ETM) is a disbursal mechanism between internal sources of climate finance for specific projects. The ETM is split into a Carbon Reduction Facility (CRF) to retire coal-fired power plants and create a Clean Energy Facility (CEF) to develop green energy facilities.

Observations

- Indonesia could use a national transition strategy. A unified strategy would provide a clear pathway towards net-zero and a stable regulatory environment in the pathway to net-zero.
- Indonesia could boost climate finance using domestic sources. Already innovating in climate finance and leading a global blended finance initiative that seeks USD 30 billion for its transition goals, Indonesia should explore ways to channel its fossil-fuel revenues towards RE infrastructure.

Kenya

Kenya is on an ambitious pathway to a full and just transition to renewable electricity by 2030. In 2021, RE accounted for almost 90 per cent of installed power generation capacity . This excludes Kenya's clean cooking access reliance on wood and biomass for over 68 per cent of overall energy use .

Cost-competitive RE is driving high adoption in Kenya, a country with the fourth highest household power tariffs in Africa. Solar is cheaper than grid-supplied power and household solar systems are cheaper to set up in Kenya than in other parts of Africa. For instance, household solar systems in Kenya cost USD 92.3 compared to USD 400 and more in other parts of rural Africa .

Favourable policy measures such as the removal of Value Added Tax (VAT) and import duties for RE, equipment and accessories have helped reduce the cost of RE systems. Presently, non-captive RE projects benefit from a standardised 20-year Power Purchase Agreement (PPA) . Kenya's Feed-in Tariff (FiT) policy has been phased out and as of 2021 only benefits small scale biomass, biogas and hydro up to 20 mega-watts (MW).

A weak transmission and distribution network has, interestingly, promoted the adoption of RE to cope with regular power outages. Industrial captive power consumers, which make up almost 55 per cent of Kenya Power's revenue, are shifting to off-grid solar power

Table 5: Kenya Installed RE Capacity, June 2020

Source	Installed MW	% Capacity
Hydro	833.9	29.94
Geothermal	811.14	29.12
Biomass	2	0.07
Solar	52.51	1.89
Wind	336.05	12.07
	2,036	73.09

Source: Kenya Power

Kenya's tremendous RE potential is yet untapped. Geothermal reserves in the Rift Valley and Lake Turkana basin are estimated at 10 GW and solar potential is 15 GW . Ideal wind speeds of 6m/s can be found in 73 per cent of Kenya but it has only installed 336.05 MW of wind power . As per the 2018 National Energy Policy, Kenya may shift to open access transmission and distribution, and is also expanding battery storage capacity through its Least Cost Power Development Plan 2021-2030 (LCPDP) to raise capacity to 480 MW .

In 2021, Kenya's fuel imports made up 20 per cent of its import bill, and it faces a weighty subsidy bill for petrol, diesel and kerosene, having spent USD 220 million to stabilise prices in the latter half of 2021 alone . In a transition scenario, key challenges will include sustainable urban planning and phasing in sustainable fuels (and the allied infrastructure) to replace petrol and diesel for the mobility sector and replacing kerosene. As a starting point, the Ministry of Energy (MoE) issued a roadmap to transform the energy sector, setting an ambitious target of 100 GW RE by 2040 . Kenya was also one of the countries that launched the African Green Hydrogen Alliance in May 2022, signalling its openness to phasing in new solutions .

Resolving energy interdependencies

In 2021, **Kenya** generated a weighty subsidy bill by importing 6.149 million litres of refined petroleum worth USD 3.48 billion, mainly from the UAE (USD 1.41 billion) and Saudi Arabia (USD 1.14 billion), apart from India, the Netherlands and Kuwait . Facing political and economic instability due to rising fuel prices, in June 2022, Kenya's treasury announced

that it would take steps to progressively eliminate the fuel subsidies for petrol, diesel, and kerosene, which will entail phasing-in alternate and cost-effective energy sources .

Phasing in renewables to cut the subsidy bill will require large investments in infrastructure for RE, particularly for mobility. Leveraging Kenya's geothermal, solar and wind potential will also require new investment. Apart from investment support, Kenya is exploring grid interconnections with neighbours. The national grid already transmission lines to Uganda (132 kV) and Ethiopia (500 kV). Kenya plans to use the Eastern Africa Power Pool (EAPP) to add connections to Rwanda (400 kV), Tanzania (1700 MW) and Zambia .

Climate and energy finance

The estimated cost of implementing Kenya's mitigation and adaptation actions is KES 6,775 billion (USD 65 billion) in 2020-2030 The status of transition finance in Kenya is:

- In 2018, KES 243.3 billion (USD 2.4 billion) of public and private capital was invested in climate-related activities – only half the financing Kenya needs annually to meet the targets set in its NDC .
- Overall, public investment (from domestic and international providers) totalled KES 144.3 billion while investment from the private sector totalled KES 98.9 billion.
- The current estimated cost of implementing Kenya's mitigation and adaptation actions stands at USD 65 billion for 2020-2030
- To meet the climate ambitions outlined in the NDC, both public and private climate finance needs to be scaled-up significantly by 2030.

Source: East Africa Power Pool, 2014

Observations

- A just and equitable energy transition relies on cost-effective energy access. For its 2030 targets, Kenya should redouble its efforts towards clean cooking access, use RE to drive down the cost of electricity, and invest in sustainable urban planning to bring energy efficiency.
- Kenya must account for the challenges that accompany rising demand and access. Considering its relatively low electrification rate, low per-capita power consumption rate and low access to clean cooking fuels, Kenya's plans ought to factor growing demand as well as transitioning existing power and energy sources to renewables.
- Proactive engagement with global partners, multilateral and private financiers can drive the transition. Kenya could meet its considerable transition finance needs by engaging with its allies, multilateral and private financial institutions to generate more access to low-cost transition finance and reduce its risk-perception in capital markets.

Singapore

The smallest of the six countries selected for this report, **Singapore has limited capacity for RE deployment**. Almost 95 per cent of Singapore's power mix is natural gas, 3.2 per cent solar and biomass, and the remaining 1.8 per cent petroleum products (EMA 2021). Its main domestic RE resource is solar power. It currently generates 443.6 MW – a fraction of its 12 GW consumption (EMA 2021) , but intends to increase its solar capacity to 2 GW by 2030, i.e. 3 per cent of its energy mix. Singapore has brought its signature urban planning innovation to RE deployment to overcome its limited solar potential by utilising every available surface for deployment – from ATM rooftops to vertical panels on buildings, to floating solar. RE power imports and hydrogen are expected to help Singapore deliver on its promise to achieve net-zero by 2050 (MTI 2022).

Singapore is planning for storage solutions and improving grid resilience. It plans to deploy at least 200 MW of energy storage systems (ESS) by 2025 (ibid). Singapore's ESS National Roadmap envisions using its build-up of storage systems to improve business models and seed new technologies such as solid-state, metal air, and hydrogen storage. To achieve these targets and put a price on its emissions by 2030, the country intends to raise its carbon tax to USD 50-80/tCO_2e. Implementing the carbon tax will be a challenge as it would raise the price of electricity by 8-12 per cent by 2030. The benefits could outweigh the costs if the carbon tax financed solar capacity additions and proposed grid interconnections.

Green hydrogen could be the game changer for the energy transition of the world's biggest container port. Singapore has bet on green hydrogen for industrial decarbonisation and to diversify its fuel mix using marine pipelines for gaseous hydrogen, or carriers such as methanol or ammonia. Potential import partners include Asian Renewable Energy Hub, Yuri, Neoen, Oman and Sarawak Energy. Singapore has the technical potential for 5 per cent hydrogen blending within its existing natural gas infrastructure and anticipates that hydrogen will supply half of its power needs by 2050 . Singapore is partnering with Royal Dutch Shell for hydrogen fuel cells for ships and Engie SA for hydrogen-based energy storage system on Semakau Island. It has an agreement with New Zealand on low-carbon hydrogen cooperation .

Resolving energy dependencies

Proactive management of Singapore's energy interdependency could enhance energy security. Singapore imports nearly 70 per cent of its LNG from Australia and the US, and over two-thirds of its crude oil requirements from the Middle East viz. Kuwait, Qatar, Saudi Arabia and the United Arab Emirates. Singapore is constructing a 4,200km underwater cable to Australia to procure enough solar power to meet 15 per cent of its energy demand. The Australia-Asia Power Link (AAPL) seeks to transport 100 MW of clean electricity, including a line that could run through Indonesia.

The Energy Market Authority (EMA) plans to issue two Requests for Proposal (RfP) for up to a total of 4 GW of low-carbon electricity imports into Singapore by 2035 to meet 30 per cent of Singapore's electricity demand . The first RfP to import up to 1.2GW of electricity will be launched in 2022 to commence work by 2027. The second RfP for the remaining 2.8GW is expected to be issued in the second quarter of 2023 and to start by 2035 .

Other low-carbon electricity imports include 100 MW of electricity from Peninsular Malaysia via an interconnection from 2022; a pilot project to import 100 MW of non-intermittent electricity from a solar farm in Pulau Bulan, Indonesia, by 2024; and 100 MW of power from Laos via the Laos-Thailand-Malaysia-Singapore Power Integration Project, among others . The largest project, which includes the 2.2 GW floating solar PV development in Duriangkang reservoir (Batam), is expected to provide 1 GW of non-intermittent electricity to Singapore by 2024 .

Climate and energy finance

Singapore will need USD 72 billion in transition finance. Its 2022 budget included a finance plan for its 2030 climate goals , covering:

- Gradually raising the current carbon tax from USD 5 per tonne to USD 80 per ton by 2030, but providing a U-Save rebate to cushion the impact on household consumption.
- Allowing businesses to use international carbon credits to offset up to 5 per cent of emissions.
- Issuing USD 35 billion in green bonds to fund public infrastructure projects.

Observations

- **Singapore needs to invest in energy efficiency and phase-out its reliance on fossil fuels to become a transition leader**. Singapore's policy experiments and transition efforts are remarkable for their innovative use of urban planning in maximising the use of every surface to generate renewable power, but it still needs to do more.
- **A one of Asia's largest financial hubs, Singapore could also do more to fund the energy transition in its neighbourhood.** Singapore has already implemented measures to generate transition finance, and could channel investments towards RE deployment in its neighbouring countries to fund RE power projects that could provide its own power via grid interconnections.
- **Interconnected and interdependent on its neighbours for trade, investment and energy, Singapore could adopt a strategic leadership role for the Indo-Pacific.** Singapore is in a unique position to bridge political differences and steer the Indo-Pacific energy transition.

Viet Nam

Viet Nam has made great strides towards its COP26 targets. In 2020, Viet Nam's power mix comprised 49 per cent hydrocarbons (coal and oil), 30 per cent hydroelectricity, 24 per cent solar power (including rooftop), and 1 per cent wind and biomass; bringing renewables (including large hydro and imports) to 55 per cent of the power mix (PDP-VII). Viet Nam has also attracted several new projects – the Trungnam Group recently completed a 152 MW wind farm in Ninh Thuan province, while Denmark-based Orsted has proposed a USD 13.6 billion offshore wind project off the coast of Hai Phong .

Viet nam's RE achievements could be attributed to a favourable policy landscape. Till end-2020, Viet Nam had a robust feed-in-tariff policy, providing 9.8 US cent/kilo-watt hour (KWh) for wind, 7.09 U.S. cents/kWh for ground mounted solar, and 7.69 U.S. cents/kWh for floating solar . Favourable tariffs caused Viet Nam's solar deployment to skyrocket from just 86 MW in 2018 to 16.5 GW in 2020 . To keep pace with consumer demand, EVN, the sole-state owned transmission company, capped the FiT to 2000 MWp for Ninh Thuan province .

Viet Nam's transmission and distribution lines, however, are not equipped to handle heavy demand. An excess of solar power is overloading Viet Nam's grid infrastructure, forcing producers to reduce power generation from RE. With battery storage still expensive, a scalable solution would be to expand the transmission grid. A new 461-mile transmission line extension with three 500 KV lines has been initiated to connect nine cities and provinces across Vietnam . It has also launched a Direct Power Purchase Agreement (DPAA) Mechanism between 2021-2023 for projects launched after 2020, with a cap of 1000 MW .

Viet Nam's RE power capacity could rise by 64.8 GW in 2030 as per the latest Draft Power Development VIII Plan (PDP VIII). TGS Green Hydrogen is building the country's first hydrogen plant for USD 840 million to generate 24,000 tonnes of hydrogen, 150,000 tonnes of ammonia, and 195,000 tonnes of oxygen annually . However, the 2030 plan does not yet explore Viet Nam's massive potential for 475 GW offshore wind , 300 GW solar , 2.5 GW biomass, and 340 MW geothermal .

Viet Nam's Battery Energy Storage Solutions (BESS) market is expected to grow from USD 1.53 billion in 2021 to USD 8.62 billion in 2026 . Due to the lack of a regulatory framework to standardise BESS, it has not yet been deployed at scale, leaving the grid vulnerable to intermittency disruptions. In 2021, Viet Nam received a USD 2.96 million grant from the United States for AMI AC Renewables Company to build its first pilot BESS system at the 50 MW Khanh Hoa solar plant . Viet Nam abundant nickel, a key component of lithium-ion (LI) batteries, and PDP VIII includes the development of investment incentive mechanisms for utility scale BESS.

Resolving energy dependencies

Viet Nam relies on fossil-fuel and power imports to meet its rapidly growing demand. Coal imports are set to rise from 36 million tonnes in 2021 to 46.5 million tonnes by 2025 , relying mainly on Australia, Russia, Indonesia, and more recently, South Africa . Viet Nam relies on Lao PDR and China for electricity imports , with average daily imports of 853 million kWh in May 2022 . Historically, Viet Nam has exported over 10 billion kWh to Cambodia through the Chau Doc – Ta Kei 220 kV transmission line . Viet Nam may also consider power trade via the inter-ASEAN 500kV network in future . Although existing Chinese electricity imports of 450 MW are a politically sensitive matter, Viet Nam may import up to 4 GW from China by 2030 .

Hydroelectric power imports may prove to be unsustainable for Viet Nam. It has an agreement with Lao PDR to import electricity from the 600 MW Monsoon Wind Project and has helped construct Lao PDR's Sekong A dam that generates 86 MW. Lao PDR is the largest electricity exporter in ASEAN and has signed an agreement to supply Viet Nam with 5 GW by 2030 . However, most of the exports from Lao PDR are thermal and hydropower based, and in the long run, may not be sustainable for the environment and people of the Mekong basin . The external cost of the 11 hydropower projects on the Lower Mekong basin from lost fisheries and sediments, biodiversity reduction and social impacts has been estimated at USD 18 billion .

Climate and energy finance

Viet Nam needs to invest USD ~13 billion annually between 2021–2030 in the electricity industry and over USD 12 billion between 2031–2045 (Draft PDP VIII). The revised draft plan shows that a total investment of USD 99-115 billion is required between 2021 and 2031, of which ~84 per cent will be invested in power generation and the rest in transmission and distribution. To attract transition finance, Viet Nam will need to:

- Make PPAs cost-competitive and reduce the risk of EVN's arbitrary curtailment .
- Develop a suitable debt structure, enhance the effectiveness of credit guarantee schemes, and build the capacity of credit rating agencies for appraisals .
- Consider imposing a carbon tax of USD 5 per tonne on fossil fuels to generate revenue that can be invested into RE (ibid).

Observations

- **Overreliance on hydroelectric power could be unsustainable in the long term.** Beyond biodiversity and ecosystem damage, the climate crisis will cause water stress. Considering Viet Nam's high non-hydroelectric RE power potential, it does not need to expose itself to this water-stress related energy and geopolitical vulnerability.
- **Transmission and distribution infrastructure upgrades are a prerequisite to the expansion of Viet Nam's energy transition.** If existing grid-infrastructure cannot keep up with demand, little would be achieved from RE capacity additions.
- **Grid integration guarantees could mitigate curtailment risk in RE projects in Viet Nam.** A first-loss guarantee could safeguard investors from curtailment due to transmission challenges to enable low-cost RE capacity addition .

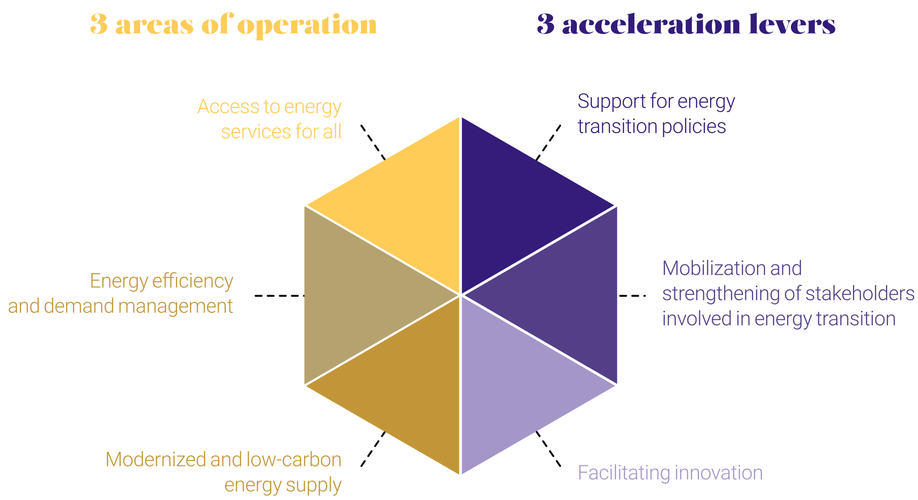
Annexure II:

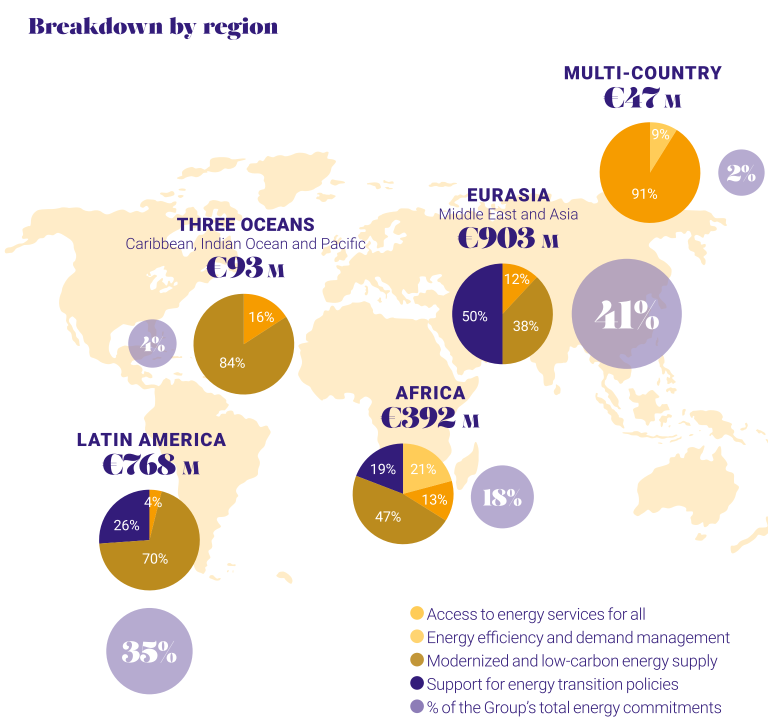
AFD's projects in the six countries

AFD Group's energy transition strategy is based on three areas of operation, mobilising three intersecting levers. At the crossroads of climate issues and the achievement of SDG 7, AFD Group's activities aim to accelerate the energy transition in its partner countries towards efficient, resilient and low-carbon energy services accessible to all.

To meet these objectives, AFD maintains an ongoing political dialogue with many countries on their low-carbon energy transition trajectories. AFD teams also place a strong emphasis on energy efficiency as key to the transition.

AFD Group's energy commitments in 2021





AFD Groups activities. Source: AFD Group

AFD has developed a unique set of development finance tools for the Indo-Pacific region, from project-based loans targeting primarily facilities, to public policy loans targeting structural and sectoral dialogue with counterparts. AFD also provides lines of credit that could foster public investment from banks to beneficiaries involved in renewable energies and energy efficiency. AFD also aims to bring added value to the project by financing feasibility studies and capacity building.

These mechanisms could be used to fund several types of operations: project preparation studies (planning, pre-feasibility, preliminary or detailed design); technical cooperation (resident technical assistance, short term or repeat expertise, high level training actions, strategic partnerships between peer institutions). For example, in India, AFD has financed EUR 750,000 in preparation studies for construction of two Floating Solar PV projects (FSPV) under its technical assistance envelope.

As a transversal objective, AFD also prioritises innovative solutions for RE. One example of financing innovative energy schemes is AFD's financing of the first solar power plant developed by KenGen, Kenya's public power generation company. This 42.5 MW plant and its battery storage facility will be located alongside Kamburu Dam on the Seven Forks Falls. Its "hybrid" operation makes it possible to store water in a reservoir upstream from the waterfall during the day. In the evening, to handle peak demand, this water is run through turbines by power plants installed along the waterfall to reduce the country's dependence on backup thermal energy.

This table showcases AFD's projects in the six main countries selected for this report. Most of these projects are enabling the energy transition by investing in RE production, and bringing energy efficiency to distribution grids, the residential sector and industrial units. Although there is only one project (Kenya) that seeks to broaden energy, advancing SDG 7 remains a key priority for AFD.

The AFD Group's efforts to advance SDG 7. Source: AFD Group

Renewable Energy Development	Energy Efficiency and Demand Management Energy Access	Energy Access
• India - IREDA I and II, HPPCL Hydro • Indonesia- PLN project • Kneya- KENGEN hybrid solar + stroge project • Kneya- KENGEN 80 MW Wind project • Viet Nam- Development or extension of hydroelectric power plans, such as the Huoi Quang plant, Iayl plant	• Bangladesh- Smart Grid DPDC project • India- EESL supporting UJALA and SLNP, SIDBI, NHB • Kenya: KPCL distribution project • Viet Nam: Southern power distribution grid project	• Kenya- Kentraco Nairobi Project

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Cover image iStock. Developed on a 540ha site in the East Dam region of Bac Lieu province, Viet Nam, the 99.2 MW Bac Lieu near-shore wind farm is Asia's first offshore wind farm in the Mekong Delta region.

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