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REPORT >>

CHINA'S COOPERATION WITH SOUTHEAST ASIA TO SUPPORT AN AMBITIOUS CLEAN ENERGY TRANSITION BY 2030

China's Cooperation with Southeast Asia to Support an Ambitious Clean Energy Transition by 2030

A REPORT OF THE ASIA SOCIETY POLICY INSTITUTE

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CONTENTS

EXECUTIVE SUMMARY

The transition toward clean energy has gained momentum across the power sectors in Southeast Asia, with countries in the region scaling up their support to shift away from coal power and embrace cleaner alternatives. The Asia Society Policy Institute (ASPI) has partnered with Energy Foundation China (EFC) to develop a project aimed at understanding how China could support this transition. The project included a sequential series of three consecutive convenings with industry leaders on the topic of clean energy investment, along with expert consultations and desk research.

Increased private sector investment is crucial for turning Southeast Asia's ambitions for a cleaner electricity future into actual outcomes. To achieve net zero energy emissions by 2050, the region would need an average annual investment of US$92 billion to expand the clean power supply in the years leading up to 2030. This investment requirement surpasses the capacity of the region's public sector, which has funded most past power projects. This is especially so when the governments in Southeast Asia are trying to control public debt and spending after COVID-19 while dealing with food and energy stress on government budgets.

Mobilizing sufficient private investment to support renewable energy projects in Southeast Asian countries, as in many other developing countries, is affected by a wide range of project-specific issues. Such key issues include insufficient grid infrastructure, difficulty in land acquisition, regulatory complexity and uncertainty for project development, lack of commercial arrangements (e.g., power purchase agreements) that provide sufficient and predictable revenues for capital-intensive investments, the presence of multiple public agencies in the governance of renewable energy projects with overlapping and sometimes unclearly defined roles and responsibilities, and concerns about the financial health of national electric utilities and their ability to fulfill payment obligations.

The project-specific issues are often compounded by macroeconomic challenges, undermining risk-adjusted returns for investors and hence limiting the availability of bankable projects. These challenges include, for example, restrictions on foreign direct investment, currency risks, and weaknesses in local banking systems and capital markets.

Given these conditions, private investors tend to prioritize renewable energy projects in lower-risk, mature economies, presenting a significant challenge to Southeast Asian countries as they seek sufficient funding to achieve their climate aspirations. This challenge becomes apparent when considering that despite a global surge in renewable energy investment in recent years, much of the increased investment has been concentrated in advanced economies and China. In contrast, the rest of the world, including Southeast Asia, has contributed only 3% to the overall increase in renewable energy investment since 2019.

The three convenings held between February and November 2023 provided valuable insights into how to rectify the situation, particularly through enhanced cooperation with China. Key points emerging from these convenings are summarized as follows:

- **Deeper local reforms are essential for fostering a conducive environment for renewable energy investment in Southeast Asia.** These include standardizing power purchase agreements, ensuring clear procurement processes, rationalizing electricity subsidies, eliminating fossil fuel subsidies, and advancing grid augmentation. Additionally, establishing a clear policy framework, underpinned by short-, medium-, and long-term targets, is vital to investors, promoting renewable energy project prioritization.

- **To ensure a successful clean electricity transition in Southeast Asia, a broader agenda that goes beyond investment mobilization needs to be developed and implemented.** This agenda should include addressing energy security and affordability, industry decarbonization, long-term economic development, and equitable social prosperity.
- **An integrated, multidimensional solution package to support Southeast Asia's clean electricity transition should be planned and offered.** Key aspects of this solution package include (1) providing access to technology, including floating solar; offshore wind; energy storage; carbon capture, utilization, and storage (CCUS); smart grid technology; and so on; (2) ensuring industrial development that promotes domestic production rather than relying excessively on imports for these technologies; (3) offering a suite of policy supports through the promotion of best practices on, for example, tax policy, carbon pricing, and incentives for investors; and (4) creating partnerships between public agencies, energy companies, project developers, local banks, and multilateral development banks (MDBs).
- **Practical opportunities for implementing such an integrated approach should be prioritized.** These include establishing joint green industrial parks between China and Southeast Asia, integrating renewable energy projects with industrial policies, and leveraging the Regional Comprehensive Economic Partnership (RCEP) to facilitate the free trade of green products. In Indonesia, for example, these initiatives can support the phasedown of captive coal power and the progressive deployment of co-located renewable energy and storage at industrial sites. Another example is the development of offshore wind zones integrated with onshore green hydrogen industries or grid extensions.

Building on the insights provided above, some further reflections on how China can support Southeast Asia's clean energy transition are presented as follows:

- **Facilitating large-scale investment in renewable energy projects in Southeast Asia requires major reforms aimed at improving the power sector's foundational architecture to lower the risks and costs of renewable energy projects.** Such reforms go beyond standard business and financial strategies, requiring major changes across various areas including planning practices, permitting processes, regulatory frameworks, governance structures, financial mechanisms, and others.
- **The implementation of these reforms is not easy, requiring a strong policy commitment.** This is especially so when the reforms encroach into politically sensitive policy areas.
- **This situation may lead to a "chicken and egg" dilemma.** Southeast Asian governments may prefer immediate outcomes, such as increased investment and more jobs, before fully embracing broader reforms. Achieving these positive outcomes would create a more favorable environment for making difficult policy decisions. In the absence of major reforms, however, private investors might opt for a "wait-and-see" approach until a more favorable investment environment emerges, or they might seek financial terms unattractive to Southeast Asian countries.
- **To address this dilemma, China could collaborate with Southeast Asian countries in developing strategic pilot projects, using them as leverage for greater impact.** These project-oriented initiatives should aim to support a rapid deployment of renewable energy projects, customized to local contexts, and seize the opportunities these projects present for local

clean industry development. These initiatives are relatively easy to implement, bypassing the difficulties often associated with deeper reforms. Their implementation can bring immediate socioeconomic benefits, thereby creating a more favorable environment for deeper reforms.

Recommendations: A Clean Prosperity Plan as a leverage for more ambition

This report lays out a specific package of recommendations entitled the Clean Prosperity Plan (CPP). The CPP is an integrated, project-oriented solution for socioeconomic prosperity and climate security in Southeast Asia. It prioritizes joint efforts between China and Southeast Asia, leveraging industrial demand for clean electricity and emphasizing the implementation of green industrialization and renewable energy projects that are immediately viable with project-specific policy support and international assistance.

The CPP represents a leverage point for greater impact.

Following the principle of "starting with the easy tasks and then gradually proceeding to the difficult ones" (先易后难), the Clean Prosperity Plan can circumvent the complexities and delays often associated with comprehensive top-down planning. As a result, it has the potential to bring immediate outcomes, such as job creation, industrial upgrading, and sustainable economic growth.

These positive outcomes become greater if replicated by many other localities, creating the effect of "using a point to bring out the whole" (以点带面).

These outcomes could also help the governments in Southeast Asian countries legitimize the implementation of deeper reforms to mitigate the risks of renewable energy projects, especially in sensitive policy areas. This approach can create a more stable and attractive environment for investment, thus complementing Just Energy Transition Partnerships (JETP) and other regional initiatives, achieving synergistic outcomes where "1 plus 1 is greater than 2" (1加1大于2).

Details of the CPP are presented in Table I. While the CPP outlined here focuses on industrial parks, there are additional practical opportunities for implementing such a plan.

TABLE I: **CLEAN PROSPERITY PLAN – KEY LEVERS, RATIONALES, SPECIFIC RECOMMENDATIONS, AND TARGETED AUDIENCES**

KEY LEVERS	RATIONALES	SPECIFIC RECOMMENDATIONS	TARGETED AUDIENCES
Repower: Cleaning the industrial sector via green electrification	**Large potential consumer of clean power:** The region's industrial sector accounts for almost half of the region's final energy consumption, currently relying on fossil fuels and captive coal power.. **Ease of implementation** ▪ Fewer complications in land acquisition around industrial parks. ▪ Ability to circumvent complexities in the expansion of on-grid clean electricity supply.	1. Support the development and extension of carbon pricing mechanisms to cover the industrial sector, including captive coal power.	Public agencies responsible for the design and implementation of carbon pricing.
		2. Develop technology solutions tailored to local contexts. ▪ Offshore floating wind, for example, between the Philippines and Vietnam, combined with onshore hydrogen and/or grid connectivity. ▪ Floating solar in Vietnam, Thailand, and Indonesia. ▪ Energy storage, smart grid, etc.	China-ASEAN Clean Energy Cooperation Centre, jointly hosted by the China Renewable Energy Engineering Institute and the ASEAN Centre for Energy.
		3. Establish a dedicated facility for financing the technology solutions, including project preparation support, corporate power purchase agreements (PPAs), and project aggregation platforms.	Stakeholders involved in the Green Investment and Finance Partnership.
		4. Develop a plan for phasing down captive coal power owned by Chinese investors.	Energy and industry ministries in China and Indonesia.
Rebuild: Promoting green industrialization	**Large potential for green industrialization:** Large reserves of critical minerals, widely used in clean technologies, and local projects providing opportunities for domestic manufacturing. **Value added to local and regional economies:** Creating local jobs and growth and unlocking opportunities for Chinese and foreign investors.	1. Accelerate the establishment of ASEAN-China Industry Ministerial Policy Dialogue Mechanisms.	Relevant ministries from both China (e.g., Ministry of Industry and Information Technology) and Southeast Asia responsible for the development of clean industries.
		2. Scale up successful models for clean industry development—e.g., Thailand's Eastern Economic Corridor, China-Egypt TEDA Suez Economic and Trade Cooperation Zone.	
		3. Promote green industrialization through financial (e.g., subsidies and tax breaks) and nonfinancial incentives (e.g., preferential procurement).	
Revamp: Deepening local capital markets	**Large potential in local capital markets:** Green, social, sustainability and sustainability-linked (GSSS) bonds only account for 2% of the world's total. **Attractive for Chinese investors**, due to its proximity to China, stable political relations, and large growth prospects.	1. Conduct surveys to understand the needs of Chinese institutional investors.	Chinese financial institutions: Conduct surveys and collaborate with Southeast Asia stakeholders to develop more attractive financial products for Chinese investors. Ministries of Finance from both China and Southeast Asia to provide more effective dialogue platforms and data disclosure mechanisms.
		2. Information sharing with Chinese investors: ▪ Regular updates on clean project opportunities. ▪ More standardized data disclosure and reporting mechanisms.	
		3. Conduct regular dialogues between Chinese investors and financial institutes in Southeast Asia, to facilitate mutual understanding.	

1. INTRODUCTION

The transition toward clean energy has gained momentum across the power sectors in Southeast Asia, with countries in the region scaling up their support to shift away from coal power and embrace cleaner alternatives. However, translating this momentum into actual progress presents significant challenges, particularly in the context of fast-growing economies. These economies face the critical task of securing a sufficient and reliable supply of clean energy to support their developmental aspirations while advancing decarbonization goals. As Southeast Asian countries grapple with the challenge of charting their paths to a clean energy future, international support that can assist their clean power transition is essential.

The Asia Society Policy Institute (ASPI) has partnered with Energy Foundation China (EFC) to develop a project on how China can support a clean power transition in Southeast Asia. Specifically, the project seeks to identify practical solutions to enhance China–Southeast Asia cooperation in the financial, technical, and policy domains to support an ambitious clean power transition in the region by 2030 that aligns better with the Paris Agreement's climate goals.

The project has been implemented through a phased approach, involving a sequential series of three consecutive convenings, as well as consultations with domain experts and desk research. Key insights and findings from the project are presented in this report.

As a contextual backdrop, **Section 2** highlights the crucial role of increased private sector participation and engagement in driving an ambitious clean power transition in Southeast Asia.

Section 3 discusses key issues and challenges affecting renewable energy investment in Southeast Asia, highlighted by the experts during the consultations conducted between May and July 2023, and presents trends in renewable energy investment.

Section 4 summarizes key insights gained from three convenings, held in February, July, and November 2023, focusing on how China could support large-scale renewable energy investment in Southeast Asia in ways that maximize the developmental impact of this investment and complement other major regional initiatives and programs.

Built on insights from the three convenings, **Section 5** recommends a novel, integrated, multidimensional solution—the Clean Prosperity Plan—focused on accelerating Southeast Asia's transition to clean electricity through project-based initiatives and strategic partnerships between Chinese and Southeast Asian stakeholders. This solution emphasizes the region's industrial sector as a potential buyer of clean electricity to support the deployment of renewable energy projects and to leverage these projects for green industrialization to maximize the developmental impact of the region's clean electricity transition.

2. REPOWERING SOUTHEAST ASIA: THE CRITICAL ROLE OF PRIVATE SECTOR INVESTMENT

This section discusses the critical role of increased private participation in achieving an ambitious clean electricity transition in Southeast Asia.

2.1 Large investment requirements for achieving ambitious transition

The generation mix in Southeast Asia historically has been dominated by coal and other fossil fuels, which accounted for almost 80% of the region's total electricity generated in 2020 (ACE, 2023). This dominance has contributed to the provision of cheap and reliable electricity in the region and consequently to its socioeconomic prosperity. It has, however, also contributed to escalated air pollution and carbon emissions, highlighting the unsustainable nature of the current fossil-fueled development model.

It is reported that nearly all people in Southeast Asia live in areas with particulate pollution levels higher than the World Health Organization's guideline of 5 $\mu g/m^3$ (AQLI, 2022). These particles, originating from power generation, industrial emissions, vehicle emissions, and forest fires, are one of the deadliest forms of air pollution that could significantly heighten the risks of lung cancer and heart disease. Southeast Asia, one of the most vulnerable regions to climate change, is also experiencing fast-growing carbon emissions at an average annual rate of 5% from 1,039 Mt CO_2-$_{eq}$ in 2005 to 1,815 Mt CO_2-$_{eq}$ in 2020. Of this growth, almost half was from the power sector, making it the fastest-growing emitter in the region (ACE, 2022a).

Recognizing these sustainability challenges, countries in the region are demonstrating a strong commitment to the clean energy transition. Nearly all countries in the region have pledged to achieve net zero emissions—many of them by mid-century—and have consequently increased the role of renewable generation in their national power development plans (see Appendix A).

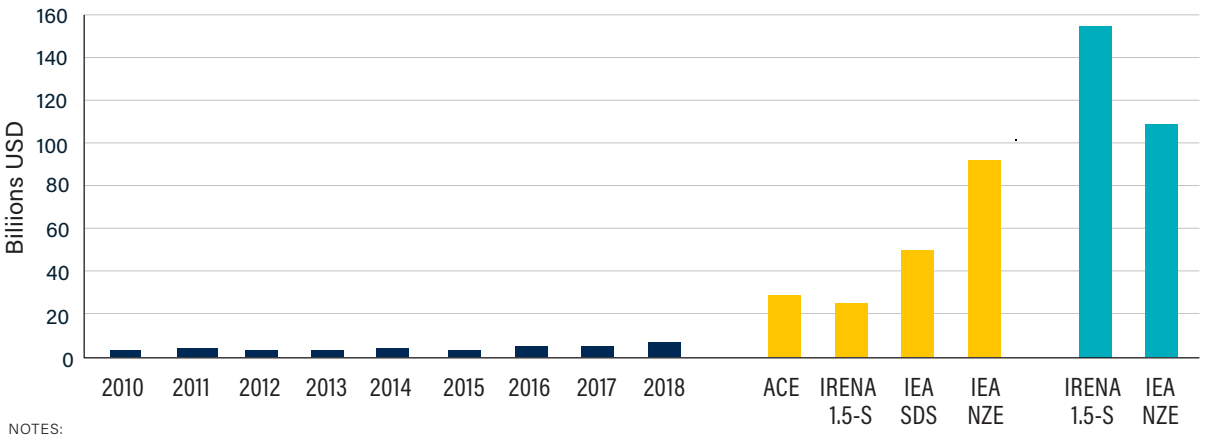
Facilitating clean power transition in Southeast Asia largely depends on the availability of financial resources. As shown in Figure 1, Southeast Asia's annual clean power investments never exceeded US$10 billion over the decade before the COVID-19 pandemic, falling substantially short of the investment required for achieving ambitious transitions to clean power.

Meeting the regional target of having 23% of primary energy supply from renewable energy by 2030, for example, would require an average annual investment of US$29 billion in clean power projects over the period 2021–2030, according to ASEAN Centre for Energy's 7th Energy Outlook report (ACE, 2022a).

The 1.5oC-aligned scenario (i.e., RE100) analyzed in IRENA (2022a) anticipates a similar level of annual investment (about US$25 billion) until 2030, but a steep increase in investment to more than US$150 billion per year post-2030.

In the Sustainable Development Scenario (SDS) analyzed by the International Energy Agency (IEA), which is consistent with limiting global temperature rise to 1.65oC, an average annual investment of US$50 billion is required to expand the clean power supply in the years leading up to 2030. This investment would need to increase to US$92 billion per year in the years to 2030 to achieve net zero energy emissions by 2050.

FIGURE 1: **HISTORICAL AND REQUIRED LEVELS OF AVERAGE ANNUAL INVESTMENT IN CLEAN POWER**



NOTES:

1. Historical investment data are obtained from (Vakulchuk et al., 2022), while future investment data are sourced from the APS scenario in (ACE, 2022), the 1.5-S scenario in (IRENA, 2022), the SDS scenario in (IEA, 2021), and the NEZ scenario in (IEA, 2023a).
2. ACE APS scenario assumes the achievement of the regional target on renewable energy.
3. IRENA 1.5-S and IEA NEZ scenarios assume the achievement of net-zero emissions by 2050.
4. IEA SDS scenario is consistent with limiting the global temperature rise to 1.65°C.

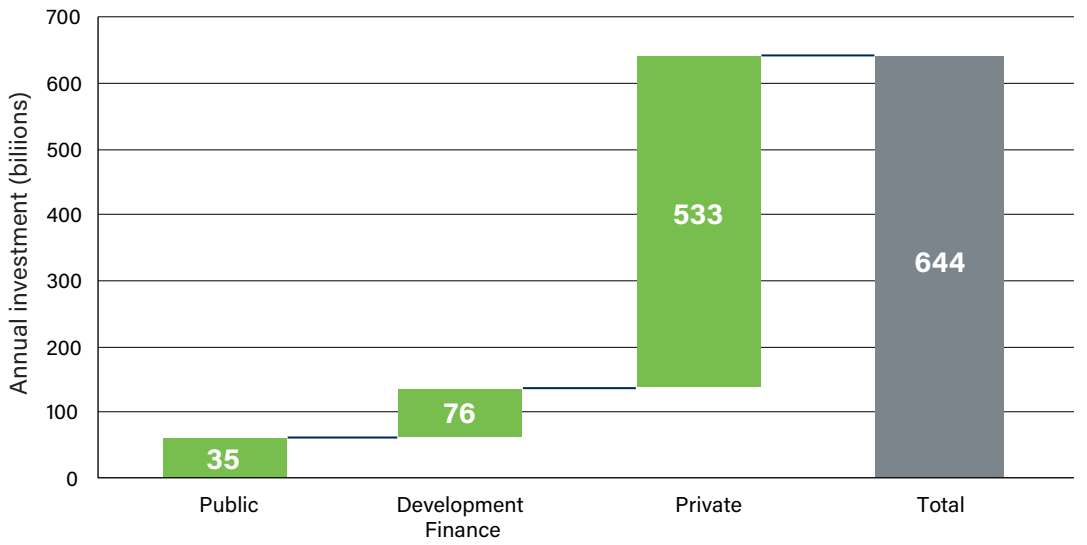
2.2 Increased private participation is crucial

It would be challenging for the public sector, historically the largest source of funding for power sector development in the region, to meet the investment needs for achieving ambitious transitions to clean power. To put this financial challenge in perspective, the region's total public investment in the entire energy sector amounted to about US$20 billion over the period 2016–2020 (IEA, 2022). This amount is insufficient to meet even one year's investment needs for progressing the region's clean energy transition along 1.5°C-aligned pathways.

It is also challenging for the region's public sector to increase its budgetary allocation to clean energy projects, given the region's growing levels of public debt. In 2018–2019, Southeast Asia's climate finance amounted to US$27.8 billion, with about 45% (US$12.5 billion) directed toward renewable energy projects. Most of the climate finance (about 68%) was in the form of debt funding, primarily at the project level (ADB, 2023). Meanwhile, the government debt-to-GDP ratio in Southeast Asia increased from 40% to 57% over the period 2015–2021, partly due to substantial fiscal spending to protect the vulnerable from the harsh socioeconomic impacts of the COVID-19 pandemic (UNESCAP, 2023).

Increased private participation is crucial for the successful clean power transition in Southeast Asia, and an enhanced role for developmental finance (e.g., concessional loans) will be critical to catalyze private investment (see Figure 2).

FIGURE 2: **SOURCES OF FUNDING, 2024-2030**



NOTES:

1. The total clean power investment is obtained from the NEZ scenario in (IEA, 2023a). It represents investment required for the entire period 2024-2030.
2. Public investment is estimated based on the assumptions that it will remain at the same level over the period 2024-2030 as it was in 2022. In 2022, US$23 billion was spent on clean power projects in Southeast Asia (IEA, 2023a), with 40% of this spending from the public sector (IEA, 2021).
3. Development finance and private investment are estimated based on investment multiplier taken from (IEA, 2021). It is assumed that the investment multiplier, defined as the ratio of private investment mobilized by a given amount of development finance, is seven This ratio is high and requires deeper market and regulatory reforms to create a morefavorable environment for private investment (IEA, 2021).

3. RENEWABLE ENERGY INVESTMENT IN SOUTHEAST ASIA

This section discusses key issues affecting the profitability of renewable energy projects in Southeast Asia, drawing on insights from expert consultations conducted between May and July 2023. It also presents investment trends.

3.1 Key issues and challenges

3.1.1 Grid infrastructure

Power grids play a critical role in facilitating the integration of renewable energy. An expert from the power sector noted that "expanding the capability of the grid to absorb more renewables is the most important infrastructure to address if we are to realize the ambitious targets in Southeast Asia. . . . Countries such as Vietnam, Philippines, and Indonesia will need massive support to improve their respective networks." Large solar curtailments in Vietnam, a country often cited as a success story in clean energy transition, are just one case of the grid integration challenge faced by Southeast Asian countries. In 2021, there were plans to curtail approximately 500 GWh of solar power in Vietnam (Sang, 2021). The curtailment rate at the country's largest solar power plant in Thuan Nam, boasting a capacity of 450MW, reached about 40% (Vu, 2022).

While wind and solar projects typically take six to eight months to complete, grid projects often require much longer time frames. In many Southeast Asian countries, the main planning tool to ensure that additional renewable generation capacity does not compromise the overall reliability and security of electricity supply is grid impact studies jointly developed by project developers and network companies prior to project approval.

An expert noted that "in the Philippines, it currently takes 12 months before a grid impact study can be done by the transmission provider, the National Grid Corporation of the Philippines (NGCP). The queue is very long and, thus, delays in project implementation become inevitable." In a similar vein, an expert from Vietnam noted that "in 2022, completed solar projects need to wait to come online until 2030 when the grid expansion is finished."

Another factor is the lack of experience with managing new technologies, including solar power, as an expert in Vietnam noted that "government needs to adapt. . . . They need to learn how to plan for variable renewable energy, because previously the power sector was dominated by baseload coal and hydro power."

Several participants from the power sector highlighted land acquisition as an important factor contributing to Vietnam's grid constraints for solar integration. One pointed out that "solar irradiation is high in central Vietnam, but the demand is in [the] south and north. . . . Land is expensive, and developers sometimes face lengthy negotiations with local communities." Another added that "land clearing is an issue in grid expansion. Firstly, public-owned companies may not be able to pay above market prices to procure land. Secondly, most of the projects are in remote areas, and sometimes in forest areas." Addressing these issues, as one expert noted, will take significant time and effort, which partly explains why the Vietnamese government is now prioritizing offshore wind and rooftop solar PV. This interviewee explained that "the potential [for offshore wind) is more equally distributed in the north, central, and south. . . . On-site solar power, like rooftop solar, does not need much effort on grid augmentation."

3.1.2 Project preparation and procurement

Land acquisition is a key challenge faced by many renewable project developers in land-stressed Southeast Asia countries. This challenge is mainly caused by fragmented land ownership dispersed across multiple owners, which makes the acquisition of large land parcels a complex and protracted process. While this issue affects all energy projects, its impact is more pronounced in land-intensive, utility-scale solar projects. As one expert explained, "Large-scale solar projects require significant amounts of land. At least one hectare of land is needed for every one MW solar capacity. There is currently no incentive [in Indonesia) to support land acquisition." Another expert argued that "if incentives to address these issues are not available, the acceleration of solar uptake in Indonesia will be challenging."

Complex and nontransparent administrative procedures for obtaining project approvals were identified by several experts as a key issue affecting clean energy investment in Southeast Asia. Specifically, in Vietnam, one expert noted that "investors need to clear several administrative steps, including environmental impact assessment, construction license, grid connection approval and so on. . . . There are different governmental entities involved in the approval process. . . . The procedures for obtaining these approvals are not clear and often lack details. . . . The investors often don't know what procedures to follow."

To reduce risks, one expert mentioned that some investors sought to collaborate with well-connected local partners and used low-quality materials, often available at lower prices. Another strategy for risk mitigation employed by some investors, as a solar industry expert mentioned, was to build small-scale solar projects that are easier to implement. Another expert added that the deployment of these small-scale solar projects is not always fully incorporated into the planning process, partly contributing to the solar curtailments observed in the past few years.

The issue pertaining to the permitting process is particularly significant for nonconventional renewable technologies, such as solar and wind. One expert noted that many investors have already gained experience with the development of conventional renewable projects in the region, such as hydro, and consequently have acquired a good understanding of the permitting process, including its associated costs and risks. Another issue related to the permitting process, as noted by some experts, is the lack of a legal framework for governing emerging technologies, such as offshore wind.

As noted by several experts, the **bankability of the power purchase agreements (PPAs)** is a key issue affecting clean energy investment in Southeast Asia. According to one expert, an important obstacle to solar uptake in Indonesia is unfavorable PPAs with investors forced to take excessive risk.

Another issue is the procurement process. According to an Indonesian expert, only companies included in the so-called selected supplier list can join the auction process led by the State Electricity Company (PLN), potentially limiting the scope for private participation. Similarly, an expert from Vietnam noted that the criteria for participation in the procurement process for implementing the recently approved power development plan remain largely unclear. Private investors are concerned that they might not be given sufficient time to prepare for their bidding, potentially reducing the scope for private participation.

The Build, Own, Operate and Transfer (BOOT) scheme, as highlighted by several experts, presents another issue associated with the PPAs. Under the BOOT model, independent power producers (IPPs) are often required to transfer assets, such as land, buildings, and equipment, to the national electric utilities upon completion of the operational period. In some cases, IPPs are responsible for land acquisition, and the transfer of assets to the utility companies may prevent IPPs from enjoying any appreciation in land values.

Other issues include nonstandardized PPAs, sometimes with fluctuating offtake prices or no take-or-pay clause, tight deadlines for feed-in tariff eligibility, and short duration of the PPAs that increases the risk for project investors regarding revenue remuneration (ACE, 2022b).

The challenges associated with PPA bankability are exacerbated by macroeconomic risks in some Southeast Asian markets, where PPAs are denominated in local currencies while the costs of project equipment, such as solar panels, are priced in foreign currencies (Centre for Climate Finance & Investment, 2023). While these risks are common to all projects, they are more pronounced for renewable energy projects, given the capital-intensive nature of these projects.

Electricity prices in many Southeast Asian countries are regulated and heavily subsidized, especially for household consumers. This pricing model, as noted by some experts, provides limited incentive for household consumers to adopt rooftop solar PVs. The situation has changed in more recent times, with the surge in fuel prices in the international markets creating upward pressure on the cost of electricity supply in some Southeast Asian countries. Higher electricity bills may create opportunities for the uptake of rooftop solar PV in the household sector, though its actual impact could be moderated by the scope and size of the price rise, the cost of solar installations, financial incentives, and the metering schemes available to household consumers.

The need to provide electricity subsidies has also exerted pressure on the budgets of national electric utilities in Southeast Asia, such as PLN in Indonesia and Vietnam Electricity (EVN). In Indonesia, efforts have been made to rationalize electricity tariffs since 2014, mainly through the introduction of a tariff adjustment mechanism. These efforts, however, were short-lived and the tariff adjustment mechanism was suspended in 2017. Once again, the electricity subsidies started to rise, climbing to US$3.8 billion (about IDR55 trillion) in 2020. PLN has struggled to generate an adequate return on its assets, despite significant financial support provided by the government as compensation revenue (ADB, 2020). This situation, as noted by some experts, has prompted concerns among investors regarding the utility's ability to meet its financial obligations for the purchased electricity. The possibility of nonpayment could affect investors' willingness to participate in renewable energy projects.

Excessive supply capacity backed by long-term PPAs with take-or-pay[1] clauses is considered an important obstacle to renewable capacity expansion in Indonesia. The Widodo administration introduced the 35GW program to increase supply capacity in 2015, offering private investors long-term PPAs with take-or-pay[1] and guaranteed rate-of-return clauses (Hamdi, 2021). Much of the contracted capacity is coal based. This combined with less-than-expected demand growth, however, resulted in PLN having excess supply capacity supported by expensive take-or-pay PPAs. This also explains, as one expert noted, why PLN opposed a new regulation introduced in 2021 to give incentives to investment in commercial and industrial rooftop solar PVs. According to this expert, this regulation enables solar owners to sell all excessive electricity generated to the grid, which could cause financial losses for PLN given the existing market glut. Another expert added that this happens because "PLN needs to gain a profit as a state-owned company, as required by the Ministry of State-Owned Enterprises."

3.1.3 Local manufacturing capacity

One of the key drivers behind the clean energy transition in Southeast Asia is the expectation that it will

[1] Take-or-pay obligates the utility company to pay for the electricity as agreed, even if it does not ultimately use or need the entire quantity. It is often used to provide investors with some level of revenue certainty, even if market conditions or the buyers' needs change.

boost the development of the local clean energy industry. This is evident if one notes the introduction of local content requirements (LCRs) in various Southeast Asian countries, such as Indonesia and Malaysia (IRENA, 2022b). While Thailand does not have specific requirements on local contents for renewable energy projects, it is reported that the project auctions often favor local bidders. Moreover, bioenergy projects have been prioritized in the country, partly due to the need for local materials and employment benefits for the local agricultural sector (Merdekawati et al., 2023).

We asked participants in the consultation why solar power is as expensive as it is in Indonesia. Several noted that a significant contributing factor is the local content requirement, which mandates that project developers must procure certain amounts of materials and services used in the project from local sources. This is particularly challenging in the context of solar PV, where Indonesia's small domestic manufacturing base means that solar panels produced locally are often of lower quality and significantly more expensive than those available in international markets (IESR, 2023). One expert noted that "the local content requirement was introduced with [the] good intention of reducing import dependency. But the Ministry of Industry did not fully understand the solar development issues; therefore, this regulation also affects the progress of solar deployment in the country."

3.2 Investment outcomes

The preceding discussion suggests that mobilizing private investment in renewable energy projects in Southeast Asia, as in many other developing countries, is affected by a range of issues and challenges:

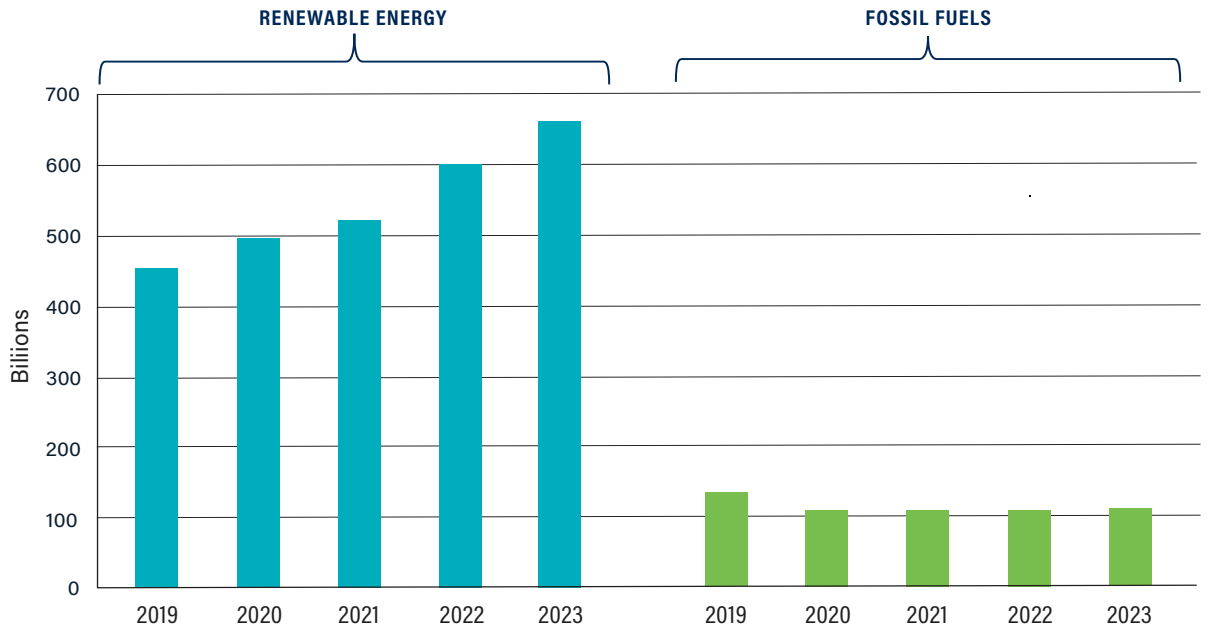
- Insufficient grid infrastructure to accommodate the increasing demand for the integration of variable renewable technologies.
- Substantial difficulties in acquiring sufficient land for wind and solar projects in land-stressed regions across Southeast Asia.
- Complex and nontransparent permitting processes that involve multiple institutions with overlapping and sometimes unclearly defined roles and responsibilities.
- Lack of commercial arrangements (e.g., power purchase agreements) that provide sufficient and predictable revenues for capital-intensive investments.
- Concerns about the financial health of national electric utilities and their ability to fulfill payment obligations.

These electricity-specific issues undermine risk-adjusted returns for investors and hence limit the availability of bankable projects. The situation is often compounded by broader challenges including restrictions on foreign direct investment, currency risks, and weaknesses in local banking systems and capital markets. In these circumstances, climate finance from the private sector tends to prioritize projects in mature economies with large demand and a sound business environment, offering lower risks and more stable returns to the investors.

Globally, there has been a substantial increase in renewable energy investment in recent years, rising from US$1,225 billion in 2019 to US$ 1,740 billion in 2023—a more than 40% increase in just four years. Meanwhile, fossil fuel investment has remained at roughly the same level (see Figure 3).

Much of this increase in renewable energy investment has been concentrated in advanced economies and a handful of major developing countries, most notably China. In contrast, the rest of the world, including

FIGURE 3: **GLOBAL POWER INVESTMENT, 2019-2023**

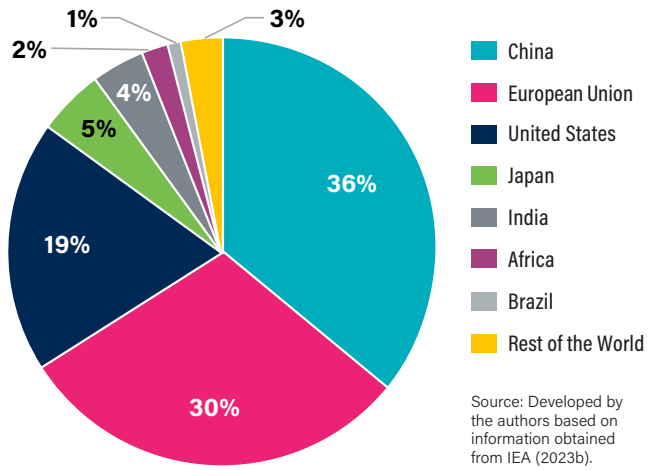


Source: Developed by the authors based on information obtained from IEA (2023b).

Southeast Asia, has contributed to only 3% of the increase in renewable energy investment since 2019 (see Figure 4).

Between 2000 and 2022, Chinese firms made significant investments in 1,423 overseas power plants, covering both greenfield investments and mergers & acquisitions. Collectively, these power plants have a capacity of 168 GW, with 31% located in Southeast Asia (see Table 1). This makes the region the most popular destination for Chinese overseas investment in power generation. Four out of the top ten countries hosting Chinese investment in power projects are in Southeast Asia, including Indonesia (22 GW), Vietnam (11 GW), Myanmar (7 GW), and Malaysia (6 GW) (Boston University Global Development Policy Center, 2022).

FIGURE 4: **INCREASE IN RENEWABLE ENERGY INVESTMENT, 2019-2023**



Source: Developed by the authors based on information obtained from IEA (2023b).

There has also been a growth trend toward renewable energy projects in China's overseas energy investment, with the first half of 2023 being the "greenest" in any six-month period since the inception of the Belt and Road Initiative (BRI) in 2013 (Green Finance & Development Center, 2023). However, Southeast Asia appears to have only received a small proportion of the Chinese investment in non-hydro renewable energy projects (see Table 1).

Greenfield investment and development

finance provided by Chinese policy banks are the primary sources of Chinese investment in power projects throughout Southeast Asia. Between 2000 and 2022, these sources (18 GW for greenfield investment and 19 GW for policy banks) contributed a combined capacity of 37 GW to the region's power sector, accounting for roughly 70% of the total capacity financed by Chinese investors in the region. The remaining capacity is financed by Chinese investors through either mergers & acquisitions deals (20%) or foreign direct investment (FDI) with support provided by Chinese policy banks (10%) (see Appendix B).

TABLE 1: **CHINESE OVERSEAS INVESTMENT IN POWER GENERATION PROJECTS, 2000 TO 2022 (MW)**

REGION	COAL	GAS	OIL	NUCLEAR	HYDRO	NON-HYDRO RENEWABLES	TOTAL	SHARE (%)
Africa	7,550	3,625	417	-	9,476	962	22,030	13%
Central Asia	1,480	808	16	-	400	270	2,974	2%
East Asia	398	1,486	375	-	-	65	2,324	1%
Europe	350	5,477	152	5,840	40	5,207	17,066	10%
Americas	356	5,052	411	-	20,567	7,279	33,665	20%
Middle East	1,320	2,464	-	-	51	1,196	5,031	3%
Oceania	885	630	-	-	124	4,604	6,243	4%
South Asia	13,810	3,883	623	3,295	3,620	1,314	26,545	16%
Southeast Asia	28,576	8,204	624	-	15,082	86	52,572	31%
Total	54,725	31,629	2,618	9,135	49,360	20,983		100%

NOTE:

The table provides an overview of Chinese overseas investment in power generation projects since 2000, covering greenfield investments and mergers & acquisitions. It offers a more complete picture than other widely used databases, such as China's Global Energy Finance, which only focuses on public financing for global energy projects provided by China's policy banks – the China Development Bank and the Export-Import Bank of China.

Source: Developed by the authors based on China's Global Power Database (Boston University Global Development Policy Center, 2022)

4. HOW CAN CHINA HELP?

This section summarizes key insights gained from three convenings held in February, July, and November 2023, focusing on how China could support large-scale renewable energy investment in Southeast Asia in ways that maximize the developmental impact of this investment and complement other major regional initiatives and programs. To better understand the various arguments made by the participants in the convenings, this section begins with a brief overview of major Chinese initiatives that can be mobilized to support Southeast Asia's clean electricity transition. It then details the main points discussed during the convenings.

4.1 Existing Chinese initiatives and programs

Chinese and Southeast Asian leaders have made a strong commitment to enhancing cooperation in the clean energy transition. The ASEAN-China Strategic Partnership Vision 2030, adopted at the 21st ASEAN-China Summit in 2018, emphasized the importance of taking a regional approach to promote clean energy development. In 2022, the Plan for Action to Implement the ASEAN-China Strategic Partnership for Peace and Prosperity (2021–2025) was released as a guiding document to further enhance ASEAN-China cooperation in areas of mutual interest, in which investment attraction in clean energy was identified as a key priority area for action. Later in 2022, the ASEAN-China Joint Statement on Mutually Beneficial Cooperation on the ASEAN Outlook on the Indo-Pacific was presented at the 26th ASEAN-China Summit in Jakarta, reaffirming the importance of cooperation in clean energy transition and green growth.

China has also entered into various bilateral agreements with Southeast Asian countries to deepen cooperation in clean energy transition. From October 16–18, 2023, Indonesian President Joko Widodo attended the 3rd Belt and Road Forum for International Cooperation and paid a state visit to China. A joint statement was released on October 18, underscoring the commitment of both nations to deepen comprehensive strategic cooperation; both sides agreed to strengthen cooperation in accelerating energy transitions. Likewise, in the joint press communiqué on October 19, 2023, China and Thailand agreed to deepen cooperation on emerging industries, including clean energy.

BRI is China's main international cooperation platform. Since its announcement in 2013, the BRI has undergone major reforms, with a specific emphasis on its "greening." Several policy documents and investment guidelines have been introduced to guide the conduct of Chinese financial institutions and companies. The aim is to encourage investment in renewable energy projects and to achieve better social and environmental outcomes. See Appendix C for further details.

In addition to these reforms, efforts have been made to expand the BRI's role from a direct investor to a catalyst for clean energy projects. A significant development in this regard was the introduction of the Green Investment and Finance Partnership at the 3rd Belt and Road Forum for International Cooperation in 2023. This partnership serves as a green project pipeline facility, aimed at using the BRI funds, as well as carbon finance supported by Core Climate, a carbon trading arm under Hong Kong Exchanges (HKEX), to expand the capital available to renewable energy projects in developing countries, Southeast Asian countries included.

During the 3rd Belt and Road Forum, President Xi Jinping announced the equivalent of more than US$100 billion in new funding for BRI cooperation projects from Chinese development finance institutions. Both the China Export and Import Bank and the China Development Bank will receive a new financing window

of approximately US$50 billion, while the Silk Road Fund, also a part of the BRI financing mechanism, will receive a capital infusion of US$10 billion.

4.2 Insights from the convenings: A summary

Deeper reforms are essential for fostering a conducive environment for renewable energy investment in Southeast Asia. The participants emphasized that there is no lack of financing; however, when perceived risks are considered, projects become commercially unviable.

Key areas for reforms, as noted by the participants, include more standardized power purchase agreements, clear and transparent processes for supply contract procurements, a more rationalized approach to electricity subsidies, the elimination of fossil fuel subsidies, and grid smartization. The importance of deepening electricity market reforms in Southeast Asian countries was emphasized during the convening to establish a level playing field for private investors. These reforms should also aim to attract investments through organizational arrangements, such as energy service companies (ESCs) and promotion of consumer choice in clean energy adoption, including options such as rooftop solar PVs.

Furthermore, the participants also noted the importance of developing a clear policy framework in Southeast Asia, underpinned by short-, medium-, and long-term targets. This framework would, as explained by one participant from the financial sector, provide a clear policy signal to Chinese investors, encouraging them to prioritize renewable energy projects in the region, as they are required by the Chinese government to comply with the regulations and laws of the host countries.

Beyond investment mobilization, the participants highlighted the need for a broader agenda to ensure a successful clean electricity transition in Southeast Asia. Key aspects they emphasized include the following:

- **Energy security and affordability:** Ensuring the security and affordability of electricity supply is essential when decarbonizing, especially considering the crucial role of electricity in supporting economic growth and social welfare improvement. The clean electricity transition should not compromise energy security and access to affordable electricity. A key issue here is to coordinate renewable energy investment with coal power phasedown.
- **Transition for prosperity:** The transition should extend beyond emissions reduction to encompass sustainable development and socioeconomic prosperity. This entails not only securing sufficient investment for rapid deployment of clean energy technologies and systems but also using this investment as a catalyst for local industry upgrading, job creation, and ultimately fostering sustainable development for long-term regional prosperity.
- **Industry decarbonization:** This includes deploying co-located renewables (e.g., solar power and bioenergy) and storage at industrial sites, generating carbon credits for avoided emissions and creating opportunities for developing manufacturing capacity for relevant technologies.

The participants stressed the importance of an integrated, multidimensional solution package to support Southeast Asia's clean electricity transition. This package should encompass elements such as the following:

- **Technology:** Support the development of new technologies that extend beyond renewable energy technologies to include smart grid technology and energy storage, ensuring integration while maintaining supply reliability and security. Carbon capture, utilization, and storage (CCUS) is also important.

It was also suggested that in Indonesia, a significant opportunity lies in phasing down captive coal power at industrial sites, a sector in which China has substantial investments. The proposed model includes progressively deploying co-located renewables and storage, as described above.

The development of offshore wind, in conjunction with onshore green hydrogen production and/or grid connections, is also suggested as an important option, given the region's long coastlines.

- **Industry:** Support green industrialization in the region, leveraging the domestic clean energy transition to boost the growth of a clean economy. This can be achieved by establishing joint green industrial parks between China and Southeast Asia, where industrial policies are integrated with renewable energy projects. This initiative could leverage Regional Comprehensive Economic Partnerships (RCEPs) to facilitate the free trade of green products. The role of innovative financial instruments including green credits and bonds was noted as crucial, along with training programs to bridge workforce gaps in emerging clean industries.
- **Policy:** Support implementation of a range of policy incentives and financial instruments to mitigate project risks and diversify investments, such as carbon pricing; corporate power purchase agreements; green taxonomy; and bonds linked to environmental, social, and governance (ESG) issues.
- **Partnership:** Foster partnerships and constructive dialogues between China and Southeast Asian countries to align their interests in clean electricity transitions, prioritizing a bottom-up approach to identify and implement pilot projects to demonstrate the benefits of the transition.

  Cooperation between Chinese and local financial institutions is critical. To facilitate this cooperation, several actions were noted during the discussion, including familiarizing local banks in Southeast Asia with Chinese business practices and better integrating ESG principles into bilateral investment treaties.

  Effectively utilizing multilateral platforms including multilateral development banks (MDBs), the ASEAN Centre for Energy (ACE), and the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) is also important. It was noted that ACE can be a key platform for facilitating coordination with Southeast Asian member countries to implement the Belt and Road Initiative in driving the region's clean energy transition.

4.3 Further reflections

Building on the insights provided above, this section provides some further reflections on how China can support Southeast Asia's clean energy transition.

To catalyze large-scale investment in Southeast Asia's renewable energy sector, there is a critical need for major reforms designed to create a more favorable business environment. These reforms entail not only traditional business and financial strategies but also the institution of major changes across a spectrum of areas such as planning practices, permitting processes, regulatory frameworks, governance structures, and financial mechanisms.

Strong political commitment is key for the progress of these reforms, especially when they encroach on politically sensitive policy areas, posing an immediate threat to entrenched interests. This situation may lead

to a "chicken and egg" dilemma. Southeast Asian governments may prefer immediate outcomes, such as increased investment and more jobs, before fully committing to broader reforms. These positive outcomes would create a more favorable environment for making difficult policy decisions. The absence of major reforms, however, may lead to investor hesitation, characterized by a "wait-and-see" attitude or demands for less favorable financial terms.

To address this dilemma, China could collaborate with Southeast Asian countries in developing strategic pilot projects, focusing on supporting a rapid deployment of renewable energy projects and seizing the opportunities these projects present for local clean industry development. They often require project-specific support, rather than broad-based reforms. As a result, they are relatively easy to implement, bypassing the difficulties often associated with deeper reforms. In addition, these projects can deliver immediate outcomes, serving as a powerful leverage point for broader impact.

5. RECOMMENDATIONS: CLEAN PROSPERITY PLAN

5.1 Clean Prosperity Plan: Leverage for greater impact

The Clean Prosperity Plan represents an innovative, bottom-up, project-oriented approach specifically designed to accelerate the transition to clean energy in Southeast Asia. This approach focuses on the implementation of project-based initiatives, rather than relying on comprehensive top-down transition planning, which often involves broad-based policy reforms, aimed at fostering a conducive environment for renewable energy investment, especially from the private sector.

Like the Climate Prosperity Plan adopted by Sri Lanka and Bangladesh, the proposed Clean Prosperity Plan aims at leveraging growth-generating opportunities provided by Southeast Asia's clean energy transition to support long-term socioeconomic development. A variety of practical opportunities are available for implementing this proposal, such as establishing offshore wind zones integrated with onshore hydrogen production and developing the associated supply chain, as well as combining industrial parks with clean energy projects.

This section specifically focuses on industrial parks. Central to this opportunity are the collaborative efforts and partnership between Chinese and Southeast Asian stakeholders, which aim to do the following:

- Strategically use the region's industrial sector as a potential buyer of clean electricity to support the deployment of renewable energy projects and systems.
- Identify and initiate renewable energy projects that are viable and ready for immediate implementation, supported by project-specific policy incentives and international assistance.
- Utilize these renewable energy projects as leverage for promoting green industrialization within the region, both upstream (e.g., critical mineral supply) and downstream (e.g., clean technology assembly and manufacturing), to maximize their developmental impact.

The proposed Clean Prosperity Plan represents a leverage point for greater impact by doing the following:

- **Bringing immediate benefits:** Following the principle of "starting with the easy tasks and then gradually proceeding to the difficult ones" (先易后难), the Clean Prosperity Plan can circumvent the complexities and delays often associated with comprehensive top-down planning. As a result, it has the potential to bring immediate outcomes, such as job creation, industrial upgrading, and sustainable economic growth.

  In contrast, a top-down planning approach often starts with the establishment of emissions caps for the power sector, followed by developing a comprehensive plan. This plan details the required scale of renewable energy projects to achieve the emissions reduction targets, as well as the necessary financial resources for project development. The lead-up time for the development and implementation of a comprehensive top-down plan can be lengthy, and political obstacles can be enormous. The number of stakeholders involved in developing such a plan is often large, and the competing interests are complex. Coordinating everyone involved and achieving consensus can be a difficult and sometimes insurmountable challenge.
- **Creating spillover impact:** A particular appeal of the proposed Clean Prosperity Plan is its great potential if adopted by many localities, creating the effect of "using a point to bring out

the whole" (以点带面). The implementation of a Clean Prosperity Plan can create immediate, positive outcomes, contributing to local growth and job creation. This success could in turn send a positive message to other areas and countries that the transition is beneficial. This would foster hope and inspire other areas and countries to join in, leading to an ever-widening circle of cooperative efforts in building a clean, sustainable, and prosperous future powered by renewable energy.

- **Complementing other regional initiatives:** The Clean Prosperity Plan has the potential to complement JETP and other regional initiatives, achieving synergistic outcomes where "1 plus 1 is greater than 2" (1加1大于2).

  Unlocking substantial investment in renewable energy projects in Southeast Asia, especially from the private sector, requires deeper reforms. The Indonesia JETP, for instance, includes an important policy component intended to facilitate the implementation of necessary market and regulatory reforms, aimed at creating a level playing field for private investment.

  However, such reforms often encounter challenges, including conflicting interests and limited implementation capabilities, leading to considerable uncertainty for private investors. Investors might either adopt a wait-and-see stance until a more conducive investment environment is established or demand financial terms that might not be favorable for Southeast Asian countries, despite the high sustainability commitments from companies and financial institutions.

  In this context, the immediate positive outcomes of the implementation of the Clean Prosperity Plan could be instrumental. They could help the governments in Southeast Asian countries legitimize the implementation of deeper reforms to mitigate the risks of renewable energy projects, especially in sensitive policy areas. This approach can create a more stable and attractive environment for investment, thus accelerating the region's transition to clean energy.

5.2 Key levers and specific actions

5.2.1 Repower: Cleaning Southeast Asia's industrial sector via green electrification

Rationales: In Southeast Asia, the industry sector stands out as one of the largest contributors to carbon emissions. Considering the significant economic and industrial output growth anticipated in the region over the next few decades, energy consumption and carbon emissions from the industry sector are expected to rise substantially, unless more aggressive emissions abatement policies and strategies are implemented by countries in the region. The region's industry sector also represents a potentially large consumer for clean power, given that electrification, both direct and indirect (via green hydrogen), is one of the most attractive options for decarbonizing the industry sector, alongside improved efficiency in material and energy use in the production processes.

- **Large potential consumer of clean power:** According to IEA (2023c), Southeast Asia's final energy consumption is expected to grow from 19.8 EJ in 2022 to 24.7 EJ in 2030, under the Announced Pledges Scenario. Of this growth, more than half (57%) will come from the industry sector. By 2030, the projection is that the industry sector will account for approximately 45% of the total final energy consumption in the region. Similar results are found in the ASEAN Centre for Energy's 7th ASEAN Energy Outlook report: the industry sector will contribute about 52% to the growth in final energy consumption in Southeast Asia over the period 2020–2030, under the AMS Target Scenario (ATS) assuming the achievement of ASEAN official national energy targets (ACE, 2022a).

About two-thirds of the energy used in Southeast Asia's industry sector comes from the direct burning of fossil fuels (IEA, 2019). The rest is dependent on electricity, a large proportion of which is generated from fossil fuels, particularly coal, using captive power plants. Under the business as usual (BAU) scenario, the annual demand for fossil fuels in Southeast Asia's industry sector could increase by 170 Mtoe, representing a substantial opportunity for the uptake of clean energy (ACE, 2022a).

In Indonesia, captive coal power capacity currently accounts for approximately 25% of total operational coal power capacity. In addition, a substantial increase in captive coal power capacity, amounting to 14.4 GW, is either planned or under construction (Hasan et al., 2023). This capacity addition is roughly equivalent to half of Australia's total coal power capacity as of 2022 (Ember, 2023). Chinese investors are involved in more than 70% of the captive coal power capacity in Indonesia, and their investments are closely linked to broader industrial ventures, such as critical mineral mining and the development of industrial parks (Zhu et al., 2023).

- **Better access to land around industrial parks:** More than 1,000 industrial parks and special economic zones support industrial development across Southeast Asia. The industrial parks are often located in remote, less populated regions, offering relatively easier access to land for renewable energy development. This represents a significant opportunity to transition from captive fossil fuel capacity to renewable energy, thereby supporting green industry growth across the region. In contrast, land acquisition for renewable energy projects in the densely populated urban areas of Southeast Asian countries often faces significant challenges.
- **Ability to circumvent complexities in the expansion of flexible, on-grid clean electricity systems:** The deployment of weather-dependent, variable clean power requires a more flexible power system, a requirement that extends beyond simply increasing energy storage capacity. Indeed, it also involves enhancing the flexibility of power system operations. This can be achieved by various measures, such as introducing more flexible contracts for electricity and fuel supply and reforming electricity markets to facilitate more effective sharing of surplus and reserve capacity. However, rapidly expanding flexible power systems in fast-growing economies, like those in Southeast Asia, is not easy. In this context, the development of off-grid clean electricity systems for industrial consumers provides a significant opportunity to bypass this challenge while facilitating the decarbonization of national economies across the region.

Specific steps and actions: To support the decarbonization of Southeast Asia's industrial sector, the following steps and actions are proposed, aimed at facilitating a transition away from fossil fuels and captive coal power while promoting the adoption of their clean alternatives:

1. **Supporting the development and extension of carbon pricing mechanisms in the region to cover the industrial sector:** Emissions trading systems (ETSs) are an important policy instrument for countries to achieve cost-effective outcomes in decarbonizing their economies, raise domestic climate finance, and mitigate the potential impact of carbon border adjustment mechanisms. Recognizing their importance, Southeast Asian countries have begun developing their own national ETSs. Indonesia launched its national ETS in 2023, initially covering grid-connected coal-fired power plants, with plans to include captive coal-fired power plants at industrial sites as well as oil- and gas-fired power plants by 2025 and expanding further to cover energy-intensive industry sectors. Vietnam plans to introduce a

pilot ETS by 2026 and a fully operational ETS by 2028; ETSs are also under consideration in Thailand, Malaysia, and the Philippines.

With their experience in applying national ETSs to captive power plants and their preparations for expanding ETSs to cover industrial processes, officials from relevant public agencies in China, such as the Ministry of Ecology and Environment (MEE), as well as experts from several other institutions, could offer valuable insights and knowledge to Southeast Asian stakeholders, in addition to insights from South Korea, which already includes industrial sectors in its ETS. This would support their efforts to develop and extend ETS coverage to include the industrial sector.

In Indonesia, key stakeholders include the Coordinating Ministry for Maritime and Investment Affairs and the Coordinating Ministry for Economic Affairs, which are the chair and vice chair of the National Steering Committee for Carbon Pricing Implementation. Other relevant stakeholders include the Ministry of Energy and Mineral Resources and the Ministry of Industry.

In Malaysia, the main stakeholder responsible for the development of the carbon pricing system is the Ministry of Natural Resources, Environment, and Climate Change. In addition, the Ministry of Finance, in collaboration with Bursa Malaysia, oversees the operation of the Bursa Carbon Exchange, a voluntary carbon market.

Thailand's Greenhouse Gas Management Organization (TGO) is an autonomous public agency responsible for the development and implementation of climate change mitigation programs, including carbon pricing. In Vietnam, key stakeholders include the Ministry of Natural Resources and Environment and the Ministry of Finance. These two entities are responsible for the design of a national crediting mechanism and a national ETS, according to the revised Law on Environmental Protection.

2. **Developing technology solutions tailored to local contexts:** A key aspect of the solution package is to provide international assistance, focused on enabling Southeast Asian countries access to relevant technologies for cleaning up their industrial sectors. The China-ASEAN Clean Energy Cooperation Center, jointly hosted by the China Renewable Energy Engineering Institute (CREEI) and the ASEAN Centre for Energy, can facilitate this.

   Particular attention should be given to clean energy technologies that are suitable for specific local contexts in Southeast Asia. Offshore wind, combined with onshore hydrogen production and/or grid connection, presents a significant opportunity for expanding renewable energy supply to meet the energy needs of Southeast Asia's burgeoning industrial sector, particularly given the region's long coastlines, especially in the Philippines and Vietnam. The Philippines has the potential to install 21 GW of offshore wind power, sufficient to satisfy 21% of the country's total electricity needs by 2040, according to a report jointly developed with the World Bank (World Bank, 2022). According to a 2021 study by the World Bank, Vietnam has sufficient, technically feasible offshore wind potential to meet about 12% of the country's electricity demand by 2035 (World Bank, 2021).

   Floating solar can take advantage of the region's abundant open water spaces in lakes, dams, and reservoirs. Vietnam, Thailand, and Indonesia are ranked among the top three countries globally in terms of utility-scale installation of floating solar, highlighting the significant potential of this energy source as an attractive option to alleviate the pressure on finding

land for solar deployment. Bioenergy is another solution with synergies regarding waste management. Organic waste, such as crop residues, forestry residues, and food waste, can be converted into bioenergy instead of being sent to landfills, where it would decompose and release methane, a potent greenhouse gas.

Technical support should go beyond renewable energy technologies to include supplementary technologies, such as energy storage, hydrogen, CCUS, and smart system operation technologies.

3. **Establishing a dedicated facility for financing the technology solutions:** The Green Investment and Finance Partnership, introduced at the 3rd Belt and Road Forum for International Cooperation in 2023, provides a platform for directing BRI funds to expand the capital available to renewable energy projects in developing countries, Southeast Asian countries included. This partnership should include the development of a financing facility dedicated to funding the proposed integrated solutions in Southeast Asia.

   This facility would provide financial support (including concessional finance) to prepare greenfield projects for ready-to-build status. It could also allocate part of the funding through domestic banks in each country, blending it with domestic capital, and could also incorporate innovative models for project financing, such as corporate PPAs.

   The facility should include a project aggregation platform to consolidate small renewable energy projects to meet the large minimum investment requirements of major Chinese energy investors, as well as to reduce documentation costs.

4. **Developing a plan for phasing down captive coal power:** Energy and industry ministries in China and Indonesia could collaborate to lead discussions with industry leaders and investors, aiming to develop a plan for phasing down captive coal power.

   The plan should consider the repurposing of existing captive coal power facilities, which could help reduce the costs associated with the phasedown. This can be accomplished through modifications and upgrades to existing coal-fired power plants, enabling them to operate more flexibly with lower minimum load capacity and higher ramping rates (Cochran et al., 2014). Other options include fuel switching (e.g., to bioenergy) and replacing coal power plants with battery storage and solar PVs, utilizing the existing network facilities.

   In addition, the plan could incorporate a cash-for-emissions scheme for financing coal power phasedown. Under this scheme, the phasedown of captive coal power plants can be funded by revenue raised from setting a price on avoided carbon emissions. This is similar to the debt-for-carbon swap in which the debt obligations of a company or country are exchanged for something of value, namely, avoided emissions.

5.2.2 Rebuild: Promoting the expansion of clean supply chains in the region

Rationales: The announced targets of tripling global renewable energy capacity by 2030 at COP28, supported by more than 100 countries, including several major Southeast Asian economies, signal the region's ambitions toward clean electricity. This would create a potential catalyst for rebuilding the region's economies around clean technology supply chains.

- **Upstream in the supply chains as a potential source of critical minerals for China's clean technology ambitions:** Clean technologies and products are mineral intensive, indicating a shift in the energy sector from being fossil intensive to mineral intensive. China,

as the leading global supplier of clean technologies, possesses more than 60% of the world's manufacturing capacity for most mass-manufactured clean technologies, including solar PV, wind systems, and batteries, and it holds 40% of the manufacturing capacity for electrolysers. Southeast Asia plays a crucial role as a potential source of critical minerals for China's clean technology ambitions, given the region's large reserves of mineral resources, such as bauxite in Indonesia and Vietnam; nickel in Indonesia and the Philippines; tin in Indonesia, Malaysia, and Myanmar; and rare-earth elements in Myanmar and Vietnam.

- **Downstream in the supply chains to meet the region's own demand for clean technology:** Nearly all countries in the region have committed to achieving net zero emissions, many targeting mid-century, and have accordingly increased the role of renewable energy in their national power development plans. This shift creates local markets for clean energy equipment and facilities, potentially catalyzing the localization of supply chains. For instance, the production of floaters for floating solar projects and service operation vessels and blades for offshore wind can be localized, mainly due to the high logistics costs associated with transporting this equipment from mainland China.

  Southeast Asia has made significant progress in recent years in clean industry development, contributing up to 10% of the world's production of solar photovoltaic cells and modules, mainly from Thailand, Malaysia, and Vietnam. The region also contributes to 6% to 10% of the world's production of electric two-wheelers, primarily from Indonesia and Vietnam (Fernandez, 2023). Many Chinese solar panel producers have set up production facilities in Thailand, Malaysia, and Vietnam. Chinese electric vehicle (EV) manufacturers have also committed to investing in the region's production facilities in Thailand.

  Despite the recent progress, the size of the clean energy manufacturing industry in Southeast Asia remains small, presenting huge opportunities for future growth, especially considering its rising demand for clean energy technologies, access to considerable natural resources needed for their manufacturing, and strong economic ties with China.

- **Attraction of Southeast Asia to Chinese firms:** According to ASEANstats, the statistics division of the ASEAN secretariat, annual Chinese foreign direct investment (FDI) in Southeast Asia has seen significant growth, increasing from just US$3.6 billion in 2010 to US$13.8 billion in 2021 (The ASEAN Secretariat, 2022). A Rhodium Group report analyzing data from China's Ministry of Commerce (MOFCOM) indicates a similar growth trend—annual Chinese FDI in Southeast Asia rising from about US$4.4 billion in 2010 to an average of US$14.3 billion per year over the period 2018–2020 (Rhodium Group, 2023). This trend is in stark contrast to the overall declining trends in Chinese overseas investment since the mid-2010s, highlighting the region's attractiveness to Chinese investors.

  Historically, Chinese investment in Southeast Asia tended to focus on a handful of sectors, including real estate and light manufacturing. It is now shifting toward more advanced manufacturing, mineral resource processing, and green technologies, such as electric vehicles and solar panels (Rhodium Group, 2023).

- **Adding value to local and regional economies:** Given China's growing investment in Southeast Asia's industry sector and its extensive experience in green development—encompassing renewable energy, batteries, electric vehicles, mineral processing, and eco-industrial

parks—Chinese investors and companies are well positioned to support the development of clean industry supply chains in Southeast Asia. This involvement would not only add value to local economies but would also unlock substantial business opportunities for both Chinese and international investors and facilitate the expansion and integration of clean supply chains across the region.

Specific steps and actions: To promote the proliferation of shared clean industry supply chains in Southeast Asia, the following actions should be considered:

1. **Accelerating the establishment of ASEAN-China Industry Ministerial Policy Dialogue Mechanisms:** This is needed to facilitate high-level discussion and policy coordination on emerging clean industry development to promote a more supportive business environment for clean industry development. The dialogue mechanisms could be developed as part of the existing ASEAN-China dialogue mechanisms including, for example, the annual ASEAN-China Summit and the ASEAN Post Ministerial Conference 10+1 Session with China. All relevant ministers from China and Southeast Asian countries responsible for the development of clean technology industries need to be involved.
2. **Scale up successful models for clean industry development in the region:** Through the ASEAN-China Industry Ministerial Policy Dialogue Mechanisms, public agencies in China and Southeast Asia should consider scaling up successful models for clean industry development in the region.

   One model is provided by Thailand's Eastern Economic Corridor (EEC) initiative that combines industrial policies with legal guarantees to investors. In addition to a range of tax and fiscal incentives, the Thai parliament passed the Eastern Economic Corridor Act in 2018 that ensures the continuation of policy support to industry investors, such as tax grants, and the right to land ownership. Between 2018 and 2022, the EEC attracted a total investment of approximately US$ 49.3 billion (about 1.8 trillion baht), exceeding the initial investment target of 1.7 trillion baht.

   Another model is the China-Egypt TEDA Suez Economic and Trade Cooperation Zone, situated in the Suez desert area in the northeastern part of Egypt. The construction of its first phase began in 2008, with financial support from the China-Africa Development Fund. By the end of July 2023, the cooperation zone had attracted an investment exceeding US$1.7 billion and had directly employed about 5,000 people (Xinhua News Agency, 2023).
3. **Incentivizing green industrialization:** Public agencies in China and Southeast Asia should consider introducing incentives and measures to encourage the use of clean energy in the industrial production processes. Clean technology manufacturers as potential buyers should be incentivized to purchase inputs (e.g., aluminum) produced from low-emissions energy sources. Possible incentive tools include financial incentives (such as subsidies, tax breaks, green loan interest subsidies) and nonfinancial incentives (e.g., preferential procurement).

5.2.3 Revamp: Deepening local capital markets

Rationale: The importance of private participation in clean energy financing is widely understood, and local capital markets in Southeast Asia need to be strengthened to better connect the region's clean project opportunities with potential investors, including those from China.

- **Importance of private finance:** About 60% of clean energy investments in Southeast Asia has historically relied on public financing, including government budget allocations (Centre for Climate Finance & Investment, 2023). However, with the accumulation of debt during the COVID-19 pandemic, Southeast Asian governments are now hesitant to incur additional loans. This situation underscores the important role of private finance in propelling the region's transition toward a cleaner and more sustainable energy future.
- **Large growth potential in local capital markets:** Domestic capital markets and financial systems—rather than foreign capital—have become a main source of funding for clean energy projects in major developing countries, such as China (IEA, 2023a). In China, the issuance of green bonds has increased significantly since 2015, growing from nearly nothing to more than US$140 billion in 2022 (Climate Bonds Initiative et al., 2022), making the country the leading green bond issuer in the world (Zhang, 2020). In contrast, domestic capital has played a relatively minor role in financing clean energy projects in Southeast Asia, representing a large potential for future growth.

  Lack of attractive financial instruments is a main issue. Project bonds, often used in renewable energy projects in Europe, are not commonly available in Southeast Asia. Green bonds have proven successful in attracting investments, including from institutional investors, into green assets and are gaining ground globally. The issuance of green bonds in the region was pioneered by Malaysia and Singapore in 2017. One year later, Indonesia started to issue its own green bonds. In 2019, the Philippines and Thailand began to issue green bonds (Azhgaliyeva et al., 2020).

  Despite seeing an increase in the issuance of green, social, sustainability, and sustainability-linked (GSSS) bonds, the region still constitutes a relatively small portion of the global total. In the first half of 2022, about US$8 billion worth of GSSS bonds were issued in the region, accounting for only 2% of the global total (ADB, 2022).
- **Attraction of Southeast Asia for Chinese investors:** As noted in Section 5.2.2, Southeast Asia has become increasingly attractive to Chinese investors, evidenced by the rising annual Chinese FDI in the region. This is likely due to the region's proximity to China, stable political relations, and large growth prospects.

Specific steps and actions: China could consider undertaking the following actions to help Southeast Asian countries create more attractive capital market products for Chinese investors:

1. **Conducting surveys with Chinese institutional investors to understand their needs:** Institutional investors are a heterogeneous group of investors, operating in different sectors, often subject to a diverse range of investment-related mandates and requirements. Considering this heterogeneity, surveys should be conducted to understand the preferences of major institutional investors in China for green financial products. By gaining insights into their preferences, China can effectively collaborate with leading financial institutions in Southeast Asian countries to design green financial products that are more attractive to Chinese institutional investors.
2. **Information sharing with Chinese investors and financial institutions regarding investment opportunities provided by clean energy in Southeast Asia:** For this, China could consider developing regular assessments and updates on clean energy investment opportu-

nities in Southeast Asia, such as the ASEAN Investment Report but customized for Chinese investors.

Furthermore, the establishment of more standardized and transparent data disclosure and reporting mechanisms is essential to enable investors to evaluate the environmental performance and risks associated with energy projects. It is imperative that investors have a comprehensive understanding of the environmental risks and impacts of their investments to make well-informed decisions.

3. **Conducting regular dialogues between Chinese investors and financial institutions in Southeast Asia:** This is expected to enhance mutual understanding. Through these exchanges, local banks could gain a deeper familiarity with Chinese business practices, while Chinese investors could more effectively incorporate ESG principles and local contexts into bilateral investment agreements.

REFERENCES

ACE. 2023. "Outlook on ASEAN Energy 2023 Key Insights about ASEAN Energy." https://asean.org/book/outlook-on-asean-energy-2023-key-insight-about-asean-energy-landscape-and-trends-in-2023/

ACE. 2022a. "The 7th ASEAN Energy Outlook: 2020–2040." https://asean.org/wp-content/uploads/2023/04/The-7th-ASEAN-Energy-Outlook-2022.pdf

ACE. 2022b. "Impact Analysis and Review on Governance of Renewable Energy Financing Schemes in ASEAN." https://aseanenergy.org/accept/energy-climate-101/re-and-ee-targets/

ADB. 2023. "Climate Finance Landscape of Asia and the Pacific." https://www.adb.org/publications/climate-finance-landscape-asia-pacific

ADB. 2020. "Energy Sector Assessment, Strategy, and Road Map: Indonesia, Country Sector and Thematic Assessments." https://www.adb.org/documents/indonesia-energy-assessment-strategy-road-map-update

AQLI. 2022. "Southeast Asia Fact Sheet." https://aqli.epic.uchicago.edu/wp-content/uploads/2023/08/SE-Asia-FactSheet-2023_Final.pdf

Azhgaliyeva, D., Kapoor, A., and Liu, Y. 2020. "Green Bonds for Financing Renewable Energy and Energy Efficiency in Southeast Asia: A Review of Policies." ADB. https://www.adb.org/publications/green-bonds-financing-renewable-energy-efficiency-southeast-asia

Boston University Global Development Policy Center. 2022. "China's Global Power Database." https://www.bu.edu/cgp/

Centre for Climate Finance & Investment. 2023. "ASEAN Renewables: Opportunities and Challenges." https://www.iea.org/reports/asean-renewables-investment-opportunities-and-challenges

Climate Bonds Initiative, China Central Depository & Clearing Research Centre, CIB Economic Research and Consulting. 2022. "China Sustainable Debt: State of the Market Report 2022." Climate Bonds. https://www.climatebonds.net/resources/reports/china-sustainable-debt-state-market-report-2022

Cochran, J., Miller, M., Zinaman, O., Milligan, M., Arent, D., Palmintier, B., O'Malley, M., Mueller, S., Lannoye, E., Tuohy, A., Kujala, B., Sommer, M., Holttinen, H., Kiviluoma, J., and Soonee, S. K. 2014. "Flexibility in 21st Century Power Systems." NREL. https://doi.org/10.2172/1130630

Cruz, E. D. 2022. "Philippines Approves Revival of Nuclear Power to Help Replace Coal." Reuters. https://www.reuters.com/business/energy/duterte-approves-inclusion-nuclear-power-philippine-energy-mix-2022-03-03/

Department of Energy. 2021. "Philippine Energy Plan 2020–2040." https://www.doe.gov.ph/pep

Ember. 2023. "Electricity Data Explorer." https://ember-climate.org/data/data-tools/data-explorer/

Fernandez, H. A. 2023. "A US$200 Billion Opportunity in Southeast Asia Lies in Solar, Two-Wheeler EVs, Batteries: McKinsey Report." Eco-Business. https://www.eco-business.com/news/a-us200-billion-opportunity-in-southeast-asia-lies-in-solar-two-wheeler-evs-batteries-mckinsey-report/

Green Finance & development Center. 2023.

"China Belt and Road Initiative (BRI) Investment Report 2023 H1." https://greenfdc.org/china-belt-and-road-initiative-bri-investment-report-2023-h1/

Hamdi, E. 2021. "Indonesia Wants to Go Greener, But PLN Is Stuck with Excess Capacity from Coal-Fired Power Plants."IEEFA. https://ieefa.org/wp-content/uploads/2021/11/Indonesia-Wants-to-Go-Greener-but-PLN-Is-Stuck-With-Excess-Capacity_November-2021.pdf

Hasan, K., Parapat, J., and Hummer, L. 2023. "Emerging Captive Coal Power: Dark Clouds on Indonesia's Clean Energy Horizon." CREA. https://energyandcleanair.org/publication/emerging-captive-coal-power-in-indonesia/

IEA. 2023a. "Scaling Up Private Finance for Clean Energy in Emerging and Developing Economies." https://www.iea.org/reports/scaling-up-private-finance-for-clean-energy-in-emerging-and-developing-economies

IEA. 2023b. "World Energy Investment 2023." https://www.iea.org/reports/world-energy-investment-2023

IEA. 2023c. "World Energy Outlook 2023." https://www.iea.org/reports/world-energy-outlook-2023

IEA. 2022. "Southeast Asia Energy Outlook." https://www.iea.org/reports/southeast-asia-energy-outlook-2022

IEA. 2021. "Financing Clean Energy Transitions in Emerging and Developing Economies." https://www.iea.org/reports/financing-clean-energy-transitions-in-emerging-and-developing-economies

IEA. 2019. "Southeast Asia Energy Outlook 2019." https://www.iea.org/reports/southeast-asia-energy-outlook-2019

IESR. 2023. "Indonesia Energy Transition Outlook." https://iesr.or.id/download/indonesia-energy-transition-outlook-ieto-2024

IRENA. 2022a. Renewable Energy Outlook for ASEAN: Towards a Regional Energy Transition. Abu Dhabi.

IRENA. 2022b. "Renewable Energy Auctions Southeast Asia." https://www.irena.org/Publications/2022/Dec/Renewable-energy-auctions-Southeast-Asia

Mercurio, R. 2022. "Higher RPS Level to Create Bigger RE Market." Alternergy. https://www.alternergy.com/post/higher-rps-level-to-create-bigger-re-market

Merdekawati, M., Vu, N. H. G., and Utama, N. A. 2023. "Local Content Requirements: Could It Boost Renewables in Vietnam?" Eco-Business. https://www.eco-business.com/opinion/local-content-requirements-could-it-boost-renewables-in-vietnam/

Ministry of Energy and Natural Resources. 2020. "Report on Peninsular Malaysia Generation Development Plan 2020 (2021–2039)." https://www.nrecc.gov.my/ms-my/pustakamedia/Penerbitan/Report%20on%20Peninsular%20Malaysia%20Generation%20Development%20Plan%202020%20(2021-2039).pdf

PLN. 2021. "Rencana Usaha Penyediaan Tenaga Listrik (RUPTL)." https://web.pln.co.id/statics/uploads/2021/10/ruptl-2021-2030.pdf

Rhodium Group. 2023. "ESG Impacts of China's Next-Generation Outbound Investments: Indonesia and Cambodia." https://rhg.com/research/esg-impacts-of-chinas-next-generation-outbound-investments-indonesia-and-cambodia/

Sang, X. 2021. "Vietnam Plans to Cut 500 Million kWh of Photovoltaic Power Generation in 2021." Seetao. https://www.seetao.com/details/61852.html

The ASEAN Secretariat. 2022. "ASEAN Statistical Yearbook 2022." https://www.aseanstats.org/publication/asyb2022/

UNESCAP. 2023. "Economic and Social Survey of Asia and the Pacific 2023." https://www.unescap.org/kp/2023/economic-and-social-survey-asia-and-pacific-2023-rethinking-public-debt-sustainable

Vakulchuk, R., Overland, I., and Suryadi, B. 2022. "ASEAN's Energy Transition: How to Attract More Investment in Renewable Energy." Energy ,Ecology and Environment. https://link.springer.com/article/10.1007/s40974-022-00261-6 https://doi.org/10.1007/s40974-022-00261-6

Vu, K. 2022. "Vietnam Slashes Power Usage at Its Largest Solar Farm." Reuters. https://www.reuters.com/business/energy/vietnam-slashes-power-usage-its-largest-solar-farm-2022-09-13

World Bank. 2022. "Offshore Wind Roadmap for the Philippines." https://www.esmap.org/ESMAP-Offshore-Wind-Roadmap-for-the-Philippines

World Bank. 2021. "Offshore Wind Roadmap for Vietnam." https://documents1.worldbank.org/curated/en/261981623120856300/pdf/Offshore-Wind-Development-Program-Offshore-Wind-Roadmap-for-Vietnam.pdf

Xinhua News Agency. 2023. "Egypt, China's TEDA Celebrate 15th Anniversary of Launching Joint Economic Zone." https://english.news.cn/20230713/65bb209b78344144ab0ecf8ce83abc9a/c.html

Zhang, H. 2020. "Regulating Green Bonds in the People's Republic of China: Definitional Divergence and Implications for Policy Making." ADB. https://www.adb.org/publications/regulating-green-bonds-prc-definitional-divergence-implications

Zheng, C., and Khoo, C. G. 2022. "Southeast Asia's New Energy Policy Announcements in Pursuing Clean Energy Transition." S&P Global. https://www.spglobal.com/commodityinsights/en/ci/research-analysis/southeast-asias-new-energy-policy-announcements-in-pursuing.html

Zhu, M., Lou, Z., Cui, R. Cheng, X., Li, S., Li, D., Tumiwa, F., Arinaldo, D., Li, W., and Hultman, N. 2023. "Decarbonizing Captive Coal Power Plants in Indonesia and Implications for Chinese Stakeholders: Trends, Challenges and Opportunities." University of Maryland. https://cgs.umd.edu/research-impact/publications/decarbonizing-captive-coal-power-plants-indonesia-and-implications

APPENDIX A: THE ROLE OF RENEWABLE GENERATION IN THE NATIONAL POWER DEVELOPMENT PLANS

Indonesia plans to add 40.6 GW of new generation capacity by 2030, based on the PLN's Electricity Business Plan (RUPTL 2021–2030). Of this, about 52% will come from clean power (PLN, 2021). If the planned capacity addition is fully deployed, PLN's share of clean power generation is estimated to rise to **29% in 2030** (see Table A). Given that RUPTL only covers PLN's business area, which accounts for roughly 85% of the total electricity supplied in Indonesia, the share of clean power generation for the whole country in 2030 could be lower than 29%, as fossil generation may remain preferable in non-PLN business areas, such as industrial parks and remote islands. It is also worth noting that the Just Energy Transition Partnership launched in November 2022 is poised to create additional momentum for Indonesia's clean power transition, bringing the country's share of renewable generation to 34% by 2030.

TABLE A: **INDONESIA'S ENERGY CAPACITY AND GENERATION 2020 VS. 2030**

	INSTALLED CAPACITY (GW)		GENERATION (TWH)	
	2020	2030	2020	2030
Coal	37.8	51.6	180.9	246.9
Gas	18.1	24	51.3	67.8
Oil	8.1	8.1	6.8	6.8
Geothermal	2.1	5.5	15.6	40
Hydro	6.1	16.5	24.3	65.5
Solar	0.2	4.9	0.1	1.3
Wind	0.2	0.8	0.5	2.3
Others	1.9	3.8	12.4	24.9

NOTES:

1. Estimated based on installed capacity in 2020 and information about planned capacity expansion over 2021-2030 obtained from PLN's Electricity Business Plan (RUPTL 2021-2030).
2. Estimated by multiplying installed capacity in 2030 by capacity factors for different technologies. Capacity factors are estimated based on installed capacity and generation in 2020.
3. The share of clean power is 29% in 2030. This is consistent with IEA's estimation that clean power will meet about 30% of Indonesia's electricity demand in 2030, assuming all existing policy commitments are met (the Stated Policies Scenario, STEPS).

Malaysia plans to increase the share of renewable energy in the capacity mix to 29% by 2039, up from 17% in 2021, according to the Report on Peninsular Malaysia Generation Development Plan (2021–2039) (Ministry of Energy and Natural Resources, 2020). Assuming that the planned expansion of renewable capacity happens linearly, it is then estimated that renewable energy would account for **around 20% of total generation in 2030** (see Table B). Note that this estimate does not include Sabah and Sarawak, as no official plans for future capacity expansion are found in the public domain for these two states.

In its Energy Plan (2020–2040), the **Philippine** Department of Energy outlines a plan to bring the share of renewable generation from 21% in 2020 to **35% in 2030** and 50% by 2040 (Department of Energy, 2021). These targets represent a reduction from the previous plan that aimed for a 54% renewable share in the generation

TABLE B: **MALAYSIA'S ENERGY CAPACITY AND GENERATION 2020 VS. 2030**

	INSTALLED CAPACITY (GW)		GENERATION (TWH)	
	2020	2030	2020	2030
Coal	13.3	13.3	84.2	84.2
Gas	13.4	17.4	53.6	69.6
Oil	0.4	0.4	0.9	0.9
Renewable	8.6	11.6	30.5	38

NOTES:

1. Estimated based on installed capacity in 2020 and information about planned capacity expansion over 2021-2030 obtained from Ministry of Energy and Natural Resources' Report on Peninsular Malaysia Generation Development Plan (2021-2039)
2. Estimated by multiplying installed capacity in 2030 by capacity factors for different technologies. Capacity factors are estimated based on installed capacity and generation in 2020.
3. The share of clean power is 20% in 2030.

TABLE C: **THAILAND'S ENERGY CAPACITY AND GENERATION 2020 VS. 2030 (PDP 2018 REVISION 1)**

	INSTALLED CAPACITY (GW)		GENERATION (TWH)	
	2020	2030	2020	2030
Coal and imported coal	6.19	4.85	47.8	38.85
Gas	26.74	33.22	120.7	189.43
Fuel oil & Gas-oil	2.91	0.32	0.06	0.03
Diesel	0.06	0.06	0.12	0.07
Hydro	7.87	9.65	28.29	34.39
Other renewable	7.96	14.46	22.82	40.22

NOTES:

1. Exclude power generation transfer from Thai-Malaysia transmission.
2. Including lignite, imported coal, and imported power generation from coal.
3. Gas-oil thermal power plant will be phased out by 2027.

mix. To achieve these targets, some specific policy measures include tightening renewable energy portfolio standards with the minimum amount of green energy supplied to distribution utilities or direct buyers increasing from 1% to 2.5% by 2023 (Mercurio, 2022), a moratorium on new coal plants from 2020, and the inclusion of nuclear power in the options currently under consideration for phasing out coal power (Cruz, 2022).

In the latest Power Development Plan (revised in 2018 and approved in 2019), **Thailand** plans to add 56,431 MW of generating capacity by 2037, of which 37% would come from renewables. This capacity addition would bring the share of renewable generation to 35% by 2037, as estimated by the Climate Action Tracker. If the share of renewable energy increases along a linear trajectory, then it would reach **about 26% in 2030**, up from 15% in 2021. The government is considering a new national power development plan that follows the climate

goals (e.g., carbon neutral by 2050 and net zero emissions by 2065) announced at COP26. The program will aim to increase the renewable share by up to 50% of total power generation by 2050 (Zheng and Khoo, 2022).

Vietnam's eighth national power development plan has recently been approved by the deputy prime minister under Decision No. 500/QD-TTg. It outlines the country's electricity roadmap for the period through to 2030, with the share of renewable capacity reaching nearly 50% by 2030, primarily driven by a rapid expansion of offshore wind and hydro capacity.

APPENDIX B: CHINESE POWER GENERATION INVESTMENT IN SOUTHEAST ASIA, 2000–2022 (MW)

	COAL	GAS	OIL	HYDRO	OTHER RENEWABLES	TOTAL
GREENFIELD	**5,353**	**1,695**	**-**	**10,997**	**72**	**18,117**
BRUNEI	220	14	-	-	-	234
CAMBODIA	405	-	-	1,314	-	1,719
LAOS	-	-	-	2,732	-	2,732
THAILAND	-	-	-	-	-	-
MALAYSIA	-	-	-	-	50	50
MYANMAR	-	1,621	-	4.967	-	6,588
INDONESIA	2,286	60	-	1,985	-	4,331
PHILIPPINES	-	-	-	-	10	10
SINGAPORE	-	-	-	-	-	-
VIETNAM	2,442	-	-	-	12	2,454
M&A	**2,389**	**6,509**	**624**	**-**	**14**	**9,536**
BRUNEI	-	-	-	-	-	-
CAMBODIA	-	-	-	-	-	-
LAOS	-	-	-	-	-	-
THAILAND	-	-	-	-	14	14
MALAYSIA	1,505	4,540	-	-	-	6,045
MYANMAR	-	-	-	-	-	-
INDONESIA	750	93	-	-	-	843
PHILIPPINES	-	-	-	-	-	-
SINGAPORE	134	1,876	-	-	-	2,634
VIETNAM	-	-	-	-	-	-
POLICY BANK ONLY	**15,954**	**-**	**-**	**3,097**	**-**	**19,051**
BRUNEI	-	-	-		-	-
CAMBODIA	-	-	-		-	-
LAOS	-	-	-	2,917	-	2,197
THAILAND	-	-	-	-	-	-
MALAYSIA	-	-	-	-	-	-

	COAL	GAS	OIL	HYDRO	OTHER RENEWABLES	TOTAL
MYANMAR	-	-	-	790	-	790
INDONESIA	8,790	-	-	110	-	8,900
PHILIPPINES	-	-	-	-	-	-
SINGAPORE	-	-	-	-	-	-
VIETNAM	7,164	-	-	-	-	7,164
FDI + POLICY BANK	**4,880**	**-**	**-**	**988**	**-**	**5,868**
BRUNEI	-	-	-	-	-	-
CAMBODIA	-	-	-	-	-	-
LAOS	-	-	-	988	-	988
THAILAND	-	-	-	-	-	-
MALAYSIA	-	-	-	-	-	-
MYANMAR	-	-	-	-	-	-
INDONESIA	3,640	-	-	-	-	3,640
PHILIPPINES	-	-	-	-	-	-
SINGAPORE	-	-	-	-	-	-
VIETNAM	1,240	-	-	-	-	1,240

NOTE:
Figures included in the table are generation capacity funded by foreign direct investment in the forms of greenfield, merger & acquisition, development finance provided by Chinese policy bank (policy bank only), and foreign direct investment combined with development finance provided by Chinese policy bank (FDI + policy bank).

Source: Boston University Global Development Policy Center (2022)

APPENDIX C: GREENING BELT AND ROAD INITIATIVE: KEY INITIATIVES AND INVESTMENT GUIDELINES

The Belt and Road Initiative (BRI), launched by China in 2013, focused primarily on infrastructure development, including transportation, energy, and telecommunications networks to enhance global economic connectivity. As concerns about environmental sustainability and climate change have heightened globally, there has been a growing emphasis on integrating green and sustainable principles into BRI projects. This is evident from the introduction of several policy documents and statements, along with the establishment of the Belt and Road Initiative International Green Development Coalition.

In 2017, the **Guidance on Promoting Green Belt and Road** was issued by relevant Chinese ministries and organizations as one of the early frameworks focusing on green BRI cooperation. The document aims to strengthen environmental management in foreign investments and promote the development of a green financial system. It encourages Chinese financial institutions, China-initiated multilateral development organizations, and relevant enterprises to voluntarily adopt principles for environmental risk management to support green BRI construction.

The Guidance encourages qualified green BRI projects to apply for support from existing funds such as the National Green Development Fund and other public-private partnership (PPP) funds. It also highlights the role of policy financial institutions including the China Development Bank and the Export-Import Bank in guiding and attracting various funds to support the green BRI. Existing international bilateral and multilateral cooperation institutions and funds, such as the Silk Road Fund, South-South Cooperation Assistance Fund, and China-ASEAN Cooperation Fund, are also mentioned as potential sources of support for green BRI projects.

It also focuses on strengthening technical training development to support the green BRI. It aims to build an intellectual support system for a "Green Silk Road" and establish new types of think tanks focused on green development. Innovations in talent cultivation mechanisms are encouraged, with an emphasis on training professionals who have an international perspective, understand international rules, and are familiar with environmental protection sectors.

Later in 2018, **the Green Investment Principle (GIP)** was jointly introduced by the Green Finance Committee of the China Society for Finance and Banking and the City of London Corporation's Green Finance Initiative. This initiative garnered participation from several key entities, including the Principles for Responsible Investment, Belt & Road Bankers Roundtable, Green Belt and Road Investors Alliance, World Economic Forum, and the Paulson Institute.

The GIP includes a set of guidelines aimed at promoting green investments in regions along the BRI. It operates on three distinct levels: strategic, operational, and innovative and is composed of seven principles. The first two principles emphasize the integration of sustainability and ESG (environmental, social, and governance) factors into the corporate strategies and management systems of signatory institutions. These principles advocate for the implementation of such practices from the highest organizational level down to operational tiers wherever feasible. Principles three and four concentrate on facilitating operational-level communication with stakeholders and delineate specific measures to mitigate environmental and social risks. These measures include environmental risk analysis, information-sharing mechanisms, and conflict resolution protocols. The remaining principles (five to seven) aim to prompt signatories to leverage advanced green financial tools and adopt green supply chain practices.

In 2019, the **Belt and Road Initiative International Green Development Coalition (BRIGC)** was inaugurated at the 2nd Belt and Road Forum for International Cooperation. Serving as an open and inclusive platform, the BRIGC aims to brings together the environmental expertise of all stakeholders to ensure that the BRI fosters long-term green and sustainable development across all participating countries, aligning with the 2030 Agenda for Sustainable Development.

In the following years, there has been a proliferation of policy documents and guidelines on greening the BRI. For example, the **Green Development Guidelines for Overseas Investment and Cooperation** was jointly issued by the Ministry of Commerce and the Ministry of Ecology and Environment in 2021. This document advocates for enterprises to adhere to international green rules and standards in their overseas economic activities. Although voluntary, it specifically targets enterprises engaged in promoting green development in their overseas investment and cooperation endeavors.

A year later in 2022, the Ministry of Commerce and the Ministry of Ecology and Environment- jointly issued another important policy document, titled the **Guidelines for Ecological and Environmental Protection of Foreign Investment Cooperation and Construction Projects**. This document reinforces the recommendations outlined in the earlier guidelines but places greater emphasis on specific issues related to environmental risk management throughout the entire life cycle of Belt and Road projects.

Other important documents include the following:

- **Opinions on Promoting Green Development under the Belt and Road Initiative**, jointly issued by the National Development and Reform Commission and other departments in 2022. This document serves as a top-level design for the green development of the BRI. It aims to advance the concepts of green development, ecological civilization, and climate change mitigation, setting specific goals for 2025 and 2030. The document emphasizes the deepening of international cooperation in ecological protection and climate change, with a focus on practical cooperation in green infrastructure, green energy, green transportation, and green finance.
- **Green Finance Guidelines for Banking and Insurance Industry** released by the China Banking and Insurance Regulatory Commission in 2022. While primarily focusing on domestic financial management, this document includes a section specifically addressing BRI investments. It urges banking and insurance institutions to actively support green and low-carbon construction in the BRI, emphasizing the need to strengthen ESG risk management for overseas projects under consideration for credit and investment.

For more information about China's clean energy cooperation with Southeast Asia, visit: AsiaSociety.org/ChinaSEACleanEnergy

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