UNITED NATIONS DEVELOPMENT PROGRAMME

JUST ENERGY TRANSITION IN THAILAND

SCOPING REPORT

Sustainable Energy Hub

UNDP

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EVs and renewable energy have seen strong progress in Thailand, with significant potential for further acceleration.

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Executive Summary

Thailand is accelerating a transition in its energy sector to meet its growing energy demands - net electricity demand is projected to increase by an average annual of 3.13% from 2018 to 2037[1] - while addressing the environmental and economic impact of fossil fuel reliance. In line with global climate commitments, including the Paris Agreement, the country aims to achieve carbon neutrality by 2050 and net-zero emissions by 2065.

A Just Energy Transition is deeply intertwined with the country's broader economic and social development objectives, as outlined in its Thirteenth National Economic and Social Development Plan (NESDP), that prioritizes national competitiveness, inclusive growth and environmental sustainability. Thailand's vision of a prosperous nation with universal access to sustainable, reliable and affordable energy aligns with the Agenda 2030 for Sustainable Development, which prioritizes equitable distribution of the transition's benefits while minimizing externalities on the most vulnerable, including women, youth, and marginalized communities.

To advance its energy transition, Thailand has developed several key policies including the National Energy Plan (NEP) and sub-plans such as the Power Development Plan (PDP), the Alternative Energy Development Plan (AEDP), and the Energy Efficiency Plan (EEP). Despite these efforts, Thailand remains heavily reliant on fossil fuels, particularly natural gas, for electricity generation, contributing significantly to greenhouse gas emissions. As of 2023, natural gas accounted for approximately 56% of the country's electricity generation,[2] followed by coal and oil. As energy consumption continues to rise driven by economic growth, urbanization, and climate change, Thailand faces challenges to its energy security and the urgent need to diversify its energy sources.

The country has set ambitious targets to increase renewable energy's share to 30% by 2037, focusing on solar, wind, bioenergy, and hydropower. In parallel, the government is advancing the 30@30 policy, aiming for 30% of vehicles produced in Thailand to be electric by 2030.[3] Thailand is poised to become the region's manufacturing hub for Electric Vehicles (EVs), with domestic and foreign investments in related areas to reach US$ 5.5 billion in the next five years.[3] However, the evolving landscape of global trade—particularly the imposition of U.S. tariffs—has introduced uncertainty. It remains unclear how such changes in tariffs and trade policies will ultimately affect Thailand's EV export ambitions and investment climate.

1 ADB, "Eastern Economic Corridor Independent Power Project," [Online]. Available: https://www.adb.org/sites/default/files/linked-documents/53239-001-so.pdf.
2 International Energy Agency, "Thailand Energy Profile," 2025. [Online]. Available: https://www.iea.org/countries/thailand/electricity.

More than an environmental necessity, Thailand's energy transition is a key enabler of economic and social transformation. The NESDP recognizes that clean energy is vital for strengthening Thailand's industrial competitiveness, accelerating green innovation, and expanding economic opportunities. This transition to clean energy and green transport offers a wide range of opportunities, including a reduction in greenhouse gas emissions, increased Foreign Direct Investment (FDI) and exports, job creation, moving-up along regional and global value chains, accelerated industrialization, technological advancements, and improved public health through better air quality. It is crucial to ensure that these opportunities are accessible to all segments of society, including women and marginalized communities. With the energy sector accounting for 60% of total GHG emissions, transitioning to clean energy is a key strategy to meet the country's emission reduction targets.

A successful energy transition requires upgrading the existing grid, which was designed for centralized fossil fuel plants. Modernization of the grids can help to integrate decentralized renewable sources, such as rooftop solar and community-based energy systems. Battery Energy Storage Systems (BESS) are also essential for addressing the intermittency of renewable energy and ensuring grid stability. BESS is a priority in the 2024-2037 Power Development Plan, but significant investment and technological development are needed to meet future energy storage demands. The grid also needs to be upgraded to accommodate the growing adoption of EVs while ensuring stability and reliability. In addition, expanding EV infrastructure, including charging stations, is crucial to fostering wider EV deployment. Strengthening cross-border electricity trade within the ASEAN region will bolster Thailand's energy security and facilitate the integration of renewable energy sources, contributing to a more resilient and sustainable energy system.

The social and economic impacts of the energy transition are significant. The shift away from fossil fuels risks displacing workers in traditional energy sectors but also creates new opportunities in clean energy industries, including solar, wind, and EV sectors. Targeted policies and programmes are needed to support women, youth, and marginalized groups in accessing these new opportunities. The International Labour Organization (ILO) warns that about 60,000 jobs in Thailand's fossil fuel industries could be at risk by 2030 due to the global shift away from fossil fuels.[4] Reskilling and upskilling programmes are crucial for a smooth transition. Empowering women, youth, and marginalized groups will ensure broader social inclusion.

Just Energy Transition is not only about decarbonization. It is also a pathway to social and economic equity, providing rural communities with access to reliable power. The decentralization of energy system with distributed energy resources and microgrids can be a game changer, especially where the central grid is either unreliable or non-existent.

3 M. Wong, "Thailand's push to become an electric vehicle manufacturing hub," Channel NewsAsia, 1 August 2024. [Online]. Available: https://www.channelnewsasia.com/asia/thailand-ev-hub-byd-zero-emissions-vehicles-carbon-tax-4516486.
4 International Labor Organization, "A just energy transition in Southeast Asia: The impact of coal phase-out on jobs," 1 May 2022. [Online]. Available: https://www.ilo.org/publications/just-energy-transition-southeast-asia-impact-coal-phase-out-jobs.
5 Organisation for Economic Co-operation and Development, "Clean Energy Finance and Investment Roadmap of Thailand," 10 June 2024. [Online]. Available: https://www.oecd.org/en/publications/clean-energy-finance-and-investment-roadmap-of-thailand_d0cd-6ffc-en.html.

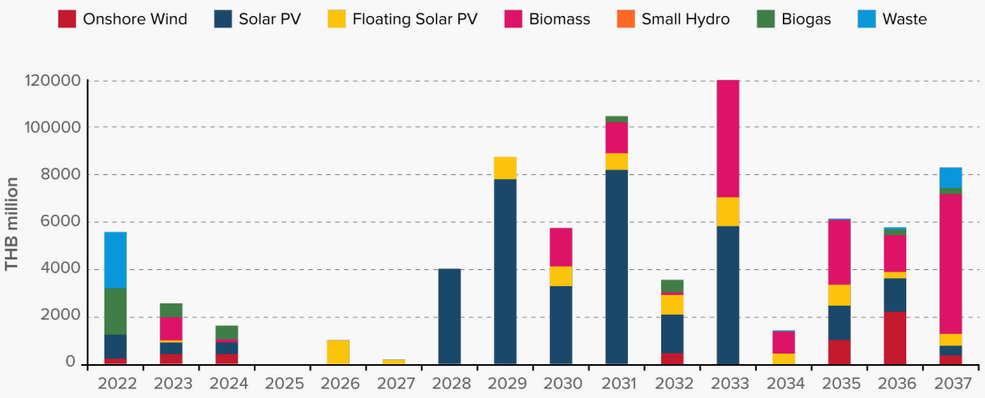
With SMEs as the backbone of Thailand's economy, fostering innovation while reskilling the SME workforce is key to keeping pace with global shifts. Adapting to new technologies can unlock new growth opportunities. If Thailand prioritises high-growth sectors for workforce development, it could create a dynamic, competitive economy that is ready for the future.

Financing is vital for driving a just energy transition. Thailand has attracted considerable investment in renewable energy. But gaps remain, particularly for small-scale projects. It is estimated that the investment needs in new renewable power during 2022 - 2037 will amount to THB 779 billion (USD 22 billion).[5] To address this, the Thai government has allocated resources from its national budget and has set up a few funds to support clean energy.

To further unlock private investments in clean energy, innovative financial mechanisms-such as green bonds, blended finance, and public-private partnerships-will play a key role. In 2023, the value of green bonds issued in Thailand came to THB 33 billion, or 4.3% of the value of all private-sector bonds issued in the year.[6] Subsequent issues of green bonds in 2024 and 2025 amount to THB 12.6 billion. In addition, in 2024, the government successfully issued its first sovereign Sustainability-Linked Bond (SLB), Asia's first of its kind and third globally, with a current total outstanding of THB 98 billion.[7] The SLB is designed to support sustainable environmental and social development, with its key performance indicators linked to total greenhouse gas emissions and annual registrations of zero emission vehicles, highlighting Thailand's commitment to achieving carbon neutrality and net zero greenhouse gas emissions by 2050 and 2065.

The government is also exploring carbon finance to fill the funding gap. Through a e-bus project in Bangkok, Thailand and Switzerland have completed the transfer of Article 6.2 carbon credits, marking a significant step towards leveraging international carbon finance to support a just energy transition.

Figure 1. Estimates of annual investment needs for new renewable energy installations in the power sector (2022-2037)



Source : OECD [5]

Efforts are also underway to overcome market and regulatory barriers, such as administrative hurdles, inadequate incentives, and resistance from vested interests in fossil fuel industries. More needs to be done to improve policy coordination between government agencies and across central and sub-national levels, to ensure successful implementation of just energy transition.

Thailand's transition to a low-carbon energy system can benefit from international partnerships and private sector engagement. International and regional cooperation plays a vital role in securing a stable and resilient clean energy supply chain. As geopolitical risks and trade barriers continue to shift global dynamics, collaboration among nations can help mitigate vulnerabilities and promote energy security. Global cooperation also provides financial, technical, and policy support, while the private sector drives innovation, investment, and scalability, especially in renewable energy and EV adoption. Thailand has established itself as a leader in Southeast Asia in solar panel and EV manufacturing. Strategic partnerships between local manufacturers and international companies are further strengthening the country's capabilities in battery production.

International development organisations like UNDP are instrumental in mobilizing financing and shaping enabling regulatory environments that support just energy transition. Achieving Thailand's ambitious clean energy goals while driving economic growth and competitiveness requires multi-stakeholder collaboration, aligned with the **2030 Agenda for Sustainable Development** and the 17 Sustainable Development Goals (SDGs). Through partnering with UNDP, Thailand can bring together UN agencies, international organisations, multilateral development banks, private sector and civil society to accelerate its transition while ensuring that the shift to a low-carbon economy is both environmentally responsible and socially inclusive. Under consecutive Strategic Plans, UNDP focuses on unlocking the potential of SDG 7—Affordable and Clean Energy—by promoting access to innovative, affordable, and equitable renewable energy systems tailored to national priorities.

Thailand's transition to a low-carbon economy presents both significant opportunities and complex challenges—from attracting finance and strengthening regulations to ensuring that no one is left behind. UNDP offers strategic support to the Thai government by helping design inclusive policy and regulatory frameworks, mobilize financing, and convene diverse partners to co-create solutions. With deep experience in policy reform and stakeholder engagement, UNDP can help Thailand to advance its clean energy goals while reinforcing economic competitiveness and social equity. **Achieving a just energy transition in Thailand requires collective action from both the public and private sectors to overcome challenges, mitigate investment risks, modernize infrastructure, foster innovation, and build a thriving ecosystem for clean technologies.** With decisive action and strategic partnerships, Thailand is not only well-positioned to meet its climate goals but also to shape the clean energy landscape in the region, generating lasting benefits for the economy, society, and the environment.

6 P. Mingsakul, "Green Financing: Accelerating the Green Transition," Krungsri Research, 11 April 2024. [Online]. Available: https://www.krungsri.com/en/research/research-intelligence/green-Financing.
7 Public Debt Management Office, "Sustainability-Linked Financing Framework," October 2024. [Online]. Available: https://www.pdmo.go.th/pdmomedia/documents/2024/Oct/PDMO%20SLB%20Framework_Final.pdf.
8 United Nations Development Programme, "What is just transition? And why is it important?," 3 November 2022. [Online]. Available: https://climatepromise.undp.org/news-and-stories/what-just-transition-and-why-it-important.

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Thailand has set ambitious targets to increase renewable energy's share to 30% by 2037, focusing on solar, wind, bioenergy, and hydropower.

1. Introduction

Thailand faces a dual challenge of meeting its growing energy demands while addressing the environmental impacts of its reliance on fossil fuels. To align with international climate commitments, such as the Paris Agreement, Thailand has set the target to achieve carbon neutrality by 2050 and net-zero emissions by 2065. However, a successful energy transition is more than just a shift in energy sources; it must also address the social and economic challenges, ensuring that no one is left behind.

Definition of Just Energy Transition

A Just Energy Transition refers to the process of shifting away from fossil fuels towards renewable and clean energy sources, prioritising fairness and inclusivity. It seeks to ensure that the benefits of this transition, such as cleaner air; new economic opportunities; and energy security, are shared

What is Just Energy Transition

While 'just energy transition' lacks a universally agreed definition, the International Labor Organization defines "Just Transition" as: "Greening the economy in a way that is as fair and inclusive as possible to everyone concerned, creating decent work opportunities and leaving no one behind."[8]

The ADB defines the term within the Paris Agreement framework, emphasizing social equity, decent work, and inclusivity in climate action.[9] The evolving concept emphasizes inclusive economic transformation, with institutions like the ADB, EBRD, World Bank, and OECD highlighting the importance of social equity and opportunity creation in the transition process.

While these provide a sound basis, perception does vary between countries and regions. What is important, though, is that each country fosters ongoing dialogue to develop a common vision for what a just transition means for their impacted workers, communities and businesses.

Source: UNDP [8]

equitably across all segments of society, regardless of gender, background, or socio-economic status. In particular, applying a gender lens is essential for addressing persistent structural inequalities and unlocking the full potential of the energy transition.

In recent years, an increasing number of governments have placed the concept of a Just Energy Transition at the core of their strategies and policies, drawing growing attention from the international community. At COP29, energy was identified as a key focus area under the Just Transition Working Group. UNFCCC Parties have been attentive to include just energy transition measures in their NDCs: 65% highlighted policy coherence and synergies between mitigation measures and development proprieties, 79% referred to arrangements for domestic stakeholder consultation, and 33% affirmed their intention to take gender into account when implementing their mitigation measures.[10] Similarly, during the 2025 World Economic Forum, ASEAN Leaders reaffirmed their commitment to both intra-regional and international cooperation to accelerate a fair, responsible energy transition and the decarbonisation of the region. South Africa, in its G20 leadership role, selected "Just, Affordable, and Inclusive Energy Transitions" as one of the four central pillars of the Just Energy Transitions Workstream, with a particular emphasis on energy access and affordability, sustainable finance, and fostering innovation to create future-oriented jobs in the energy sector.

In Thailand, energy poverty, economic inequality, and regional disparities are structurally embedded issues that must be addressed as a part of the just energy transition. Low-income households often face higher energy costs relative to their income, and rural areas may lack the necessary infrastructure to access modern energy solutions. Additionally, workers in fossil fuel-dependent industries, such as coal mining and oil refining, are particularly vulnerable to job losses and transformations as Thailand transitions away from fossil fuels.

About this study

The development of this study has been guided by extensive consultations and a scoping mission that brought together key stakeholders from various sectors, including government agencies, private sector entities, civil society organisations, and international partners. It aimed to assess Thailand's progress in its just energy transition while identifying the subsequent challenges and opportunities. In addition to stakeholder consultations, the study included extensive desk research to review Thailand's existing energy policies, analyse ongoing projects and initiatives.

9 K. Hughes and M. Rescalvo, "Just Transition Beyond the Energy Sector," Asian Development Bank, November 2021. [Online]. Available: https://www.adb.org/publications/just-transition-beyond-energy-sector.

10 United Nations Framework Convention on Climate Change, "Nationally determined contributions under the Paris Agreement. Synthesis report by the secretariat," 14 November 2023. [Online]. Available: https://unfccc.int/documents/632334.

11 Office of the National Economic and Social Development Council, "The Thirteehth National Economic and Social Development Plan (2023 -2027)," [Online]. Available: https://www.nesdc.go.th/article_attach/article_file_20230615134223.pdf.

2. Thailand's Policy Framework for Just Energy Transition

Thailand has developed several key policies to accelerate its energy transition toward a sustainable, low-carbon future. These policies form the foundation of the country's strategy to meet its climate commitments, such as achieving carbon neutrality by 2050 and net-zero emissions by 2065.* As a member of the Association of Southeast Asian Nations, the country's energy and climate policies are also part of a broader regional framework, the ASEAN Plan of Action for Energy Cooperation. This section outlines Thailand's primary energy transition policies and highlights areas where more attention is needed to ensure equity and social justice.

National Economic and Social Development Plan

To adequately address Thailand's policy framework and priorities for a Just Energy Transition, it is essential to first examine its economic and social development plan and consider the alignment between energy policies and national development priorities. Thailand's National Economic and Social Development Plan[11] acts as a key mechanism to translate the National Strategy into implementation. The plan recognizes the interdependence of economic growth, environmental sustainability and social development, and emphasizing that building an innovation-driven, resilient and equitable energy system is essential to achieving the country's development goals. This includes promoting gender equality and the empowerment of vulnerable groups in the energy sector.

With the ambitious goal of becoming "the world's major electric vehicle manufacturing base" the plan establishes a strategy to prepare the country's energy infrastructure for EV adoption. It promotes targeted investments in charging stations at key locations, while strengthening the electrical grid to handle increased demand and integrating smart grid technologies for efficient energy management.

To financially support this expansion, the plan provides for low-interest loans to businesses involved in EV manufacturing, as well as a dedicated investment fund to support EV infrastructure and promote sustainable business models. One key ambition of the plan is to advance Thailand's Digital Economy and Smart Infrastructure through the development of digital platforms to enhance infrastructure management and enable seamless integration across sectors. These platforms will also support initiatives such as energy trading, carbon markets and smart cities.

** Thailand is currently considering increasing the ambition of net-zero emissions target to advance its achievement from 2065 to 2050.*

Overall, the NESDP, puts a strong emphasis on its energy sector, linking it to economic growth, job creation, improved health outcomes, enhanced access to education and digitalization of the Thai economy. Building on this framework, the National Energy Plan operationalizes these priorities by setting clear renewable energy targets, driving emissions reductions, and modernizing the country's energy infrastructure to support long-term resilience and sustainability.

Figure 2. Alignment of Development Milestones and Main Targets

Source : NESDC [11]

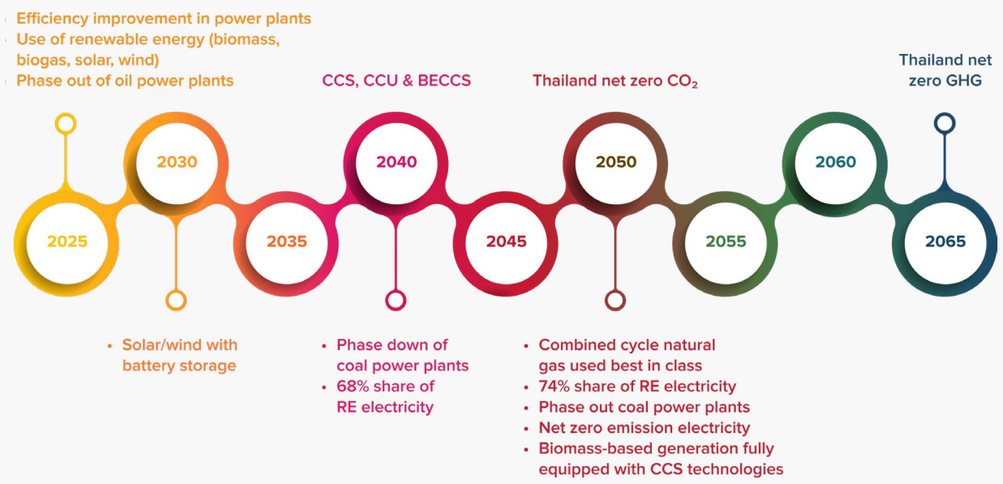
Thailand's Nationally Determined Contribution (NDC) and Long-Term Low Emission Development Strategy (LT-LEDS)

Thailand submitted its second updated NDC in November 2022.[12] It includes an unconditional emissions reduction target of 30% and a conditional target of 40% by 2030 as compared to the business-as-scenario. The second NDC covers the energy, industrial processes and product use, agriculture, and waste sectors. The country also aims to achieve carbon neutrality by 2050 and net zero by 2065.

Thailand submitted its revised Long-Term Low Emission Development Strategy (LT-LEDS) in 2022.[13] Key mitigation actions for energy sector outlined in the Strategy include further increases of renewable energy share in power generation, grid modernization and micro-grid development to support distributed energy resources, digitalization of the renewable energy control sector including both on-grid and off-grid systems, enhancement of energy efficiency improvement, use of cleaner and more efficient technologies such as hybrid, plug-in hybrid, electric and fuel cell electric vehicles (FCEVs) in transport sector, etc.

Source: UNFCCC [12, 13]

Figure 3. Net zero GHG emission timeline for Thailand's power generation



Source : UNFCCC [13]

National Energy Plan (NEP)

Thailand's Ministry of Energy is ramping up efforts to adopt a comprehensive National Energy Plan to support the country's ambitious goal of reducing carbon emissions by 222 million tonnes by 2030.[14] Scheduled to launch in 2025, the plan will provide strategic roadmap to enhance the sustainability and resilience of the country's energy sector. A key priority will be to increase the share of renewable energy sources, with specific targets likely to include significant investments in solar and wind power technologies.

The plan, which includes a significant increase in solar energy usage, is estimated to require investments of over 2.9 trillion baht and is projected to reduce CO2 emissions by more than 106 million tonnes by 2037.[15] These investments will support smart grid development, upgrading infrastructure for transportation, and new businesses to promote biofuels consumption models. The NEP combines five key plans: Thailand's Power Development Plan (PDP); Alternative Energy Development Plan (AEDP); Energy Efficiency Plan (EEP); Gas Plan; and Oil Plan. The latest available information on these five plans, drawn from their public hearings in 2024, forms the basis of this report.

Goals under the Thailand National Energy Plan (NEP)

- Reduce energy intensity by more than 30% by year 2037.
- Transition to green transport through EVs by 30@30 policy: produce at least 30% of ZEVs (Zero Emission Vehicles) to all produced vehicles by year 2030.
- Increase the share of renewable energy in the new power generation by 50%.
- Reform current energy institutional arrangement to support energy transition through 4D1E (Digitalization, De-Centralization, De-Regulation, De-Carbonization and Electrification).

12 United Nations Framework Convention on Climate Change, "Thailand 2nd Updated NDC," 2 November 2022. [Online]. Available: https://unfccc.int/documents/620602.
13 United Nations Framework Convention on Climate Change, "Thailand's Long-Term Low Greenhouse Gas Emission Development Strategy (Revised version)," 8 November 2022. [Online]. Available: https://unfccc.int/documents/622276.
14 Energy Policy and Planning Office, "National Energy Plan," 5 August 2021. [Online]. Available: https://www.eppo.go.th/index.php/en/component/k2/item/17093.
15 The Nation, "Solar power at core of National Energy Plan to achieve emission goal," 25 September 2024. [Online]. Available: https://www.nationthailand.com/sustaination/40041788.

Power Development Plan

A key component of the NEP, the Power Development Plan (PDP) serves as Thailand's primary strategic framework for planning the country's power generation, transmission, and distribution. The latest version of the PDP prioritizes reducing Thailand's reliance on coal and natural gas by increasing the share of renewable energy in the country's power mix.[16] The plan sets ambitious targets for the integration of renewable energy, with a goal to increase the share of renewables to 51% of the total electricity generation by 2037.

In addition to promoting renewable energy, the PDP also focuses on ensuring energy security, grid stability, and maintaining affordable electricity prices for consumers. The plan supports investments in modernising the power grid to accommodate increased renewable energy capacity notably due to accelerated EV deployment and improve energy efficiency across sectors. The PDP also highlights the importance of public-private partnerships to attract investments in renewable energy projects and technological innovations.

However, stronger policy considerations are required to address key challenges in grid modernisation and energy decentralisation. The growing role of distributed energy resources (DERs) and EVs demands a more flexible and resilient grid infrastructure, incorporating smart grid technologies for real-time load balancing and seamless integration of intermittent renewables. Policies should also support initiatives such as bidirectional charging, vehicle-to-grid solutions and demand-response programme to improve grid reliability. These elements should constitute a policy priority considering the importance of EV integration in the national development and energy policy frameworks.

The PDP primarily emphasizes on the technical aspects of the transition, with less attention on the social and economic impacts of phasing out fossil fuels. More concrete measures are needed to support vulnerable groups, such as workers in the coal and gas industries, acquiring new skills and knowledge to prepare them for new employment opportunities. Policies that support training programmes in the renewable energy sector could help facilitate a smoother transition for workers shifting away from traditional fossil fuel industries. A successful example of reskilling initiative can be found in South Africa, where a partnership between the ILO, banks, and mining companies established a Just Transition Fund to support reskilling and upskilling programmes for workers affected by the closure of coal mines. A more comprehensive approach is needed to ensure that these workers can transition to new roles in the renewable energy sector and that energy poverty does not become a barrier to accessing clean energy for low-income households.

16 Energy Policy and Planning Office, "Draft Thailand PDP 2024 and Gas Plan 2024," 20 June 2024. [Online]. Available: https://www.eppo.go.th/index.php/th/eppo-intranet/item/20632-news-200667-01.

17 Department of Alternative Energy Development and Efficiency, "Draft AEDP 2024," June 2024. [Online]. Available: https://drive.google.com/drive/folders/1mO_trgW4iFur4fuDauXLBM4FWfrvXt_Y.

18 Department of Alternative Energy Development and Efficiency, "Draft EEP 2024," June 2024. [Online]. Available: https://drive.google.com/drive/folders/1mO_trgW4iFur4fuDauXLBM4FWfrvXt_Y.

Alternative Energy Development Plan

Along with the Power Development Plan, the Alternative Energy Development Plan (AEDP) is another key policy framework that outlines Thailand's renewable energy targets and strategies, aiming to expand the use of solar, wind, biomass, and hydropower to diversify Thailand's energy mix.[17] It supports the country's goal to increase the share of renewable energy sources to 51% by 2037, in line with the targets set by the PDP.[17]

The AEDP also promotes various incentives for renewable energy adoption, including feed-in tariffs (FiTs), tax exemptions, and grants for clean energy projects. These incentives are designed to encourage both private-sector investments and community-based renewable energy initiatives. The AEDP highlights the importance of distributed energy resources, such as rooftop solar and community-based solar farms, which can help decentralise energy production and bring renewable energy access to rural and underserved areas.

Despite its ambitious targets and support for renewable energy, the AEDP could better address the challenges of equitable access to clean energy. While the plan acknowledges the role of DERs, such as rooftop solar and community-based solar farms, more targeted policies are needed to ensure that low-income households, rural marginalised groups can afford and benefit from renewable energy technologies. Financial mechanisms such as targeted subsidies for low-income households and microfinancing for community-owned renewable projects would improve inclusivity. Enhancing regulatory support for peer-to-peer energy trading could empower consumers to participate in the energy market, thus strengthening decentralized energy generation.

Energy Efficiency Plan

The Energy Efficiency Plan focuses on reducing energy intensity across various sectors, including industry, transportation, and residential buildings. The goal of the EEP is to decrease energy intensity by 36% by 2037 compared to a business-as-usual scenario.[18] The plan outlines a range of energy-saving measures, including the adoption of energy-efficient technologies, building energy codes, and energy management systems for large industrial facilities and commercial buildings.[18]

The EEP also promotes public awareness campaigns to encourage energy-saving behaviours among consumers and businesses. Financial incentives, such as low-interest loans and subsidies, are provided to support energy efficiency projects, particularly in the industrial sector.

While the EEP contributes to reducing Thailand's greenhouse gas emissions and energy costs, it primarily focuses on technical solutions and lacks a strong social component. There is limited attention given to how energy efficiency measures can benefit low-income households or small businesses that may not have the resources to invest in energy-efficient technologies. A more inclusive approach is needed to ensure that the benefits of energy efficiency are accessible to all segments of society, particularly those who may struggle with high upfront costs.

Oil Plan

The Oil Plan aims to strengthen national energy security, support the transition to clean energy, and enhance competitiveness in response to evolving global energy markets. It is structured around strategic directions that balance immediate energy needs with long-term sustainability objectives.

In line with Thailand's decarbonisation agenda, the plan promotes the adoption of cleaner fuels across all major transport modes. For land transport, it supports the transition of public transportation fleets to electric vehicles (EVs) and encourages the use of alternative fuels, such as hydrogen, in long-haul freight transport. In the aviation sector, the plan outlines the introduction of Sustainable Aviation Fuel (SAF), targeting a 1% blend by 2026, with a goal to increase this to 5–8% by 2037.[19] These SAF blends are expected to be derived from domestic feedstocks, including used cooking oil, palm oil, and ethanol. In the maritime sector, the plan promotes the use of cleaner marine fuels, such as biofuel blends with very low-sulphur fuel oil (B24 VLSFO), to reduce emissions from cargo shipping.

Gas Plan

The Gas Plan seeks to enhance energy security, diversify Thailand's gas supply, and align with national climate goals by integrating cleaner fuels and technologies into the system. With over 60% of electricity still generated from natural gas, the plan recognises the urgent need to address declining domestic reserves and reduce reliance on imported LNG.[16] To mitigate this dependency, the plan places greater emphasis on increasing domestic production from potential fields in the Gulf of Thailand and Myanmar. This includes new developments such as the Overlapping Claims Area (OCA) between Thailand and Cambodia.

In support of Thailand's decarbonisation agenda, the plan promotes innovation by piloting the blending of hydrogen into the natural gas stream, targeting a 5% hydrogen blend in power generation by 2030. It also outlines strategies to strengthen gas infrastructure, including the expansion of pipeline networks and the development of the third LNG terminal in the Eastern Economic Corridor (EEC), aimed at enhancing system flexibility and supporting future demand.

19 Department of Energy Business, "Draft Oil Plan 2024," June 2024. [Online]. Available: https://drive.google.com/file/d/1E9titEBmA6dN-jDxKUv-OBb60deFvy8u5/view?usp=sharing.
20 Energy Policy and Planning Office, "Vision Mission Value Duty," 28 March 2016. [Online]. Available: https://www.eppo.go.th/index.php/en/about-us/vision-mission-value-duty.
21 Energy Regulatory Commission, "Energy Regulatory Commission," [Online]. Available: https://www.erc.or.th/en.
22 Energy Regulatory Commission, "Annual Report 2023," [Online]. Available: https://www.erc.or.th/en/annual-report/3778.
23 J. Tisuthiwongse, M. Pongrujikorn and S. Chaianant, "ERC Sandbox: Thailand's Pilot Virtual PPA and How RECs and Virtual PPAs Can Further Its Decarbonization Goals," Chandler Mori Hamada, 11 March 2025. [Online]. Available: https://chandler.morihamada.com/en/insights/newsletters/6411.

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Thailand's policies support the shift to cleaner transport by promoting electric vehicles for public fleets.

Governance and coordination

In Thailand, the Energy Policy and Planning Office (EPPO) within the Ministry of Energy coordinates with other ministries to ensure that the energy sector's needs are integrated into broader national development plans.[20] The EPPO is responsible for drafting key documents such as the Power Development Plan and the National Energy Plan, which require input from various governmental bodies.

Various inter-ministerial committees exist to address specific energy-related issues. These committees bring together representatives from different ministries, such as the Ministry of Industry, Ministry of Natural Resources and Environment, and Ministry of Transport, to collaborate on initiatives like renewable energy development and energy efficiency improvements. To continue improve cross-sectoral coordination for a just energy transition, best practices such as dedicated cross-ministry task forces or inter-agency working groups could be implemented to improve policy integration.

To ensure a clear consistency between governance levels and support greater stakeholder involvement, the role of sub-national governments should be scaled up, especially in the management of decentralized renewable energy projects. Currently, each province in Thailand has its own Provincial Energy Committee, which is responsible for implementing national energy policies at the local level. These committees facilitate communication between central authorities and local stakeholders, allowing for tailored approaches to energy management that reflect regional priorities. Sub-national governments participate in public consultations organized by central authorities, where they can voice their perspectives on energy policies. Strengthening the role of local governments in renewable energy planning, for instance by granting them greater autonomy to implement community-owned solar projects, could enhance energy access and ensure that regional priorities are better reflected in national policies.

© UNDP Thailand
The Mae Hong Son project shows how provincial energy committees and community actors support decentralized renewables for Thailand's just energy transition.

The Energy Regulatory Commission (ERC) plays a key role in enforcing renewable energy regulations and overseeing compliance with emission reduction targets by collaborating with other government bodies.[21]

Notable frameworks implemented by the Energy Regulatory Commission (ERC) include several mechanisms aimed at enabling decentralized energy deployment and fostering innovation in clean energy markets. Among these, the Feed-in Tariff (FiT) scheme has played a central role in promoting small-scale and community-owned renewable energy projects across Thailand. Under the most recent FiT round launched in 2022 for 2022–2030, the ERC approved 5,203 MW of new renewable energy capacity, including 3,668 MW of solar PV (with 1,000 MW for solar-plus-storage), 1,000 MW of wind, and 335 MW of biomass.[22]

More than 20% of this capacity has been reserved for Very Small Power Producers (VSPPs), especially in rural provinces, with fixed FiT rates (e.g., 2.16–2.83 THB/kWh for solar projects) ensuring revenue certainty for developers and local cooperatives. This mechanism has been vital in encouraging private and community-based investments in areas where access to capital is otherwise limited.

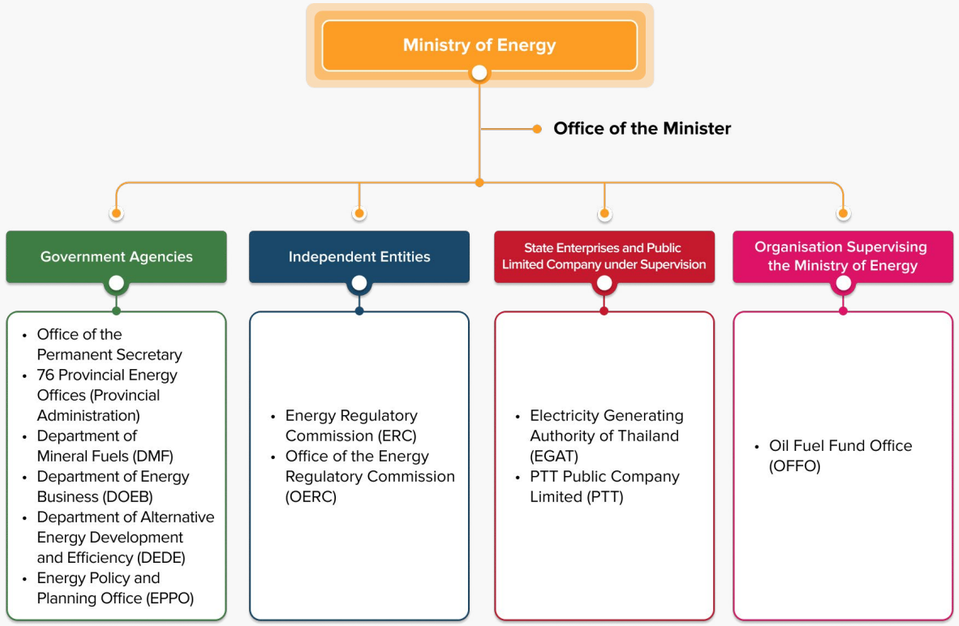
To support regulatory innovation and accommodate disruptive technologies, the ERC launched the "ERC Sandbox" programme in 2020, which concluded in 2023 after two implementation phases.[23] The Sandbox created a controlled regulatory environment to test novel business models—including behind-the-meter solar-plus-storage, peer-to-peer (P2P) energy trading, demand response systems, and electric vehicle integration. **Out of 46 applicants, 25 projects were approved, and 14 completed testing,** with a strong representation from universities, state enterprises, and technology start-ups.

For instance, Chulalongkorn University partnered with the Metropolitan Electricity Authority (MEA) to pilot P2P trading among university buildings using blockchain ledgers. The pilot demonstrated that blockchain-enabled settlement could reduce transaction time by 90% and enable dynamic pricing mechanisms.

In tandem, the ERC has actively promoted the regulatory facilitation of P2P energy trading in collaboration with the Digital Government Development Agency (DGA) and state utilities like MEA and PEA. Under the Digital Energy Regulatory Sandbox (2021–2024), supported by Thailand's Ministry of Energy and Japan's Ministry of Economy, Trade and Industry (METI), several P2P energy trading pilots have been deployed using blockchain platforms such as Power Ledger and I-EMS. Notably, the **T77 Smart Community in Bangkok*** enabled households and SMEs to trade rooftop solar power within a microgrid, reducing their monthly electricity bills by **15–30%**, and increasing self-consumption ratios above 60%—compared to the national average of 18%.

** Smart Green Community - T77 - BCPG*

Figure 4. Energy Governance Structure in Thailand



Sub-national governments, particularly provincial and local authorities, play a significant role in the country's energy governance framework. These include implementation of national policies, local energy planning, promotion of renewable energy, such as community solar power installations and biomass energy production, consumer engagement and protection, support for local initiatives that encourage community participation in energy management, such as energy cooperatives or local renewable energy projects.

Local authorities also monitor compliance with national regulations and standards related to energy production and consumption within their jurisdictions. They ensure that local operators adhere to safety and environmental standards. Ministry of Energy and the ERC collaborate with sub-national governments to align local initiatives with national objectives.

Source: Adapted from Ministry of Energy [24] *, based on various government websites*

However, there is room for further strengthening regulatory frameworks to promote renewable energy procurement and support grid decentralization. Such models, if scaled, have significant potential to empower low-income urban communities—especially tenants and informal households—who often face disproportionately high energy costs due to inefficient housing stock. Moreover, the community engagement embedded in these pilots offers pathways for more democratic participation in energy governance. **Despite these regulatory advancements, structural integration into the mainstream energy planning system remains limited.** For example,

while the ERC Sandbox has validated viable models for prosumer markets and decentralized energy systems, these learnings have not yet been systematically codified into the Power Development Plan (PDP) or the National Energy Plan (NEP). Current grid codes and market rules still favor centralized, utility-scale generation and restrict full net metering and energy export rights for households or community-based projects. **As of 2024, less than 3% of total generation is from distributed energy resources (DERs), despite technical potential estimates exceeding 20 GW nationally—of which 10 GW is from untapped rooftop solar on residential and commercial buildings alone.*** This underutilization directly affects poorer communities, who could benefit most from self-generation but face regulatory and financial barriers. For instance, low-income households often cannot access credit for solar installations, and renters lack ownership rights to participate in DER schemes.

To improve coherence, regulatory reforms should focus on the following:

- **Mandating DER integration targets** in the PDP (e.g., 5 GW rooftop solar by 2030) and harmonizing this with ERC's licensing framework;
- **Adopting national guidelines for P2P trading,** building on ERC Sandbox outcomes, and enabling participation through aggregators;
- **Introducing time-of-use tariffs and feed-in premium structures** to reflect locational and temporal grid value;
- **Aligning FiT capacity quotas with provincial energy access and poverty maps,** ensuring more equitable distribution of clean energy benefits.

Overall, these regulatory frameworks have laid a strong foundation for a more decentralized, inclusive, and innovation-friendly energy market in Thailand. However, without full integration into national energy planning instruments and budgeting frameworks, the scale-up potential remains underutilized. Embedding these mechanisms into the **NEP 2025 update and the 14th NESDP (2027–2031)** would significantly enhance Thailand's capacity to deliver a just, participatory, and distributed energy transition. Ensuring that ERC regulation promote investments in smart grid, energy storage and flexible market mechanisms would improve the effectiveness of Thailand's energy transition governance.

Opportunities exist to improve coordination between different ministries and between central and sub-national governments. For example, Malaysia has established the National Energy Council, chaired by the Prime Minister, to oversee energy policy decisions. This council facilitates collaboration among multiple ministries, including those responsible for transport, industry, and environment, ensuring a holistic approach to energy governance.[25]

Thailand has an opportunity to strengthen energy governance by improving coordination between ministries and central and sub-national governments. By enhancing inter-ministerial collaboration and empowering local authorities, the country can ensure more effective and inclusive energy policy implementation. Strengthening governance structures will enable a more holistic approach to the energy transition, drive local engagement, and optimize the impact of national policies, positioning Thailand as a regional leader in sustainable energy governance.

** Thailand Energy Industry Report 2024*

3. Energy Transition in Thailand: Past, Present and Future Potential for a Just Energy Transition

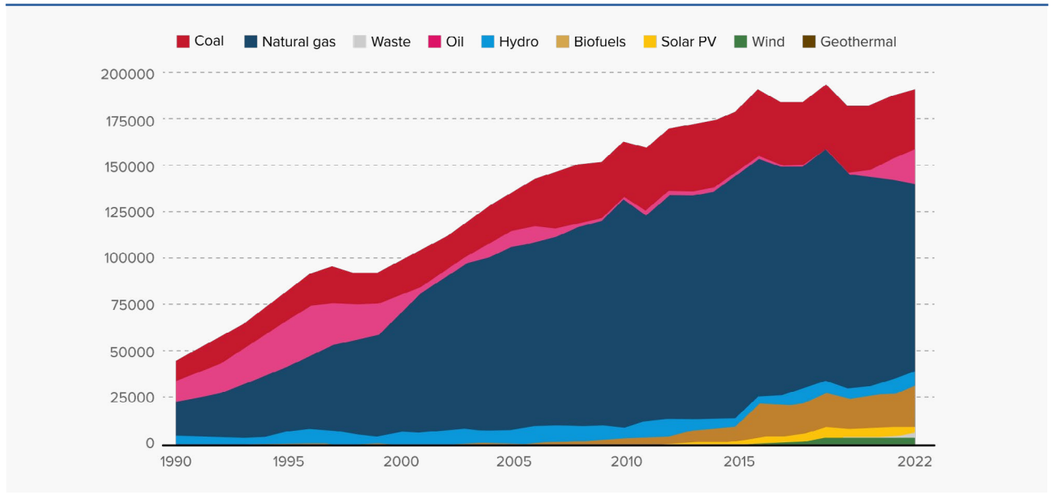
Thailand is at a critical juncture in its energy transition journey: striving to strike the balance between its growing energy demands and its climate commitments. While the country is making strides toward a cleaner, more sustainable energy future, challenges remain, particularly in balancing economic growth, energy security, per capita power demand, and environmental sustainability. This section outlines Thailand's current energy mix, its renewable energy targets, progress in increasing the share of renewable energy, greenhouse gas (GHG) emission trends, decarbonisation strategies, opportunities and challenges in just energy transition.

3.1 Past and Present Energy Transition Status:

▸ Does the National Electricity Mix align with the Transition Objectives?

Thailand's energy system has long been dominated by fossil fuels, with natural gas, coal, and oil forming the backbone of its power generation and energy consumption. As of 2024, natural gas accounted for approximately 58% of the country's electricity generation, while combined fossil fuels constituted 77% of the total electricity mix.[26] Historically, this energy composition has supported Thailand's industrial growth, however it has come at a notable cost.

Figure 5. Electricity generation by source, Thailand, 1990-2023



Source : IEA [2]

Contributing significantly to GHG emissions and environmental degradation, the country has become locked-in to fossil-based energy sources. By contrast, solar and wind energy have come to account for only 4.7% of the electricity mix, compared to the global average of 13%.[27] This over-reliance on a predominantly fossil-based energy mix has further exposed the country to global price volatility and energy security risks with the need to import 57.4% of its total energy supply.[2] To meet growing demands, not only has natural gas powered approximately two-thirds of the country's electricity demands since 2000 - overlooking the relatively untapped potential of solar and wind[28]- but 16.9% of the total electricity supply in 2022 was dependent on imports - a 1096% increase since 2000.[2]

Figure 6. Evolution of Electricity Generation Sources in Thailand Since 2000

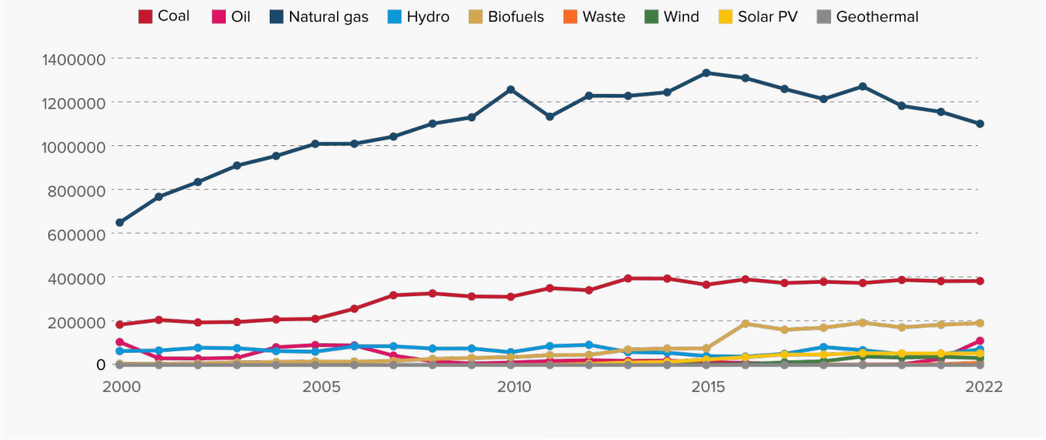
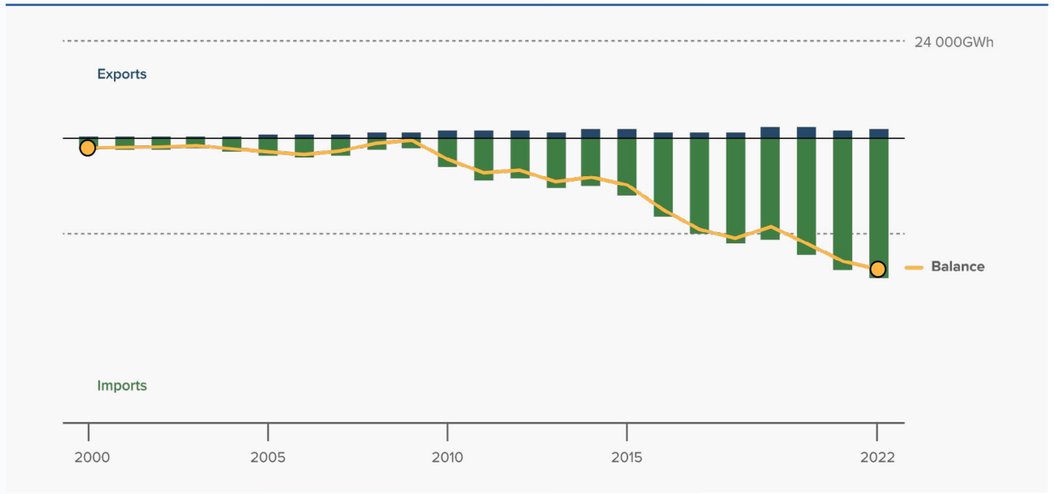


Figure 7. Trade in Electricity, Thailand



Source : IEA

To address these challenges and meet its climate commitments under the Paris Agreement, Thailand has set the target to increase its share of renewable energy in the power generation mix to 30% by 2037. This target is outlined in both the PDP and the AEDP, which focus on expanding the use of renewable energy sources, such as solar, wind, biomass, and hydropower. In comparison, the IEA's Net Zero Emissions scenario set out a global target of 60% renewable electricity by 2030 in line with the UAE Consensus to triple renewable energy capacity and double energy efficiency by 2030.[2, 29] The PDP and AEDP prioritise the diversification of energy sources to reduce dependence on natural gas and coal.[16, 17] Solar and wind energy are expected to play a role in meeting the renewable energy targets, alongside biomass, which continues to dominate 37.5% of domestic energy production by leveraging Thailand's agricultural waste and bioresources and is responsible for 9.8% of electricity generation.[2] Hydropower, though contributing a smaller share, remains an important part of the energy mix, particularly in rural areas.[17]

Figure 8. Evolution of Domestic Energy Production in Thailand Since 2000

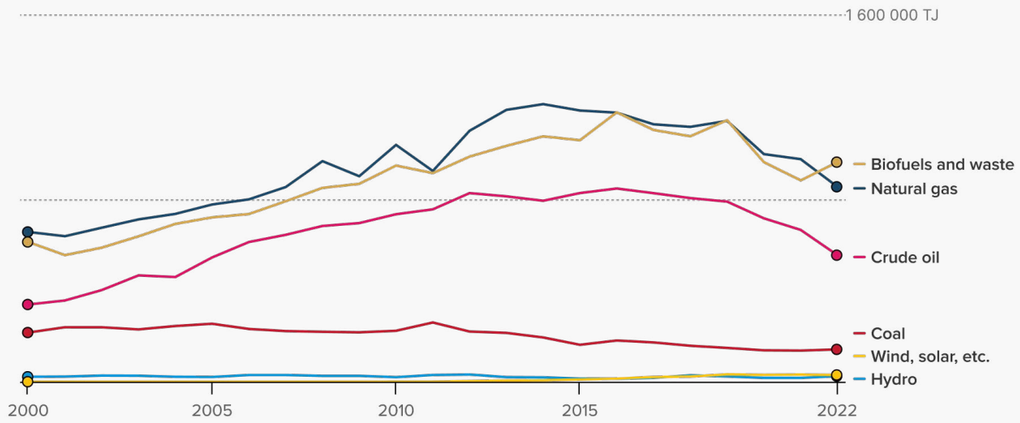
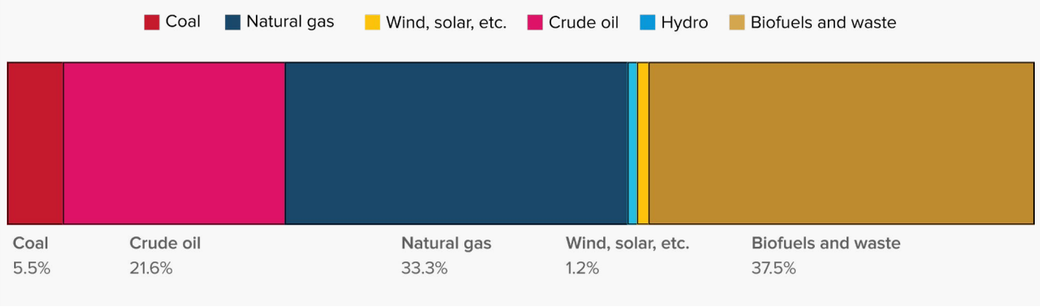


Figure 9. Domestic Energy Production, Thailand, 2022

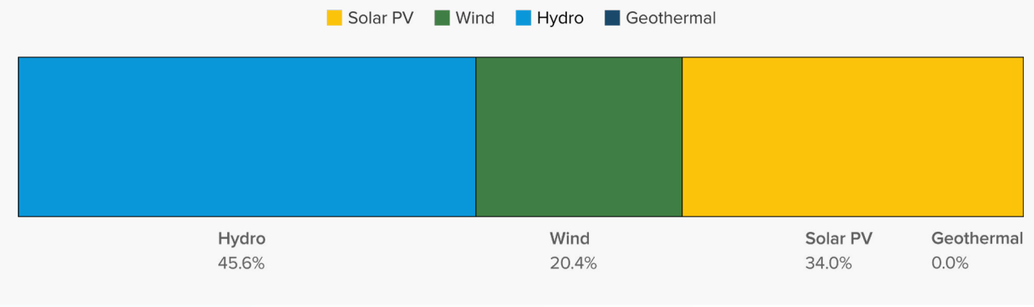


Source : IEA [2]

▸ Renewable Energy Progress and Potential

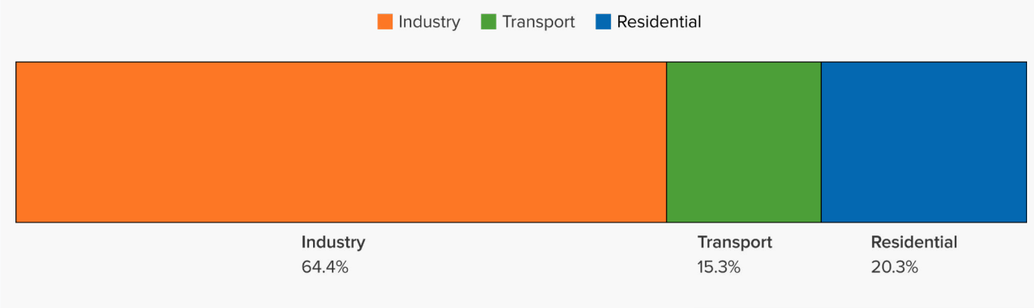
Thailand has made notable progress in expanding its renewable energy capacity, particularly in solar and biomass. The country's tropical climate provides ample sunlight, making solar power a promising option for large-scale energy generation and distributed energy systems, such as rooftop solar. As of 2022, solar PV accounted for about 34% of renewable (non-combustible, excluding biofuels and waste) energy mix.[2] Wind energy is another key area of focus, particularly in the north-eastern and southern regions of Thailand, where wind speeds are favourable for wind farm development. In 2022, wind power accounted for about 20% of renewable electricity generation.

Figure 10. Renewable Electricity Generation by Source (Non-Combustible), Thailand, 2022



Biomass energy, which capitalises on Thailand's abundant agricultural waste, such as rice husks and sugarcane bagasse, has also shown promise. Biomass projects not only contribute to renewable energy production but also provide economic opportunities for rural communities by utilising waste materials that would otherwise be discarded. Despite its potential, the biomass sector faces challenges related to sustainability, logistics, and the cost of transporting raw materials to energy production sites. However, it still accounts for 11.7% of the country's total final energy consumption, and predominantly dominates the industrial sector – with 64.4% of total consumption accountable to the sector.[2]

Figure 11. Biofuels and Waste Final Consumption by Sector, Thailand, 2022

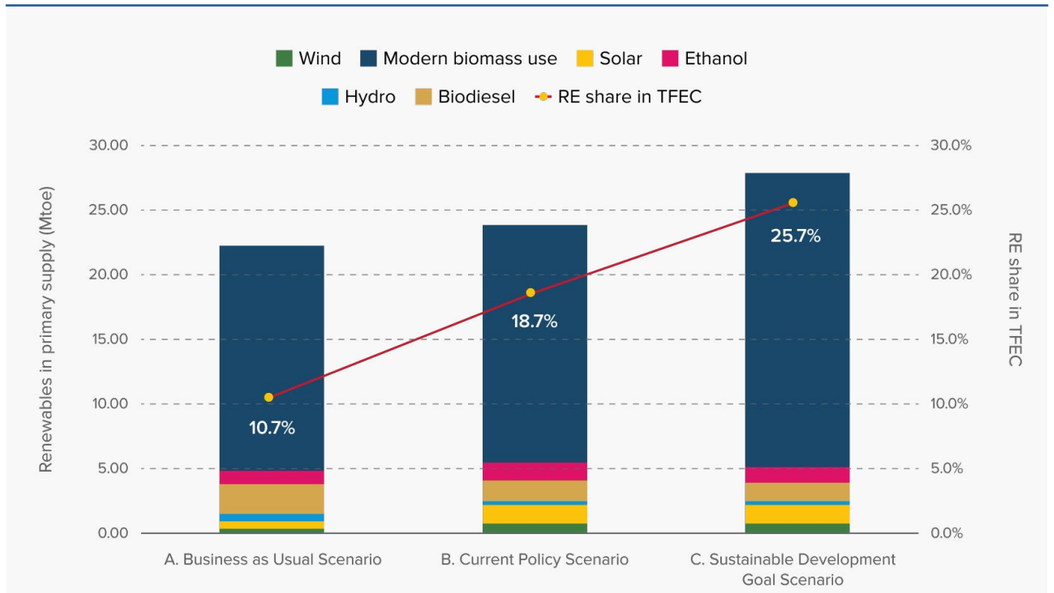


Source : IEA [2]

3.2 The Future of Thailand's Energy Transition

According to ESCAP projections, renewable energy is expected to reach 18.5% of total final energy consumption by 2030 in the current policy scenario, and surpass 25% in the SDG scenario, with modern biomass energy taking the biggest part.[30] By 2030, although fossil fuel will still dominate electric supply at 64%, renewables share will increase to 36% of the installed capacity. The SDG scenario reflects an enhanced policy pathway designed to meet SDG 7 targets, including universal access to electricity and clean cooking, a higher share of renewables, and accelerated energy efficiency improvements.

Figure 12. Renewable Energy Scenarios in 2030



Source : ESCAP [30]

24 Ministry of Energy, "Annual Report 2023," [Online]. Available: https://energy.go.th/th/annual-report/download?did=98773&filename=%E0%B8%A3%E0%B8%B2%E0%B8%A2%E0%B8%87%E0%B8%B2%E0%B8%99%E0%B8%9B%E0%B8%A3%E0%B8%B0%E0%B8%88%E0%B8%B3%E0%B8%9B%E0%B8%B5+2563.pdf&mid=13327&mkey=m_document&lang=th&url=%2Fweb-upload%2F1xff0d34.

25 Prime Minister's Department, Malaysia, "National Energy Policy 2022-2040," September 2022. [Online]. Available: https://ekonomi.gov.my/sites/default/files/2022-09/National_Energy_Policy_2022-2040.pdf.

26 Energy Policy and Planning Office, "Electricity Statistics," 2025. [Online]. Available: https://www.eppo.go.th/index.php/en/en-energystatistics/electricity-statistic.

27 Ember, "Thailand Energy Profile," 2024. [Online]. Available: https://ember-energy.org/countries-and-regions/thailand/.

28 P. Vangtook, P. Suwicharcherdchoo and J. Vorasee, "Thailand Harnesses Wind Energy Potential," T&D World, 10 May 2023. [Online]. Available: https://www.tdworld.com/renewables/article/21263029/thailand-harnesses-wind-energy-potential.

29 International Renewable Energy Agency, "Delivering on the UAE Consensus: Tracking progress to tripling renewable energy capacity and doubling energy efficiency by 2030," [Online]. Available: https://www.irena.org/Digital-Report/Tracking-progress-toward-tripling-renewable-energy-capacity-and-doubling-energy-efficiency-by-2030.

▸ The GHG Emissions Barrier

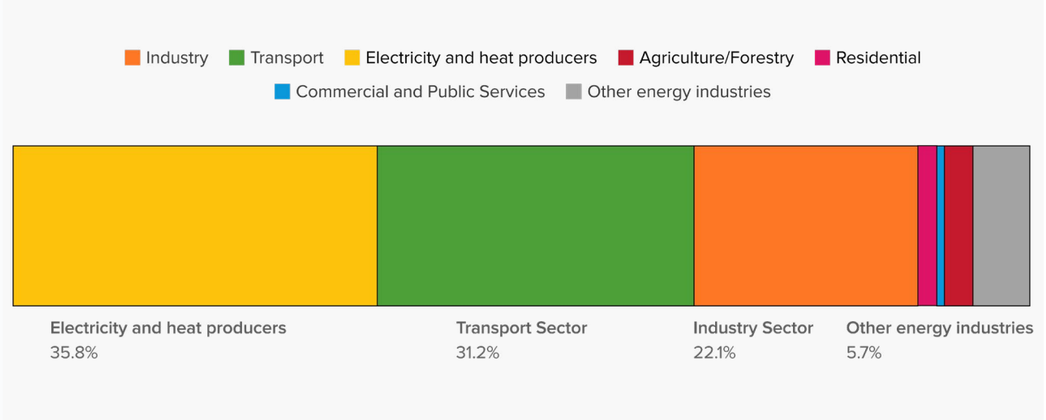
Thailand's energy sector is the largest contributor to its GHG emissions, accounting for approximately 250.042 Mt CO2 or 60% of total emissions in 2023.[31] The reliance on fossil fuels for power generation, transportation, and industrial processes has resulted in a significant carbon footprint. In response, Thailand has committed to reducing its GHG emissions by 20-25% by 2030 compared to a business-as-usual scenario, with a long-term goal of achieving carbon neutrality by 2050.[13]

While these targets are ambitious, achieving them will require significant efforts to decarbonise notable sectors and emitters of the economy: electricity and heat producers (35.8%); transport (31.2%) and industry (22.1%).[2] The energy transition will play a central role in reducing emissions, particularly through the adoption of renewable energy, improvements in energy efficiency, and the electrification of transport and industry.

▸ Decarbonising Industry and Transport through Emerging Technologies

The industrial sector is one of the largest consumers of energy in Thailand, accounting for nearly 40% of the country's total energy consumption.[32] Industries such as manufacturing, construction, hard-to-abate sector (cement, steel, chemicals) are highly energy-intensive and rely heavily on fossil fuels. Decarbonising strategies will require a combination of measures including energy efficiency; the adoption of renewable energy; technological innovations such as Carbon Capture, Utilisation, and Storage (CCUS), and the use of hydrogen—particularly for high-temperature industrial processes and heavy transport.

Figure 13. CO2 Emissions by Sector, Thailand, 2022



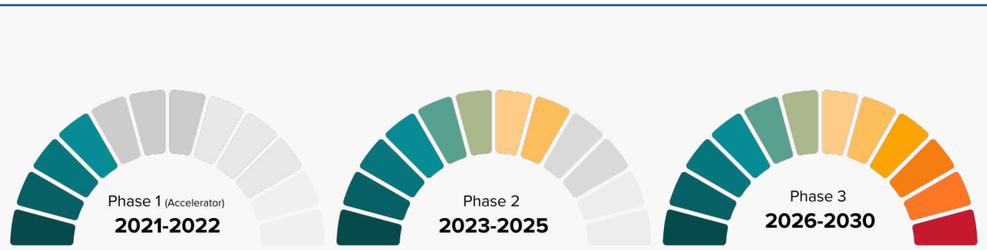
Source : IEA [33]

Electrification could be another key strategy for reducing emissions, particularly in the **transport sector**, which accounts for around 35% of Thailand's total energy consumption.[2] EV components and the integration of charging stations into infrastructure can play a significant role in stabilizing grids by facilitating renewable energy penetration and transitioning from centralized to decentralized energy systems. The deployment of smart meters could optimize grid stability and efficiency, contributing to a smoother transition.

The Thai government has made significant efforts to promote the adoption of EVs as part of its **30@30 policy,** which aims to ensure that **30% of all vehicles produced in Thailand are electric by 2030.**[34] From two-and three-wheelers, e-buses and ride sharing options, the chart below illustrates the 3 phases of the 30@30 plan.

Public transport electrification, such as the introduction of electric buses, is a priority, with plans to transition over 3,000 public buses to electric by 2030. The Thai government has implemented a variety of schemes to promote domestic EV production and use, including foreign investment promotion and import tax reductions on EV production machinery, domestic use campaigns, and EV purchase subsidies.[35]

Figure 14. 30@30 ZEV Promotion Plan



Source : Krungsri Research [36]

However, the success of electrification decarbonisation efforts depends on a number of factors: from tax benefits, rebates, purchase support and subsidized charging at public stations, to ensuring that the electricity used to charge EVs comes from renewable sources. While expanding investment in electric public transport is essential, if EVs are fundamentally powered by fossil fuel-generated electricity, their environmental benefits will be diminished. Therefore, the integration of renewable energy into the national grid, along with the development of public charging infrastructure, is essential to achieving meaningful emissions reductions in the transport sector.

Thailand's progress towards achieving SDG 7 on Energy

Thailand has achieved universal access to electricity in recent years, in line with most of the other countries in the Asia-Pacific region. Thailand has also made substantial progress in recent years to enhance the use of clean fuels and technologies for cooking, with more than 70% of people now using healthier cooking fuels. However, the current pace will not be enough to close the clean cooking access gap by 2030. Without a concerted effort, Thailand is unlikely to achieve universal access to clean cooking technology by 2030.

In the Asia-Pacific region, the share of renewable energy in total final energy consumption has shrunk, and progress on the regional capacity to produce renewable electricity is slow. Nevertheless, in Thailand, based on current policies, the share of renewable energy is projected to increase from 11.7% in 2021 to 18.7% by 2030. When non-energy use, such as Industrial Process and Product Use (IPPU), is excluded in the calculation, Thailand is on track to achieve its target of 30% renewable energy share by 2037. Thailand is also on track to achieve the target of 36% energy intensity reduction to 5.47 ktoe/billion Baht of GDP by 2037.

Source: ESCAP [30,37]; UN WOMEN [38]

30 United Nations Economic and Social Commission for Asia and the Pacific, "Energy Transition Pathways for the 2030 Agenda - SDG7 Roadmap for Thailand," 8 July 2024. [Online]. Available: https://repository.unescap.org/items/dd8c656a-cd8c-477f-8053-f5f-8c89d7936.
31 Our World in Data, "Thailand: Energy Country Profile," 2023. [Online]. Available: https://ourworldindata.org/energy/country/thailand.
32 International Energy Agency, "Energy system of Thailand," 2022. [Online]. Available: https://www.iea.org/countries/thailand.
33 International Energy Agency, "Emissions - Thailand," [Online]. Available: https://www.iea.org/countries/thailand/emissions.
34 The Nation, "Government pushing for Thailand's emergence as EV hub in Asean," 2 December 2022. [Online]. Available: https://www.nationthailand.com/thailand/general/40022681.
35 Thailand Board of Investment, "Opportunities and Support Measures for EV Activities," 6 July 2023. [Online]. Available: https://www.boi.go.th/upload/content/20230706%20EN%20BOI_.pdf.
36 S. Choksawatpaisan, "Industry Outlook 2024-2026: Electric Vehicle Industry," Krungsri Research, 10 July 2024. [Online]. Available: https://www.krungsri.com/en/research/industry/industry-outlook/hi-tech-industries/electric-vehicle/io/electric-vehicle-2024.
37 United Nations Economic and Social Commission for Asia and the Pacific, "Asia and the Pacific SDG Progress Report 2025: Engaging communities to close the evidence gap," 18 February 2025. [Online]. Available: https://www.unescap.org/kp/2025/asia-and-pacific-sdg-progress-report-2025.
38 UN Women, "ASEAN Gender Outlook 2024," 23 September 2024. [Online]. Available: https://data.unwomen.org/publications/asean-gender-outlook-2024.

© bookybuggy / AdobeStock
Wind energy accounted for around 20% of Thailand's renewable electricity in 2022, playing a growing role in the country's clean energy transition.

4. Challenges and Opportunities in the Just Energy Transition

Thailand's path toward a Just Energy Transition is shaped by a complex interplay of socio-economic, environmental, and technological factors. The transition is not only about shifting to cleaner energy sources, but it must also address structural inequalities, support inclusive economic growth, safeguard livelihoods, and protect natural ecosystems. While the country has made significant progress in advancing its energy transition agenda, cross-cutting challenges remain, including infrastructure readiness, affordability, energy access, and environmental degradation.

The ultimate challenge for Thailand is to strike a balance among four interdependent goals: **ensuring energy security, advancing social equity and inclusion, strengthening economic equity and competitiveness, and achieving environmental sustainability.** These goals are often in tension, for example, rapid decarbonisation can impact industrial competitiveness, while fossil fuel dependency may compromise both environmental and social outcomes. A successful Just Energy Transition must manage these trade-offs in a way that is just, equitable, and forward-looking.

This section examines the key challenges and emerging opportunities across these four strategic pillars, which form the foundation of a transition that is not only technically and economically viable, but also socially inclusive and environmentally sound.

4.1 Ensuring Energy Security

Thailand's energy system faces mounting pressures from both external and internal dynamics, making energy security a cornerstone of the country's Just Energy Transition. On one hand, rising demand—driven by economic growth, rising temperatures, industrialization and urbanization[39]—continues to strain existing supply and infrastructure. On the other hand, the country remains highly dependent on fossil fuel imports, exposing it to volatility in global markets. Meeting these twin pressures while ensuring affordable, reliable, and sustainable energy for all requires a transformative shift in how energy is produced, delivered, and consumed.

39 International Energy Agency, "Thailand Power System Flexibility Study," May 2021. [Online]. Available: https://www.iea.org/reports/thailand-power-system-flexibility-study.
40 International Trade Administration, U.S. Department of Commerce, "Thailand - Country Commercial Guide," 2024. [Online]. Available: https://www.trade.gov/country-commercial-guides/thailand-energy.
41 International Monetary Fund, "IMF Annual Report 2023," [Online]. Available: https://www.imf.org/external/pubs/ft/ar/2023/english/.

▸ Challenges

One of the most pressing challenges is Thailand's **high reliance on imported fossil fuels**, which account for more than 70% of the total primary energy supply. As of 2023, natural gas alone represents nearly 60% of electricity generation, yet Thailand's domestic reserves in the Gulf of Thailand are projected to be **exhausted by 2035**,[40] increasing its **vulnerability to international price volatility and supply disruptions**—trends underscored during the global energy shocks of 2022–2023. What was once considered "efficient interdependence" has now become a national security liability, as supply disruptions could halt economic activity. **The result has been increased electricity bills, disproportionately affecting low-income households,** for whom **energy expenditures already represent over 15% of monthly income,** compared to 5–7% for wealthier groups.[41] This is now a **social equity risk,** as fossil price spikes exacerbate energy poverty, especially in rural and peri-urban regions. This is posing increasing challenges to energy security and calls for diversification of energy supply. The government has been focusing on reducing energy cost, promoting the use of clean and renewable energy, and supporting new energy sources that can ensure future energy security.

A significant concern is the **concentration of critical mineral processing and clean energy technology supply chain** in a limited number of countries—most notably China, which currently dominates global production of solar panels, battery cells, and rare earth elements. This centralisation poses strategic risks for countries like Thailand that rely heavily on imported technologies for their clean energy transition. Geopolitical tensions, tariff barriers, export restrictions, and supply chain disruptions can lead to delays, price volatility, or even shortages of essential components. China has taken a strategic lead by localising clean and electrification technology manufacturing and expanding exports, while countries like the US are beginning to restrict Chinese imports, further reshaping global supply chains. As Thailand moves to expand domestic EV manufacturing and renewable energy deployment, it will need to proactively manage these risks through diversified sourcing strategies, regional cooperation (e.g. through ASEAN or BRICS+ supply networks), development of circular economy models to recycle critical materials, and investments in local manufacturing capabilities to reduce dependency on single-source imports and enhance national energy security.

A critical emerging challenge in Thailand's just energy transition is the vulnerability associated with concentrated global supply chains for clean energy technologies. As of today, China dominates the processing and manufacturing of key components such as solar PV panels, battery cells, and rare earth elements—raising serious concerns about overreliance on a single country for the technologies central to Thailand's energy transition. China accounts for over 80% of the global manufacturing capacity of solar PV components, 60% of battery cells, and over 90% of rare earth elements used in EVs and wind turbines.[42] This dependency exposes the country to supply-side risks, including geopolitical tensions, export restrictions, price volatility, and disruptions at strategic maritime routes such as the Strait of Malacca. The Ember report warns that energy security risks now extend beyond fossil fuels to the technologies needed to replace them, especially in countries like Thailand where over 55% of primary energy is imported.[43] Without a deliberate strategy to mitigate these risks, Thailand's clean energy ambitions could be delayed or derailed by global market shocks. Furthermore, the current lack of robust domestic manufacturing

capabilities, limited critical mineral processing, and weak circular economy systems—such as battery recycling and end-of-life PV management—amplify Thailand's exposure to external supply disruptions. This presents a serious constraint to long-term energy sovereignty and highlights the urgency of building domestic industrial capacity and diversifying supply sources to support a more resilient and secure transition.

Beyond electricity, the transport sector remains Thailand's largest final energy consumer (over 36% of final consumption in 2023), with road transport accounting for 85% of this demand and almost entirely reliant on imported petroleum. Despite biofuel blending mandates (e.g., B7 and B10 diesel), **fossil fuels still account for 88% of the transport energy mix,** and transport-related GHG emissions have increased by 9% since 2017. Meanwhile, **energy-intensive industries** such as cement, petrochemicals, and food processing continue to **rely on coal, natural gas, and fuel oil.** This reliance presents a major energy security risk, as **many of these fuels are either imported or subject to volatile international markets**. Diversifying fuel sources in industry through electrification, green hydrogen, bioenergy, or waste-to-energy solutions would reduce import dependency, improve supply stability, and enhance overall system resilience. **Energy insecurity in this sector disproportionately affects commuters in low-income jobs,** who spend longer hours and higher portions of income on travel. **Women and informal workers in peripheral areas are particularly impacted,** as they often lack access to affordable, clean public transit. Electrifying public and freight transport could cut costs and emissions—but only if coupled with renewable energy integration and targeted subsidies for low-income users.

Thailand's energy **infrastructure is also under strain.** The transmission and distribution networks were originally designed to support centralised generation from fossil fuel plants. The grid is now struggling to integrate a growing share of **variable renewable energy (VRE)**—such as solar and wind—as well as **Distributed Energy Resources (DERs)** such as rooftop solar, biogas, and community-based generation. These integration challenges are compounded by a lack of flexibility options and regulatory bottlenecks around grid access, permitting, and third-party generation. As of 2024, **variable renewable energy (VRE) penetration—mainly solar and wind—exceeds 18% in peak periods,** stressing grid flexibility and stability. However, only **4% of capacity is supported by energy storage systems, and less than 10% of households and SMEs have access to smart metering or dynamic tariffs.* This limits the ability of low-income prosumers to optimize energy use or sell surplus electricity back to the grid,** hindering participation in the energy market. The IEA suggest that 15% share of variable renewable energy in the power system can be integrated by 2030 with no additional technical and contractual feasibility measures.[39] IEA analysis also shows that Thailand could pursue a full suite of flexibility options, including energy storage, flexible power plants, investments to enhance the grid infrastructure and demand-side responses.

A critical constraint to enhancing system flexibility is **limited energy storage capacity**. Energy storage solutions allow excess energy generated during peak renewable production periods to be stored and used when generation is low, or demand is high. This will be particularly important for managing the intermittency of solar and wind power. Thailand has already started exploring BESS solutions. However, **scaling up these systems will require significant investment, technological development and consideration of the environmental consequences.**

As Thailand **shifts toward more EVs,** the demand for electricity will rise, especially during **peak charging times.** If the grid is not modernised to handle this increased load, it could lead to instability, including power outages or blackouts. A modernized grid can help manage EV charging by implementing demand-side management programmes that control when and how EVs are charged, smoothing out peak demand periods and reducing strain on the grid. The use of smart meters can enable charging during off-peak hours when electricity is cheaper and less strained. Smart grids allow for real-time monitoring, improved energy distribution, and automated responses to disruptions.

▸ Opportunities

Despite these challenges, the energy transition opens important pathways to improve energy security across all sectors. Thailand's **National Smart Grid Master Plan** lays the groundwork for a more flexible, decentralized, and resilient power system.[44] Smart grids can enable real-time monitoring, enhance grid stability, and support bi-directional energy flows, allowing for more effective integration of DERs and VRE. These upgrades will also facilitate better demand forecasting and more targeted investments in infrastructure.

The government approved the initial scope of the action plan to promote BESS for years 2023-2032 in order to enable the issuance of relevant regulations. The Action Plan aims to create an ecosystem and larger scale of demand for the BESS industry, as well as increase the capacity to compete in the market for BESS manufacturers or operators utilizing BESS.[45] **The 2024 PDP draft included 10,000 MW of BESS,** but this may see the country struggle to fulfil carbon neutrality and Net Zero commitments over the coming decades. It is estimated that three to four times more battery storage could be required for a shift to clean energy.[44]

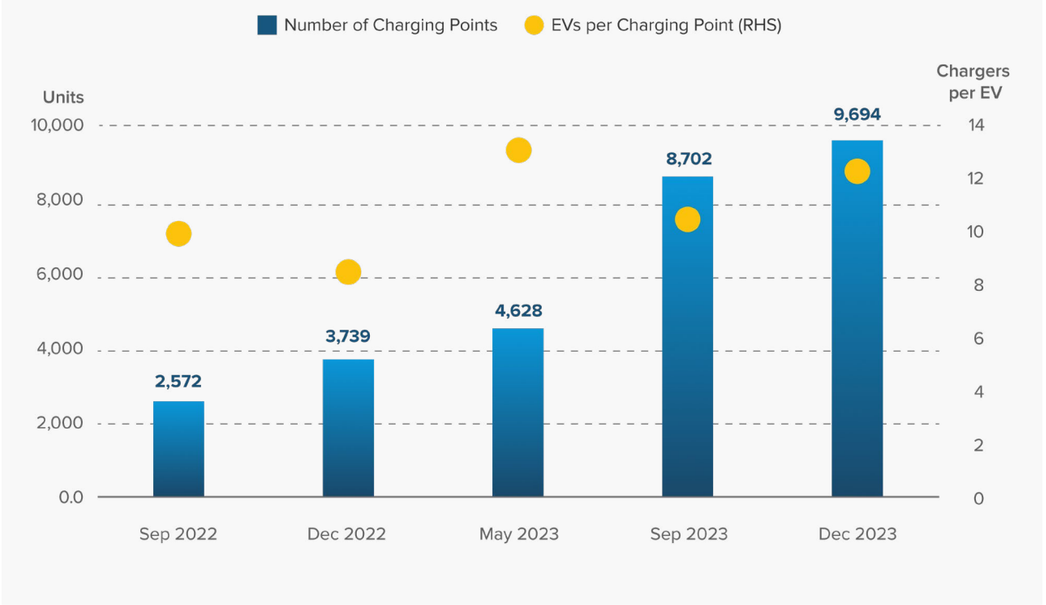
Thailand's participation in the **ASEAN Power Grid (APG)** presents a major regional opportunity. By enhancing **cross-border electricity trade** with neighbouring countries like Lao PDR, Cambodia, and Malaysia, Thailand can both diversify its energy sources and strengthen supply reliability. The APG also facilitates the **integration of renewable energy across Southeast Asia**,[46] supporting a **more balanced, flexible, and interconnected regional grid.** This will not only strengthen supply reliability but also help mitigate the risks associated with relying on a single energy source or supplier.

** MEA, 2024*

42 International Energy Agency, "Global Critical Minerals Outlook 2024," May 2024. [Online]. Available: https://www.iea.org/reports/global-critical-minerals-outlook-2024.
43 Ember, "Energy Security in an Insecure World," Ember, 2025.
44 Ministry of Energy, "Thailand's Smart Grid Development Master Plan (2015-2036)," February 2015. [Online]. Available: https://www.eppo.go.th/images/Power/pdf/smart_gridplan.pdf.
45 Mahanakorn Partners Group, "Action Plan to Promote Battery as a New S-Curve Industry," 1 May 2023. [Online]. Available: https://mahanakornpartners.com/action-plan-to-promote-battery-as-a-new-s-curve-industry/.
46 ASEAN Centre for Energy, "ASEAN Power Grid," 2024. [Online]. Available: https://aseanenergy.org/topics/asean-power-grid/.
47 International Energy Agency, "Gender and Energy Data Explorer," [Online]. Available: https://www.iea.org/data-and-statistics/data-tools/gender-and-energy-data-explorer.

In the **transport sector,** the government's **EV policies and incentive packages** are already drawing foreign investment and expanding the country's role as a **regional EV manufacturing hub.** This momentum presents a strategic opportunity to reduce oil dependence, enhance energy sovereignty, and build a cleaner, more resilient transport system. Continued investment in EV charging infrastructure, cleaner fuels, and the electrification of rail and public transport can accelerate this shift, helping to decarbonize one of the country's most energy-intensive sectors. There are promising signs of progress. According to Krungsri Research, the **number of charging stations** available nationwide rose 114.5% YoY to 2,658 sites in 2023, providing a total of 9,694 charging points (+159.3% YoY).[36] However, infrastructure gaps remain. Thailand's average of 12.3 EVs per charging points still lags behind leading countries such as China, which has 6.5 EVs per charging point. In addition, power output by Thai charging stations may be insufficient. IEA research shows that for smaller charging stations, this may average just 0.4 kW per vehicle, far below the 3.4 kW in China and 4.8 kW in South Korea. Addressing these infrastructure gaps offers a critical opportunity for Thailand to lead the region in EV readiness, while reducing import reliance and strengthening national energy security.

Figure 15. Number of Charging Points and the Ratio of Charging Points to EVs (BEVs & PHEVs)



Source : Krungsri Research [36]

Meanwhile, in **industrial energy use,** there are significant opportunities to improve energy security through energy efficiency upgrades, process electrification, and the adoption of cleaner fuels and feedstocks such as biomass, and green hydrogen. These measures can reduce dependence on imported fossil fuels while lowering energy costs and emissions. To accelerate this transition, Thailand can further explore the use of carbon pricing and trading mechanisms to incentivise cleaner technologies and internalize the environmental cost of emissions. The proposed **Climate Change Act,** which is currently under development, could play a pivotal role in laying the legislative foundation for such instruments. By providing a clear legal framework for carbon markets, emissions tracking, and carbon budgeting, the Act has the potential to drive investment into low-carbon solutions and strengthen Thailand's long-term energy resilience and climate ambition.

4.2 Driving Social Inclusion and Equitable Employment

A just energy transition must not only be technologically feasible, but also socially equitable and inclusive. In Thailand, the shift towards a green economy offers a critical opportunity to address long-standing social disparities—particularly in employment and clean-energy-related jobs creation, income, access to energy, and representation of marginalised groups. However, without proactive planning and targeted interventions, there is a risk that the benefits of the energy transition may not be equitably distributed leaving behind rural populations, vulnerable workers, women, youth, and persons with disabilities (PWDs).

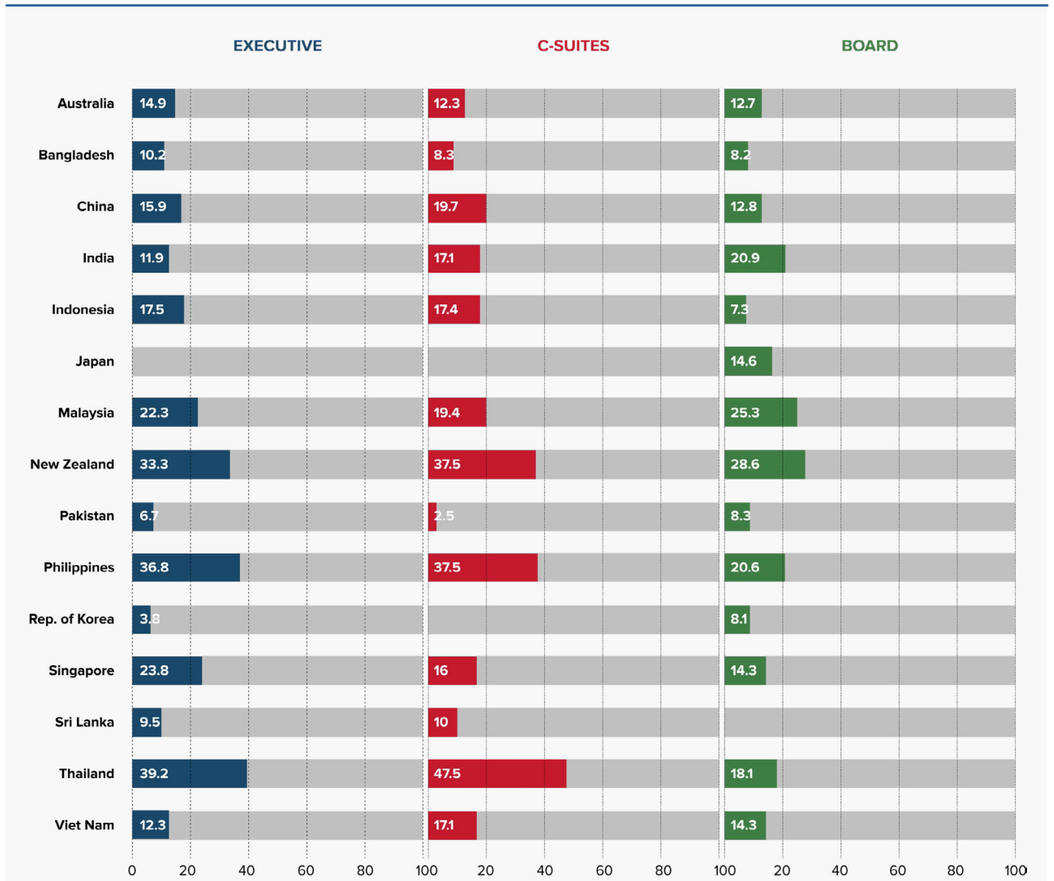
▸ Challenges

The energy transition is expected to disrupt traditional labour markets, especially in fossil fuel-related industries. According to the International Labour Organisation, approximately 60,000 jobs in Thailand's fossil fuel sectors could be impacted by 2030 as the country phases out/down coal, oil and natural gas in favour of renewable energy.[4] Workers in sectors such as coal mining, oil refining, and gas production—many of whom are older and located in specific regions—face heightened risks of job loss and displacement.

Structural barriers also limit participation in the green economy among women, youth, and other underrepresented groups. Women are severely underrepresented in energy and engineering sectors, with a gender gap of 76% in energy sector employment—far higher than the global workforce average gap of 8%.[47] Woman's participation in the ASEAN energy sector is making up about 8% of the workforce, particularly in areas such as the production of crude oil, petroleum, products and natural gas. As the country shifts away from fossil fuel-based employment (with 60,000 jobs potentially at risk by 2030), women's exclusion from reskilling and energy innovation opportunities may widen existing labor and income inequalities.[38] A gender-transformative transition requires targeted interventions—such as stipulating female quotas in training programmes, creating incentives for women-led renewable enterprises, and mainstreaming gender in all national energy and labor policy frameworks. Additionally, a lack of targeted skills development and inclusion policies hinders the ability of youth and PWDs to engage in the transition. The Employers' Confederation of Thailand (ECOT) has raised concerns about the capacity of the current workforce to adapt, especially among older workers with limited exposure to green skills and technologies.[48]

Gender equality is a critical yet often overlooked dimension of Thailand's energy transition, with significant implications for economic inclusion, workforce development, and energy access. In Thailand, women represent only **16% of the traditional energy workforce,** and while their participation in the renewable energy sector is comparatively higher at **32%**, the majority are concentrated in administrative and lower-skilled roles. Leadership remains male-dominated: while in the energy sector women hold 39.2% of executive roles and 47.5% of C-suite positions in the private sector, they represent only 18.1% of board-level leadership—figures that, while relatively high compared to the regional standard, still signal underrepresentation in strategic energy governance. Moreover, only **27% of senior positions** in public energy agencies are held by women, and women account for fewer than **7% of energy-related startup founders,** compared to 20% in other sectors. Women also continue to earn **approximately 15% less than men** in the energy sector, even when possessing similar qualifications and experience.[49]

Figure 16. Percentage share of women in executive and board roles in energy sector



Source: UNESCAP [49]

These gender gaps are reinforced by systemic barriers, including **limited access to STEM education**, where women make up less than **30% of graduates** in energy-relevant fields in Thailand, and by the lack of flexible workplace policies, childcare support, and mentorship programmes within energy institutions. In rural areas, energy poverty further compounds gender inequality. Women in low-income households often rely on biomass or diesel for cooking and lighting—fuels that are both health-damaging and increasingly costly. As women are typically in charge of performing cooking-related tasks, they are disproportionately exposed to harmful fumes generated by charcoal, wood or kerosene, worsened when stoves are located inside homes, without a separate room used as a kitchen, as the lack of proper ventilation creates harmful concentrations of solid particulate matter.[38] According to national household energy data, over **79% of the energy poor in Thailand live in rural areas,** where women are disproportionately responsible for collecting fuelwood, managing household energy, and bearing the brunt of unreliable or expensive electricity services. These dynamics not only limit women's time for education and income-generating activities but also contribute to persistent poverty cycles.

The energy transition—if not inclusive by design—risks reproducing or deepening these inequalities. For example, while the clean energy sector in Thailand is projected to generate over **172,000 new jobs by 2050,** there are currently no mechanisms to ensure that women benefit equitably from these opportunities. Without targeted interventions, women may be excluded from reskilling pathways, green apprenticeships, and entrepreneurship in emerging fields like electric mobility, solar PV, and energy storage. Data from IRENA shows that women make up only **12% of the global wind energy workforce and 32% in solar PV**—figures that are likely even lower in Southeast Asia.

To correct this trajectory, Thailand must embed gender equity across the just energy transition framework. This includes setting **gender-disaggregated employment and training targets,** investing in **inclusive skills development programmes, expanding access to finance for women-led clean energy enterprises,** and integrating **gender impact assessments** in national energy and climate strategies such as the NEP 2025, NDC 3.0, and NESDP 14. Thailand could also build on ASEAN-level frameworks, such as the **Roadmap on Accelerating Renewable Energy through Gender-Responsive Energy Policies,** to standardize data collection, adopt quotas for women's leadership in energy decision-making bodies, and replicate successful programmes—such as the **Young Executive Development Programme,** which has trained dozens of women for leadership roles in the Ministry of Energy and related agencies.

In short, placing women at the center of Thailand's energy transition is not only a matter of rights and representation—it is an economic and developmental imperative. Advancing gender equality in energy can accelerate innovation, expand the skilled workforce, reduce energy poverty, and ensure that the benefits of the transition are broadly and shared.

48 Partnership for Action on Green Economy, "Green Jobs Policy Readiness Assessment in Thailand," 2023. [Online]. Available: https://www.un-page.org/static/b74b5cc546ce1fc357b717243cf0a8f9/gj-policy-readiness-assessment-in-thailandf.pdf.

49 United Nations Economic and Social Commission for Asia and the Pacific, "Gender Equality Enables a Just Energy Transition," 20 November 2024. [Online]. Available: https://www.unescap.org/blog/gender-equality-enables-just-energy-transition.

▸ Opportunities

Despite these challenges, Thailand's just energy transition holds immerse potential to create green jobs, empower communities, and promise broader social inclusion. According to the ILO, should Thailand achieve 100% renewable energy by 2050, it is projected to generate over 172,164 jobs in renewable energy sector.[50] This transformation provides an opportunity not only for employment growth, but also improve job quality, working conditions, and gender equity in the labour market.

Thailand's green job opportunities in Energy Sector

The Office of the Permanent Secretary for the Ministry of Labor in Thailand defines green jobs as jobs in businesses that produce goods or services that benefit the environment or natural resources, including research and development, installation, and maintenance services; as well as jobs with environmentally friendly processes or that reduce the use of natural resources, or that engage in the dissemination of knowledge on the tools and methods to reduce environmental impacts.[48]

Thailand's vision of "100% renewable energy by 2050" aims to direct employment generated by the renewable energy sector, which would create 172,164 jobs. This means an average job creation of more than 4,600 jobs per year. Modern biomass and solar would then employ the largest number of people with 77,964 and 76,964 jobs, respectively, followed by wind and biogas. Jobs in the renewable energy sector will need to be developed to include decent work standards and with a focus on job quality.

A critical enabler of this transition will be **reskilling and upskilling programmes,** particularly for workers at risk of displacement. These programmes should be designed to recognise and build on existing transferable skills, while introducing new competencies needed in the clean energy economy. Under the Ministry of Labor's policy on labor skills development, the Department of Skills Development has taken responsibility for accelerating up-skilling training that will place an emphasis on energy technology applications. These efforts can be further expanded to include customised curricula, digital learning platforms and public-private training partnerships.

50 International Labour Organization, "Green jobs and just transition policy readiness assessment in Thailand," 23 March 2023. [Online]. Available: https://www.ilo.org/resource/brief/green-jobs-and-just-transition-policy-readiness-assessment-thailand.

51 World Bank Group, "Rural Thailand Faces the Largest Poverty Challenges with High Income Inequality," 21 October 2022. [Online]. Available: https://www.worldbank.org/en/news/press-release/2022/10/21/rural-thailand-faces-the-largest-poverty-challenges-with-high-income-inequality.

Skills Development Initiatives in EV Industry

The Ministry of Higher Education, Science, Research, and Innovation (MHESI) launched the "MHESI For EV" initiative in 2024, focusing on Electric Vehicle-Human Resource Development (EV-HRD), to train 150,000 people in EV-related skills within five years.

The EV-HRD action plan follows four approaches:

1. Flexible and responsive programmes that meet job position or employee demands,
2. Capacity building programmes for manufacturers in the EV supply chain,
3. Educational programmes operating under the higher education sandbox, and
4. Providing experts and research support to the industry and fostering international collaboration.

Source: MHESI [88]

To ensure no one is left behind, inclusive policies should support the participation of women, youth, and marginalised groups in the energy workforce. This includes **supporting STEM education,** leadership development for women in energy institutions, and targeted training and mentorship for youth and PWDs. Entry-level job creation, internships, and training in the renewable energy sector can help bridge the gap for new entrants into the labour market as well as ensure that they are equipped for a life-long career in the sector.

Greater social inclusion can be achieved through **transparent and participatory planning** where communities and citizens are allowed to actively involve in designing and monitoring energy transition initiatives. Multi-stakeholder platforms and consultation mechanism can help build trust, ensure that community needs are addressed, and reinforce local buy-in—particularly in areas affected by fossil fuel phase-outs or new renewable infrastructure projects.

4.3 Economic Equity and Competitiveness

A key objective of just energy transition is to ensure that the transition to a low-carbon economy is inclusive, benefiting all segments of society. One of the most pressing challenges Thailand faces is the issue of energy poverty, which disproportionately affects rural and underserved communities. These communities often have limited access to reliable and affordable energy, leaving them vulnerable to high energy costs and environmental degradation. **Further, the transition must include technical and financial support to leapfrog carbon-intensive industries and develop the new skills and expertise** required to expand into emerging (green) economic sector to create more resilient and diversified economies.

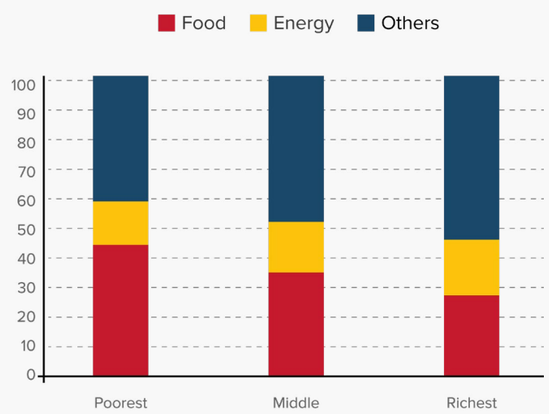
▸ Challenges

According to the World Bank, Thailand has made remarkable progress in reducing poverty from 58% in 1990 to 6.8% in 2020, driven by high growth rates and structural transformation. However, 79% of those energy poor individuals are disproportionately clustered in rural areas – notably in agricultural households.[51] This uneven distribution of energy poverty has also been uneven across the geographic regions of Thailand, with the energy poverty rate in the South and in the Northeast almost double that of the national energy poverty rate.

The Thai economy has been long suffering from widening inequality, with the proportion of poor people about 6-8% of the total, particularly in the agricultural sector.[52] Therefore, the just energy transition must address the broader issue of inequality in energy consumption and ensure that the transition does not further exacerbate the wealth gap.

IMF analysis shows that energy consumption across income categories is significantly higher in Thailand than the averages in other regions of the world including in Asia and the Pacific.[53] It also shows the differentiated impact of inflation on households depending on their income levels and consumption patterns. It breaks down the average headline inflation of 6.1% in 2022 by income and expenditure groups. The figure suggests that the poorest in Thailand are affected by both food and energy inflation while the richest segment of the population are mostly affected by rising energy prices.

Figure 17. Share of Food and Energy in Total Expenditure in Thailand

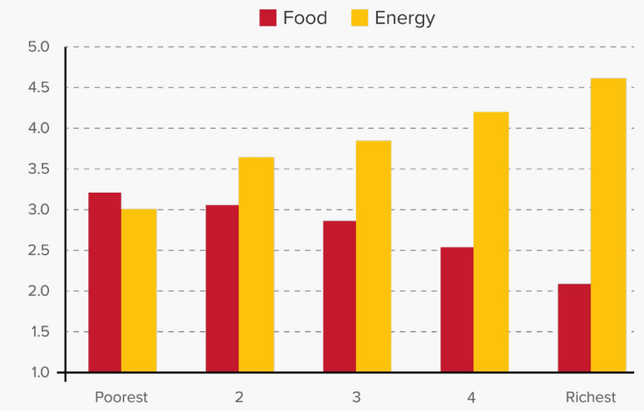


Source: IMF [53]

52 Bangkok Post, "Thailand's inequality remains entrenched," 27 June 2023. [Online]. Available: https://www.bangkokpost.com/business/general/2599963/thailands-inequality-remains-entrenched.

53 International Monetary Fund, "Who Pays the Bill? Distributional and Fiscal Consequences of Elevated Inflation in Thailand," 2 February 2024. [Online]. Available: https://www.imf.org/en/Publications/WP/Issues/2024/02/02/Who-Pays-the-Bill-Distributional-and-Fiscal-Consequences-of-Elevated-Inflation-in-Thailand-544396.

Figure 18. Contribution of Inflation Components for Households, By Income



Source: IMF [53]

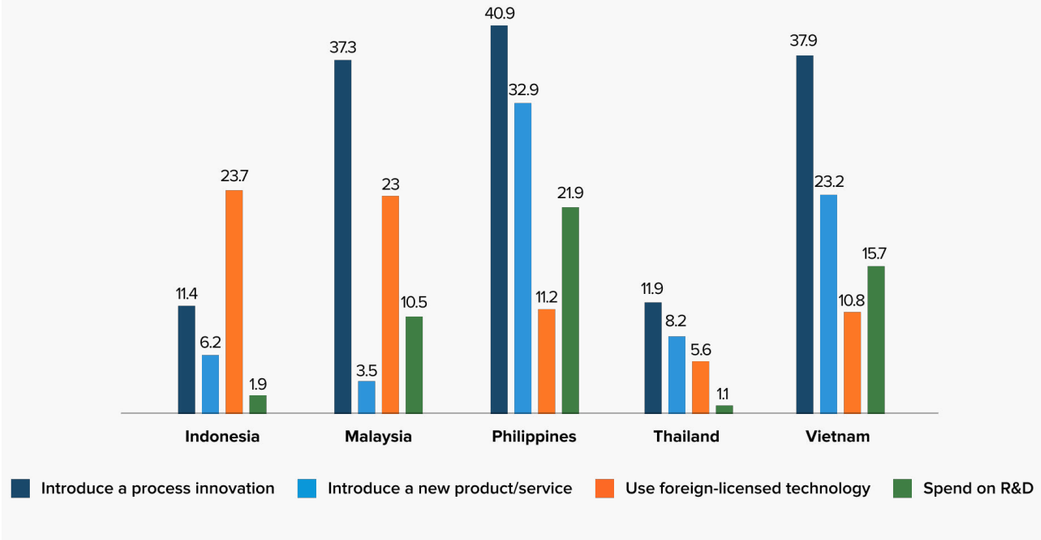
Apart from an economic equity, addressing the decent work impact of a transition and building the capacity of SMEs to adopt green practices is crucial since Thai SMEs formed the backbone of national and local economies, representing 98% of all businesses and 72% of total employment.[54] According to the World Bank,[55] one critical finding shows that investments in SME R&D **remain concentrated in only a few firms and are lower than in peer and other middle-income countries** such as Vietnam and Philippines, despite Thailand's relatively good performance in terms of aggregate R&D intensity. **Furthermore, Thailand lags regional peers in high-skilled labor availability, and the weak Technical and Vocational Education and Training (TVET) system disproportionately impacts SMEs,** which lack the resources to invest in workforce development compared to larger firms. Hence, those could significantly lead to future Thailand's position and competitiveness regarding less innovative and productive in global value chains.

54 SCB Economic Intelligence Centre, "The journey of Thai SME," 2024. [Online]. Available: https://www.scbeic.com/th/detail/file/product/9590/gzo6dhozd6/In-focus-SME-survey-20240906.pdf.

55 World Bank, "Thailand Economic Monitor February 2025: Unleashing Growth – Innovation, SMEs and Startups," 14 February 2025. [Online]. Available: https://www.worldbank.org/en/country/thailand/publication/thailand-economic-monitor-february-2025-unleashing-growth-innovation-smes-and-startups.

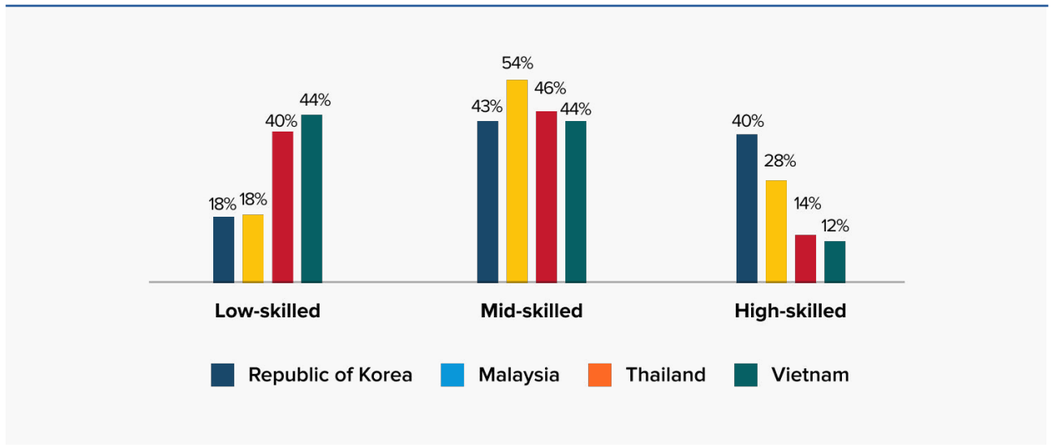
56 United Nations Development Programme, "Clean Air Without Border: Crossing Boundaries to Collaborate for Clean Air in Thailand and Lao PDR," 14 June 2024. [Online]. Available: https://www.undp.org/laopdr/blog/clean-air-without-border-crossing-boundaries-collaborate-clean-air-thailand-and-lao-pdr.

Figure 19. Share of firms that engage in innovation activities (%)



Source: The World Bank [55]

Figure 20. Share of labour force in each skill level (%)



Source: The World Bank [55]

57 IQ Air, "World Air Quality Report," 2018. [Online]. Available: https://www.iqair.com/dl/pdf-reports/world-air-quality-report-2018-en.pdf.
58 Greener Bangkok, "Where Does PM2.5 Dust in Bangkok Come From? And How Can It Be Prevented?," 22 May 2024. [Online]. Available: https://greener.bangkok.go.th/%E0%B8%9D%E0%B8%B8%E0%B9%88%E0%B8%99-pm-2-5-%E0%B9%83%E0%B8%99%E0%B8%81%E0%B8%A3%E0%B8%B8%E0%B8%87%E0%B9%80%E0%B8%97%E0%B8%9E%E0%B8%AF-%E0%B8%A1%E0%B8%B2%E0%B8%88%E0%B8%B2%E0%B8%81%E0%B9%84%E0%B8%AB/.

▸ Opportunities

Just Energy Transition presents a significant opportunity to reduce energy poverty by expanding access to clean, affordable, and reliable energy in rural and underserved areas. Distributed energy resources, such as rooftop solar and community-based energy systems, can play a crucial role in decentralizing energy production and bringing electricity to remote regions. Off-grid and microgrid solutions can provide an immediate solution for communities that are not yet connected to the central grid, ensuring that even the most remote areas have access to clean energy.

Urban areas and wealthy households often have greater access to energy-efficient technologies and clean energy, while rural and low-income communities are left behind. **By ensuring that the benefits of clean energy (such as lower energy costs and improved reliability) are distributed equitably, just energy transition can help reduce inequality and promote social cohesion.** Public awareness campaigns and educational initiatives can also help empower communities to take advantage of renewable energy opportunities. By raising awareness about the financial and environmental benefits of clean energy, the Thai government can encourage greater participation in renewable energy projects, particularly in rural areas. As most of the renewable energy infrastructure would be located in rural areas, investments in expanding renewable energy production could offer employment opportunities for rural women, with the provision of adequate training.[38]

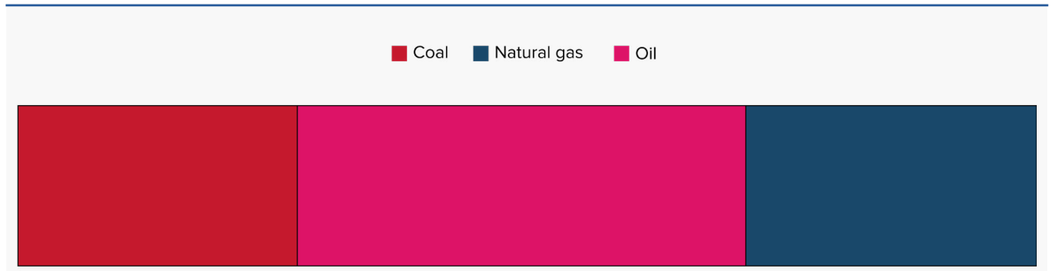
SMEs are crucial to Thailand's economic growth. **Empowering SMEs is a cornerstone for Thailand in building a strong adaptive economy, particularly in a landscape where global value chains are constantly shifting.** Innovation is also the key driver of long-term competitiveness, and Thailand can accelerate economic growth by encouraging SMEs to embrace new technologies while equipping the workforce with reskilling and upskilling initiative. This workforce development programme could be tailored to high-growth sectors, ensuring employees are equipped with the latest industry-relevant skills.

© Shutterstock
Distributed energy resources, such as off-grid solar panels, play a crucial role in decentralizing energy production and bringing electricity to remote regions.

4.4 Achieving Environmental Sustainability

A core pillar of Thailand's Just Energy Transition is the urgent need to address the environmental consequences of fossil fuel dependence. While Thailand has made progress in deploying renewable energy and advancing transport electrification, continued reliance on coal, oil, and natural gas has resulted in widespread air pollution, ecosystem degradation, and mounting GHG emissions. These challenges threaten not only the environment but also public health and economic productivity, underscoring the importance of embedding sustainability into every facet of the energy transition.

Figure 21. CO2 Emissions by Fuel, Thailand, 2022



Source : IEA [33]

▸ Challenges

Fossil fuel-based energy system remains a significant source of environmental pollution in Thailand and Southeast Asian. Southeast Asia is one of the regions that suffers the most with over 2 million deaths annually. According to the World Health Organization (WHO), the region recorded the highest urban ambient air pollution levels in the world in 2016. An estimated 2.4 million premature deaths were attributed to air pollution.[56] Air Quality Report from IQAir found that 95% of Southeast Asian cities surveyed exceeded the WHO's annual exposure guideline.[57]

Major urban centres, like Bangkok, consistently face **PM2.5 levels above safe thresholds,** primarily due to emissions from **diesel vehicles, followed by secondary sources (e.g. power plants, and industrial activity), biomass burning and gasoline vehicles.**[58] This air pollution has severe health consequences, contributing to respiratory diseases, cardiovascular illness, and premature death, while reducing worker productivity and increasing healthcare costs.

Compared to other Southeast Asian countries, in Thailand and Malaysia, which have elevated levels of fine particulate matter annually, related deaths have been somewhat mitigated thanks to more advanced health-care services and infrastructure.[38] Nevertheless, in Thailand specifically, annual all-cause mortality has been estimated to be almost 40 000, with the percentage of deaths attributed to PM2.5 at nearly 17% for lung cancer. Country factsheets indicate that 5% of total air pollution deaths in Thailand concern children under five and 9% of adults over 70. According to the World Bank, **PM2.5 air pollution is costing Thailand an estimated 6% of GDP per year.**[59,60]

The **transport sector**—the second largest contributor to energy-related CO_2 emissions—remains dominated by internal combustion engine vehicles, particularly in freight and personal transport. Despite recent EV adoption progress, systemic challenges such as limited public transit coverage, and urban congestion continue to hinder emissions reductions. Moreover, while EVs offer local air quality improvements, their full climate benefits are currently constrained by the high emission factor of Thailand's electricity grid, which remains largely dependent on fossil fuels. Additionally, fossil fuel subsidies and inconsistent enforcement of emission standards have delayed the transition to cleaner alternatives.

In the **power generation sector,** coal and natural gas continue to emit substantial amounts of **sulfur dioxide (SO_2), nitrogen oxides (NOx) and particular matter,** which not only contribute to smog and acid rain but also accelerate climate change and biodiversity loss. Meanwhile land-use change and fossil fuel extraction have degraded ecosystems particularly in rural and coastal areas.

Green School Project-A Community-based Renewable Energy Project

In Sop Pong, located in Pang Ma Pha District of Mae Hong Son, the community has pioneered renewable energy project, which installed solar panels across community buildings and homes. The "Green School Project," has revolutionized local education by powering schools entirely through solar energy. This project not only reduces carbon emissions but also lowers energy costs, demonstrating a model of eco-friendly infrastructure. It addresses the immediate concerns of air pollution and lays the groundwork for a sustainable future, showcasing the power of community involvement and innovative practices in creating lasting environmental change.

Source: WHO [61]

59 World Bank Group, "Thailand Economic Monitor: Thailand's Pathway to Carbon Neutrality: The Role of," December 2023. [Online]. Available: https://www.worldbank.org/en/country/thailand/publication/temdec2023.

60 Thailand Pollution Control Department et al., "Simultaneously Achieving Climate Change and Air Quality Goals in Thailand," October 2023. [Online]. Available: https://www.ccacoalition.org/sites/default/files/policy-documents/Thailand%20Integrated%20Air%20Pollution%20and%20Climate%20Change%20Mitigation%20Assessment%20Final%20%281%29.pdf.

61 World Health Organization, "Thailand's Grassroots' Path to Environmental Health and Battle Against Air Pollution," 22 February 2024. [Online]. Available: https://www.who.int/thailand/news/feature-stories/detail/thailand-s-grassroots--path-to-environmental-health-and-battle-against-air-pollution.

As Thailand accelerates its transition to clean energy, the robustness of supply chains for key technologies becomes increasingly critical. IEA highlights that the production and manufacturing stages of clean energy technologies—such as solar panels, wind turbines, and batteries—account for over 90% of their total CO_2 emissions. This underscores the importance of not only deploying these technologies but also **ensuring that their supply chains are sustainable and resilient.**

▸ Opportunities

Thailand's transition to clean energy presents a major opportunity to reverse environmental degradation, improve public health, and build climate resilience. Scaling up the deployment of **renewable energy,** particularly solar, wind, and sustainable bioenergy, can reduce emissions of GHGs and local air pollutants, while lowering Thailand's overall ecological footprint. Accelerating the **retirement of coal-fired plants** and reducing reliance on gas in power generation would significantly decrease particulate and chemical emissions.

Electrifying the **transport sector**—including the adoption of EVs, electric buses, and rail—offers one of the fastest routes to improve air quality. The transition to **cleaner two- and three-wheelers**, which dominate mobility in many Thai cities and towns, can deliver immediate health and climate benefits. Thailand's commitment to enforce Euro 6 vehicle emission standards for new petrol engine vehicles in 2025 represents a critical step in this direction. By sharply reducing NOx and particulate matter, Euro 6 not only offers co-benefits for urban air quality but also contributes to reducing overall GHG emissions in the near term—particularly for vehicle segments not easily replaced by EVs.[62] Moreover, expanding active transport infrastructure (e.g., cycling and walking paths) and modernising public transport systems can also reduce emissions while enhancing social inclusion.

In addition to emission reductions, Thailand can embed **circular economy practices** into the energy transition. Technologies such as **biomass, biogas, and waste-to-energy** can transform agricultural waste and organic residues into clean power, reducing methane emissions from landfills and improving waste management. These practices not only reduce emissions but also contribute to the sustainable management of natural resources as well as offer co-benefits in terms of rural job creation and energy access.

By seizing these opportunities, Thailand can not only improve environmental sustainability but also position itself as a **regional leader in green growth**, delivering co-benefits for public health, biodiversity, and climate adaptation—while building a low-carbon, nature-positive energy future.

62 The Nation, "Environment board to enforce Euro 6 standard on petrol engines," 17 November 2024. [Online]. Available: https://www.nationthailand.com/business/automobile/40043362.

© Oporty786 / AdobeStock
Thailand's transition to clean energy presents a major opportunity to reverse environmental degradation, improve public health, and build climate resilience.

5. Enabling Environments for the Just Energy Transition

5.1 Enhanced Collaboration: Harmonizing Market and Regulatory Reforms

According to the IEA, in order for Thailand to be on track to achieve its NDCs by 2050 and 2065, it will need to deploy 32 GW of additional variable renewable energy (i.e. wind and solar) to the grid by 2030.[63] The Government has recognised the importance of alternative, especially renewable energy sources and EVs, and put in place policies and incentives to promote development of renewable energy and EVs. However, to realize the full potential of this transition, addressing key market and regulatory barriers is essential.

Streamlining administrative and permitting processes will not only accelerate project timelines but also create a more attractive investment environment for both domestic and international stakeholders. Addressing concerns over power market risks, centralization, and the reliability of renewable energy can help build public and investor confidence. Furthermore, expanding the role of local service providers and developing a clear regulatory framework for third-party ownership models will empower communities to actively participate in the transition.

While the approval process for renewable energy projects can involve multiple regulatory steps, these procedures present an opportunity for improvement. By enhancing efficiency in areas such as land permits, environmental clearances, and grid connections, the government can accelerate project timelines, reduce costs, and create a more supportive environment for developers. Addressing potential inconsistencies in local implementation will further ensure smoother, faster approvals and greater policy alignment across levels of government.

Although there is ongoing support for fossil fuel projects and resistance from state-owned enterprises with vested interests in conventional energy, these challenges present an opportunity to shift the focus toward clean energy. With targeted policy reforms and stronger coordination, the government can effectively navigate these vested interests and overcome obstacles.

63 International Energy Agency, "Thailand's Clean Electricity Transition," August 2023. [Online]. Available: https://www.iea.org/reports/thailands-clean-electricity-transition.

64 Climate Investment Funds, "How Thailand's Solar Power Visionary Built an Industry with a Boost from IFC," 25 November 2014. [Online]. Available: https://www.cif.org/news/how-thailand%25E2%2580%2599s-solar-power-visionary-built-industry-boost-ifc.

Thailand's Electricity Market

Thailand's energy market is centered around the state-owned Electricity Generating Authority of Thailand (EGAT), which is responsible for generating, transmitting and wholesaling electricity, and whose own generating capacity accounted for 34% of Thailand's total electricity generating capacity as of the end of 2022. As the Transmission System Operator (TSO), EGAT oversees the balance of the supply and demand in the transmission system and controls and administers all the electricity generated in provincial areas from those power plants connected with its high-voltage transmission lines and high-voltage substations. EGAT is the only organization that can purchase or resell wholesale electricity to other distributors.

Besides EGAT, there are two retail distributors who are responsible for distributing and providing low-voltage electricity to end users, the Metropolitan Electricity Authority (MEA) and the Provincial Electricity Authority (PEA), with the MEA servicing Bangkok, Nonthaburi and Samut Prakan provinces (28% of the market in 2019), while the PEA services the remainder of the country (71% in 2019).

Source: BOI

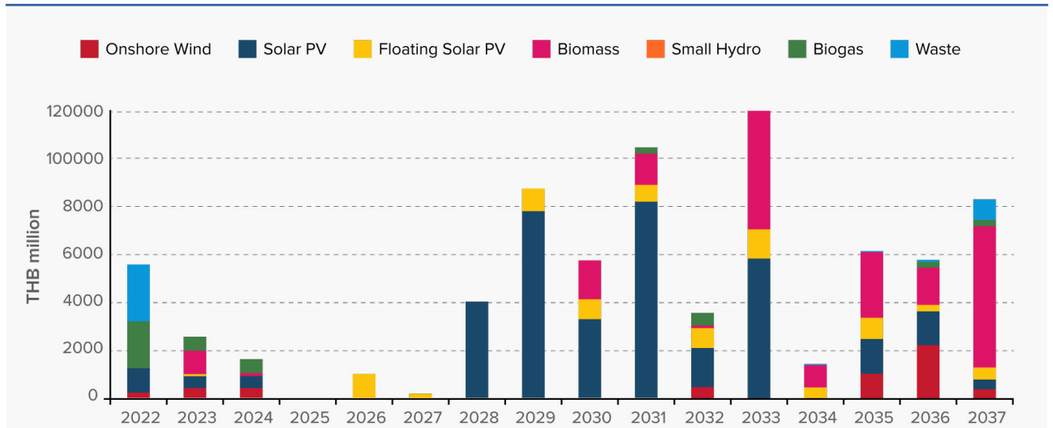
Effective policy coordination is key to accelerating the energy transition. With multiple government agencies involved, there is a greater potential to enhance collaboration and ensure seamless implementation. Harmonizing grid connection codes across electricity authorities will simplify project development and improve efficiency. Strengthening coordination between central and sub-national governments will also foster more integrated, cohesive efforts, driving the transition toward a sustainable energy future.

5.2 Addressing Inequities in Financing the Just Transition

Thailand has made impressive strides in renewable energy finance, attracting over USD 11 billion in renewable energy investment from 2014 to 2023, according to OECD.[5] Looking ahead, it is estimated that the investment needs in new renewable power during 2022 - 2037 will amount to Thai Baht (THB) 779 billion (USD 22 billion), whereas investment needs in energy efficiency improvements in industrial, commercial, residential and agricultural sectors are predicted to reach THB 974 billion (USD 28 billion), over the same period. These figures highlight significant opportunities for both public and private sector investments to drive Thailand's just energy transition.

While Thailand has made positive progress to deploy large-scale renewable power capacity over the past decade, there is considerable untapped potential in financing small-scale renewable power solutions such as solar, wind and bioenergy. The Thai government has already allocated resources for the development of renewable energy from its national budget and has set up a few funds to support clean energy, including the Energy Conservation Promotion Fund (ENCON Fund), Energy Efficiency Revolving Fund (EERF) and the Power Development Fund. These initiatives create a strong foundation for further private and public sector collaboration, development of frameworks, offering opportunities to unlock new financing mechanisms, financing and access to capital and foster the growth of both large- and small-scale renewable energy projects.

Figure 22. Estimates of annual investment needs for new renewable energy installations in the power sector (2022-2037)



Source : OECD [5]

Private sector investment is essential for scaling up renewable energy projects in Thailand and advancing the country's clean energy transition. With investment needs in new renewable power during 2022 – 2037 amounting to Thai Baht (THB) 799 billion (USD 22 billion) combined with a supportive regulatory environment, including favourable policies and incentives, Thailand is increasingly attractive to private investors. This environment creates significant opportunities to drive the growth of renewable energy initiatives.

To maximize these opportunities, Thailand can continue to innovate in financing mechanisms, pilot green credit guarantee schemes, and provide incentives for both multinational corporations and SMEs to adopt renewable energy. Facilitating Power Purchase Agreements and ensuring smooth private sector participation in distributed energy projects will help unlock substantial investment in the just energy transition. **Additionally, Thai Government could have a significant leverage to drive climate investments through strategic policy-making and financial incentives.** They can do this by issuing sovereign green bonds linked to equitable transition principles, for instance, or by setting up just energy transition funds that could not only attract domestic investors by providing

financial support for retraining and reskilling workers, developing new economic opportunities, and ensuring social protection for vulnerable groups, but also international investors who prioritise sustainable projects, funneling capital into clean energy, infrastructure, and other green initiatives through providing both credit enhancement and technical assistance facility.

Blended finance also holds considerable potential for mitigating risks and attracting investment in renewable energy projects. By combining concessional funds with commercial capital, blended finance reduces the cost of capital and enhances returns, making projects more appealing to investors. For example, the International Finance Corporation (IFC) blended $8 million of its commercial funds with $4 million from the Clean Technology Fund (CTF) to support Solar Power Company Group (SPCG) solar projects.[64] This combination not only facilitated the financing of specific solar farms but also sent positive signals to local banks, encouraging them to invest in subsequent projects.

Thailand has significant potential to strengthen its financial institutions, government bodies, and project developers, building their capacity to design and implement successful blended finance projects. Developing a pipeline of bankable projects and specialized financial products—such as risk mitigation tools and long-term financing options—will help attract further investment and accelerate the country's transition to sustainable energy.

Carbon finance is another growing opportunity for Thailand to support its clean energy transition. Through mechanisms like carbon trading, carbon credits, and participation in international carbon markets, Thailand can generate additional funding for clean energy projects while meeting climate targets. The government is exploring carbon pricing mechanisms, including pilot projects for an Emissions Trading System (ETS),[65] and is laying the groundwork for a nationwide carbon market, encouraging emissions reductions through carbon credit trading.

The Thai government and private sector are also tapping into **green bonds** to fund renewable energy projects. In 2023, the value of green bonds issued in Thailand came to THB 33 billion, or 4.3% of the value of all private-sector bonds issued in the year. Over the period 2018 to 2023, green bond issuance totalled THB 157 billion, or 3.3% of the total market for bonds.[6] For example, Gulf Energy Development Public Company Limited (GULF) successfully raised THB 8,000 million of green bonds for its wind power project together with THB 12,000 million of non-green bonds.[66] In 2024, the government issued its first Sustainability-Linked Bond (SLB), marking a significant step in integrating national sustainability goals into sovereign debt instruments. As of 2025, the total outstanding amount of this SLB stands at THB 98 million. This landmark issuance positioned Thailand as the first country in Asia—and the third globally, after Chile and Uruguay—to launch a sovereign SLB.

65 Bangkok Post, "Thailand to launch new carbon credits market to boost trading," 16 January 2025. [Online]. Available: https://www.bangkokpost.com/business/general/2941237/thailand-to-launch-new-carbon-credits-market-to-boost-trading.

66 Gulf, "GULF successfully issued its inaugural green bonds with overwhelming demand from investors to support its clean energy goals," 30 March 2023. [Online]. Available: https://www.gulf.co.th/en/newsroom/news-and-activities/173/gulf-successfully-issued-its-in-augural-green-bonds-with-overwhelming-demand-from-investors-to-support-its-clean-energy-goals.

67 Southeast Asia Infrastructure, "UOB launches U-Solar programme in Thailand to support local solar industry ecosystem," 23 March 2020. [Online]. Available: https://southeastasiainfra.com/uob-launches-u-solar-programme-in-thailand-to-support-local-solar-industry-ecosystem/.

Private sector companies, particularly in manufacturing and industry, are aligning their operations with global sustainability standards. Multinational corporations in Thailand are committing to **Science-Based Targets (SBTi)** to reduce their carbon footprints, creating increasing demand for renewable energy. This demand serves as a strong incentive for private companies to invest in clean energy projects, further advancing Thailand's energy transition.

Community-based financing mechanisms also present significant opportunities, such as cooperatives for rooftop solar installations, which can address energy access challenges in rural areas. The U-Solar programme, initiated by UOB Thailand in 2020, serves as Asia's first integrated solar energy financing platform. This programme connects various stakeholders across the solar value chain, including businesses and consumers, facilitating access to financing solutions for solar projects. UOB provides comprehensive support such as project loans, green financing, and cash management services tailored for solar developers and end-users.[67]

Microfinance offers additional opportunities to support small-scale clean energy projects, particularly in rural communities. While access to microfinance for clean energy initiatives remains limited, there is a clear opportunity to expand these services. By developing tailored financial products for community energy projects and exploring innovative financing models—such as non-collateralized loans or blended finance—Thailand can unlock new pathways for rural areas to adopt clean energy solutions. This can strengthen community resilience, stimulate local economic growth, and contribute to sustainable development across the country.

5.3 Private Sector Engagement and SMEs

Private companies and industrial associations play a pivotal role in advancing Thailand's renewable energy objectives, particularly in scaling up solar, wind, and bioenergy usage, while accelerating the adoption of EVs. Thailand has emerged as a leader in Southeast Asia for solar panel manufacturing, hosting factories for major global players like First Solar and LONGi Green Energy, as well as local companies such as Sungrow Power Supply and Gunkul Engineering. Combined with Thailand's commitment to increase its renewable energy share to at least 50% by 2030, this can both reduce carbon emissions, create new industries and attract foreign investments in renewable energy sectors.

These manufacturers produce solar panels and related equipment that not only meet domestic demand but are also exported to markets across Asia, Europe, and the Americas. Thailand's competitive manufacturing environment, infrastructure, skilled labour force, and access to key markets make it an attractive base for renewable energy production.

Thailand's already established automotive manufacturing base further enhances its potential to become a regional hub for electric vehicle production. In 2023, Thailand ranked 10th in the world and number one in Southeast Asia as an automobile manufacturer.[68] With the growing global demand for EVs, with sales of over 17 million EV's over the course of the 2024 globally,[69] Thailand is well-positioned to capitalize on this shift and join the electric vehicle revolution.[70] Both domestic and international automotive companies, including Toyota, Honda, BYD are heavily investing in Thailand's EV market, creating jobs and driving innovation in green transportation technologies.

Thailand has set ambitious targets to become a regional leader for electric vehicles manufacturing, with already some large automakers setting up factories in Thailand. For example, China's BYD EV manufacturer announcing in 2024 the opening of its first Southeast Asia EV factory in Thailand, highlighting the ambitions to attract foreign investments and become the leading EV manufacturing and e-mobility hub in the region.[71] By ensuring just energy transition while advancing EV adoption, Thailand could address environmental impact, affordability, workforce shifts, and global supply chains, especially when considering the automative value chain including OEMs and their suppliers, plus manufacturers and operators of infrastructure to which Thailand will have opportunities to tap the growing demand for vehicles that produce minimal GHGs.

In 2023, the Thai Electric Vehicle Association (EVAT) signed a Memorandum of Understanding with 12 organizations to create a comprehensive network of charging stations for PHEVs and BEVs.[72] This initiative includes the launch of an EV charging station map on the EVAT website, marking a major step in the development of EV infrastructure.

Additionally, industrial associations are working to build localized supply chains to support the EV sector's growth. Strategic partnerships between local manufacturers and international companies are enhancing Thailand's battery production capabilities. This will further solidify Thailand's position as a regional leader in EV manufacturing. Attracting investments in the EV automotive manufacturing will also develop new industries linked to the EV supply chain and the production of batteries. As Thailand is already a large manufacturing hub in other industries and the countries proactive approach to developing policies and incentives towards the EV sector can lead to local suppliers producing parts, batteries and hybrid technologies for EV's, and foster a comprehensive EV ecosystem of suppliers, manufacturers and a skilled labour force that can enhance the investments from various automakers.

Together, these developments underscore the vibrant and competitive nature of Thailand's private sector. With a rapidly growing renewable energy market, robust manufacturing capabilities, and strategic investments in green technologies, the private sector is a driving force in accelerating Thailand's clean energy transition and can accelerate and scale up untapped renewable energy and EV potential.

68 Thailand Board of Investment, "Thailand Supercharged EV Sales Poised for a New Surge," 2024. [Online]. Available: https://www.boi.go.th/index.php?page=press_releases_detail&topic_id=135688&_module=news&from_page=press_releases2&language=en.

69 International Energy Agency, "Global EV Outlook 2024," April 2024. [Online]. Available: https://www.iea.org/reports/global-ev-outlook-2024/executive-summary.

70 International Energy Agency, "Cheaper electric cars: The key to unlocking mass-market adoption," 20 December 2024. [Online]. Available: https://www.iea.org/commentaries/cheaper-electric-cars-the-key-to-unlocking-mass-market-adoption.

71 Reuters, "China's BYD opens EV factory in Thailand, first in Southeast Asia," 4 July 2024. [Online]. Available: https://www.reuters.com/business/autos-transportation/chinas-byd-opens-ev-factory-thailand-first-southeast-asia-2024-07-04/.

72 Environmental and Regional Planning, Research and Consulting, "Thai Electric Vehicle Association joins with 12 organizations to develop charging station networks," 2 August 2023. [Online]. Available: https://www.exri.co.th/post/thai-electric-vehicle-association-joins-with-12-organizations-to-develop-charging-station-networks.

▸ Small and Medium-sized Enterprises (SMEs)

With over 3.1 million SMEs contributing more than 35% of Thailand's gross domestic product in 2023, these businesses are central to the country's economic growth and crucial to the success of its energy transition.[73] SMEs are particularly well-positioned to drive localized clean energy solutions, such as solar rooftop installations, energy-efficient technologies, and sustainable practices for small businesses. Their agility and innovation make them key players in accelerating Thailand's just energy transition and creating new job opportunities.

The clean energy and EV sectors also present market significant opportunities for SMEs. As demand for affordable and sustainable energy solutions grows and Thailand emerges as a regional hub for EV manufacturing and related services, SMEs have vast opportunities to engage in these value and supply chains. This includes manufacturing energy-efficient products, battery storage, circular economy approach, software development, providing installation and maintenance services, and developing new clean technologies.

To unlock the full potential of SMEs in the just energy transition, the Thai government, alongside international partners and financial institutions, can play a critical role in providing targeted economic, financial, technical and policy support. This could include offering access to low-interest loans, grants, blended finance, and technical assistance tailored to the needs of small businesses. Encouraging partnerships between financial institutions and clean energy providers can also help SMEs overcome financial barriers and improve their capacity to integrate renewable energy technologies.

One notable example of such support is the partnership between UOB Thailand and A Solar Corporation in 2024, which aims to help SMEs decarbonize by adopting solar rooftop installations. Through this partnership, UOB Thailand offers SMEs credit lines at special interest rates, without requiring collateral, to install and maintain solar systems.[74] This initiative not only makes clean energy more accessible to SMEs but also sets a precedent for future collaborations that can scale up the adoption of renewable energy across the sector.

73 Bangkok Post, "Revamp policies to boost Thai SMEs," 31 July 2024. [Online]. Available: https://www.bangkokpost.com/opinion/opinion/2838707/revamp-policies-to-boost-thai-smes.
74 Bangkok Post, "UOB and A Solar Partner for SME Decarbonisation," 18 July 2024. [Online]. Available: https://www.bangkokpost.com/thailand/pr/2831483/uob-and-a-solar-partner-for-sme-decarbonisation.
75 Rystad Energy, "BRICS expansion to widen the renewable energy gap with the G7, ushering in new global market dynamics," 21 September 2023. [Online]. Available: https://www.rystadenergy.com/news/brics-expansion-to-widen-the-renewable-energy-gap.
76 ASEAN Centre for Energy, "ASEAN Plan of Action for Energy Cooperation (APAEC) 2016-2025 Phase II," 23 November 2020. [Online]. Available: https://aseanenergy.org/publications/asean-plan-of-action-for-energy-cooperation-apaec-phase-ii-2021-2025/.
77 Ministry of Foreign Affairs, "Minister of Foreign Affairs attended IPEF Ministerial Meeting in Singapore," 10 June 2024. [Online]. Available: https://www.mfa.go.th/en/content/fm-ipef-ministerial-en?cate=5d5bcb4e15e39c306000683c.
78 Bangkok Post, "Green deal powers Thailand's future," 9 October 2024. [Online]. Available: https://www.bangkokpost.com/opinion/opinion/2880348/green-deal-powers-thailands-future.

5.4 International and Regional Cooperation

As Thailand seeks to transition to a low-carbon, sustainable energy system, international partnerships, private sector engagement, policy reforms and attracting renewable energy investments will be critical to achieving the ambitious goals outlined in the country's energy transition framework. International organisations provide essential financial, technical, and policy support, while the private sector plays a vital role in driving investment, market development, innovation, and scalability of industries and job creation. Further, international and regional cooperation plays a vital role in securing a stable and resilient clean energy supply chain. As geopolitical risks and trade barriers continue to shift global dynamics, collaboration among nations can help mitigate vulnerabilities and promote energy security.

▸ Global Alliances and Regional Cooperation to Amplify Renewable Energy

Thailand's energy transition is a multi-faceted process that requires the involvement of numerous international stakeholders, including governments, international organisations, financial institutions, development agencies and the civil society. These global partnerships provide the financial resources, technical expertise, and policy frameworks necessary to support Thailand's transition towards a more sustainable and inclusive energy future, while ensuring no one is left behind.

Globally, Thailand plays a significant role as an economic powerhouse in trade and as a manufacturing hub in sectors such as automobiles, electronics and agriculture. Thailand maintains a balanced geo-political and a pragmatic foreign policy with partners such as the EU for manufacturing, with China, through the Belt and Road Initiative investments in infrastructure and with the United States on technology, defence and security.

In January 2025, Thailand joined the BRICS+ countries as partner nation to enhance its economic and trade ties with Brazil, Russia, India, China, South Africa the United Arab Emirates, Iran, Argentina, Egypt and Ethiopia. Countries that are part of the BRICS+ are poised to become global leaders and the drivers of the renewable energy sector in the next decades rapidly expanding their renewable energy capacity, aiming for over 80% of their power from renewables by 2050, surpassing the G7.[75]

On the regional level, Thailand is considered a key player in the ASEAN's economic growth, energy transition, and a geo-political actor between the North and South Asian regions. Being one of the five founding members of the ASEAN along with Indonesia, Malaysia, the Philippines, and Singapore and the second largest economy in Southeast Asia after Indonesia, Thailand plays an important role in economic growth of the region and is one of the leading manufacturing hubs in the region together with Vietnam and Indonesia.

The ASEAN Plan of Action for Energy Cooperation (APAEC) outlines the Southeast Asian region's

strategy for energy security, accessibility, affordability and sustainability for the period 2016 to 2025. With primary energy demand in the region expected to rise by 4.7% annually, ASEAN is preparing to ramp up clean energy production targeting to increase renewable energy to 23% of the energy mix by 2025, while reducing energy intensity by 32% by 2025 (ASEAN, 2020).[76] To fulfil these ambitions, key strategies include the expansion of the ASEAN Power Grid aimed at strengthening regional multilateral electricity trading, modernizing the grid and promote renewable energy across the region, the development of a Trans-ASEAN Gas pipeline to enhance gas and LNG connectivity and accessibility, and optimizing the role of clean coal and facilitating the transition towards sustainable and lower emission development. Additionally, APAEC supports multilateral electricity trading and investments in civilian nuclear energy research.

For Thailand, this regional framework aligns with the country's own just energy transition goals, particularly in scaling up renewables, modernizing the power grid, and improving energy efficiency. Given its strategic position in ASEAN, Thailand is a key participant in the ASEAN Power Grid project, facilitating cross-border electricity trade with Lao PDR, Cambodia, and Malaysia. The focus on cross-border energy connectivity also supports Thailand's ambition to become an energy trading hub in the region. However, to meet these goals, Thailand must accelerate grid upgrades, enhance energy storage solutions, and expand policies that ensure equitable access to clean energy technologies for all communities.

In its capacity within ASEAN's energy initiatives, Thailand is involved in assessing and identifying potential investment opportunities in renewable energy. This includes exploring innovative technologies and their applications in enhancing efficiency and effectiveness in energy production and consumption.

Thailand joined the Clean Economy Agreement under the Indo-Pacific Economic Framework for Prosperity (IPEF) in June 2024.[77] IPEF is a multilateral economic cooperation framework launched in 2022, with goals to strengthen economic ties across the Indo-Pacific region. The Clean Economy Agreement, dubbed "IPEF Pillar 3", focuses on building environmentally friendly economies through clean energy and green technology. Joining the agreement is expected to help Thailand's transition towards a green economy, with wider access to climate-friendly energy and technologies, and will improve its capacity to develop know-how in solar panel and battery production, methane leak detection and reduction, and hydrogen fuel.[78]

Thailand and Switzerland have completed the transfer of Article 6.2 carbon credits, marking the first ever for deal for emissions reductions under the Paris Agreement. The Swiss-based KliK Foundation purchased ITMOs from the Thai company Energy Absolute Public Co. Ltd. for the Bangkok E-Bus Programme. The Bangkok E-Bus Programme is designed to convert the fleet of private operators of e-buses in the Bangkok Metropolitan Area from internal combustion engines to electric vehicles.[79] Thailand is also strengthening cooperation with Japan, China, UK, Saudi Arabia in clean energy and low carbon economy.

79 The Nation, "TSB sells carbon credits to Swiss company," 10 January 2024. [Online]. Available: https://www.nationthailand.com/thailand/general/40034550.

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The Bangkok E-Bus Programme, supported by Swiss carbon finance, aims to shift private bus fleets from combustion engines to electric vehicles.

6. UNDP's Strategic Support for Just Energy Transition

With a robust energy offer, UNDP is well-positioned to help unlock the opportunities for a just energy transition in Thailand. With energy as one of its six signature solutions, UNDP's Strategic Plan 2022-2025 recognizes the transformative nature of SDG7. By leveraging strategic policy interventions, UNDP can support the Thai government to not only ensure that the energy transition is environmentally sustainable but also socially inclusive, unlocking significant opportunities for economic growth, job creation, and social equity. As a trusted development partner, UNDP delivers through close partnerships with UN agencies, international organisations, multilateral development banks, private sector and civil society. This section highlights the impactful support that UNDP can provide to help Thailand realize its ambitious energy transition goals by mobilizing financing and building enabling regulatory environments while maximizing the benefits of a sustainable energy future for all to deliver on the 2030 Agenda for Sustainable Development.

6.1 Aligning national energy and development strategies through Sustainable Energy Policy and Governance

Achieving a successful energy transition requires the integration of energy security, environmental sustainability, economic growth, and social justice into a holistic policy framework. Thailand's existing policy framework provides a good basis for tackling technical aspects of energy transition, such as power sector decarbonization, energy efficiency, electronic vehicles. Yet given the cross-cutting nature of energy as an enabler of sustainable development and of realizing human rights, a more holistic approach is needed that goes beyond energy systems alone. A holistic approach would connect a wide range of policy domains, such as economy, industry, labour and human resources, employment, finance, education, gender, technology, innovation, trade, investment, etc.

For example, UNDP has maintained a long-standing partnership with the Energy Community to advance the governance of a just energy transition through knowledge exchange and collaborative action. **Energy Community's Just Transition Initiative, which brings together the European Union and its neighbours, is established to ensure full recognition of rights and labour contributions, equal participation in decision-making processes and fairness, taking into account the various dimensions of just transition.**[80] This initiative is also driven by a set of principles, processes and practices that aim to "Greening the economy in a way that is as fair and inclusive as possible to everyone concerned, creating decent work opportunities and leaving

no one behind". Its objectives are to strengthen institutional frameworks to support just energy transitions by integrating just transition principles into key policies anstrategies (e.g., National Energy and Climate Plans, long-term strategies), fostering inclusive community engagement, promoting cross-sector collaboration, and encouraging regular exchange of best practices on energy justice, gender equality, and clean air.

In Vietnam, the Just Energy Transition Partnership (JETP) is mobilizing $15.5 billion in public and private funds over the next three to five years to help the country transition from coal while supporting communities and industries affected by the shift. UNDP is assisting the government in localizing the Global Accelerator on Jobs and Social Protection for Just Transitions, ensuring that social equity is at the heart of economic transformation. By 2045, Vietnam aims to become a high-income economy, where a just transition ensures that workers are not left behind in coalfields and factories, that small businesses are not excluded from the green and digital economy, and that women, youth, and vulnerable groups are not only protected but also uplifted. **Investments in renewable energy and sustainable infrastructure could generate up to half a million new jobs by 2030, particularly in sectors such as solar power, energy efficiency, and clean transport.**

In Indonesia, the energy transition presents both opportunities and challenges. The country aims to increase the share of renewables in its energy mix to 23% by 2025. **Achieving the targets set out in Indonesia's JETP Joint Statement could support one million domestic jobs in the renewable electricity sector by 2030.** However, systemic barriers such as fossil fuel subsidies, the monopolistic structure of the state-owned utility PLN, and inefficient procurement processes hinder progress toward renewable energy goals. Addressing these challenges is crucial to ensure that the energy transition contributes to economic growth, job creation, and poverty reduction.

The European Union offers a comprehensive and integrated model of energy transition, rooted in the broader ambition of the **European Green Deal**—a transformative agenda aiming to make Europe the first climate-neutral continent by 2050. Central to this effort is the **Renewable Energy Directive III (RED III),** which mandates that member states achieve at least **42.5% renewable energy in final energy consumption by 2030,** with an aspirational target of 45%.[81] Complementing this is the **EU's Just Transition Mechanism,** which allocates **€55 billion between 2021–2027** to support the regions, sectors, and workers most affected by the shift away from fossil fuels. The EU has also advanced regulatory innovation—introducing **streamlined permitting procedures, sectoral decarbonization roadmaps, and mandatory integration of energy and climate objectives into industrial, employment, and social policy.** Thailand could consider embedding similar framework to its forthcoming National Energy Plan (NEP 2025) and National Economic and Social Development Plan (NESDP 14), along with regionally differentiated targets and financing instruments to support vulnerable provinces. Furthermore, establishing a Thai Just Transition Facility, inspired by the EU model, could help mobilize domestic and international finance for retraining workers, supporting local industries, and expanding energy access in low-income communities—ensuring that equity is at the heart of Thailand's energy transition.

UNDP can support the government in building a sound energy governance system and policy framework, that ensures effective coordination among different ministries, and between central and

sub-national governments. By bringing in international and national expertise together, tailored to Thailand's context, UNDP can help unlock the full potential of clean energy and EVs. This can be achieved by setting-up cross-ministry and multi-stakeholder consultation mechanisms, screening and incorporating social and community considerations into energy policies, and facilitating the design, development, and implementation of holistic approaches and programmes to accelerate just energy transition, while ensuring energy security and justice.

For example, as Thailand prepares its **NDC 3.0 submission** and **its next five year development plan,** UNDP can work with other UN agencies to provide policy support in setting energy and transport related targets, aligning them with national and regional climate, energy, and socio-economic development strategies, including Thailand's National Economic and Social Development Plan, ensuring equitable access to clean energy, integrating just energy transition considerations such as social equity, gender equality, skills development, and assisting rural and low-income communities.

UNDP Just Transition Navigator for Eurasia

The Just Transition in Eurasia Navigator is UNDP's strategic response to the critical challenge of transitioning economies in Eurasia to a low-carbon future while ensuring fairness, inclusivity and equity. The Navigator outlines four interconnected areas of engagement that governments, communities, and businesses must navigate to manage the complexities of a low-carbon transformation. The framework underscores the importance of prioritizing social equity and gender equality, fostering economic diversification, and nurturing regenerative systems to sustain the planet's capacity to support thriving societies. Each of the four following areas works together to help ensuring that the transition is fair and inclusive and facilitates the delivery of the Paris Agreement

- **Reimagining and Diversifying Local Economies:** Empowering communities—especially those reliant on carbon-intensive industries—to build resilient, diversified economies. Emphasis is placed on circular and care-based economies to enhance local well-being and place-based attractiveness.
- **Accelerating a Fair and Inclusive Energy Transition:** Ensuring that energy reforms are equitable and inclusive by addressing energy poverty and making clean, affordable energy accessible to all.
- **Governance for a Just Transition:** Strengthening and adapting governance frameworks to manage the transition transparently and inclusively. This includes fostering collaborative stakeholder engagement and recognizing women as key agents of change.
- **Regional Scale and Impact:** Promoting cross-border collaboration to scale up learning, innovation, and the impact of just transition efforts across regions.

Source: UNDP [82]

Another example, as part of the Pacific Green Transformation Project, Japan has funded UNDP's efforts to provide significant technical advisory support to the Pacific Island countries, playing a crucial role in identifying energy policy needs and gaps across various countries. This included micro-grid regulation in Papua New Guinea, primary renewable energy legislation in Timor-Leste, secondary renewable energy legislation in Samoa, and the energy capacity development plan in Vanuatu. Additionally, the project developed technical training, to be held in Q1 of 2025 along with a High-Level Policy Dialogue, for Timor-Leste and other Pacific countries to manage innovative energy systems, focusing on digital grid technologies integration and energy storage solutions.

6.2 Delivering a just energy transition that empowers communities and leaves no one behind

So far, there is limited data and analysis on the impacts of the energy transition on social equity, employment, inequalities, exports, industrialization and gender equality in Thailand. This can lead to gaps in addressing the particular challenges and difficulties of vulnerable groups, rural and remote communities. Strengthening the understanding of these links can help to inform policy making and enhance local ownership and buy-in from different groups of society.

UNDP's is well-positioned to support central and sub-national governments, industries and sectors in mitigating these risks, avoiding unintended socioeconomic consequences of the energy transition to ensure no one if left behind. This can be delivered by conducting in-depth evidence-based analysis, organizing targeted capacity building and awareness-raising activities. UNDP has extensive experience in designing delivering stakeholder engagement strategies, targeting local communities in rural and remote places, women, youth, and vulnerable groups. Among these solutions, UNDP can help establish multi-stakeholder platforms that facilitate regular dialogue between the government, private sector, civil society, and local communities on energy transition issues and implementing monitoring and evaluation mechanisms that allow communities to track the progress of energy transition projects.

Furthermore, UNDP can help mobilize resources from development partners to deliver concrete assistance programmes and grants for skills development, gender-responsive solutions, and participatory planning processes at the local level for renewable energy projects.

80 Energy Community, "Governance for a Just Transition," [Online]. Available: https://www.energy-community.org/regionalinitiatives/Transition.html.
81 European Union, "Directive (EU) 2023/2413 of the European Parliament and of the Council," 18 October 2023. [Online]. Available: https://eur-lex.europa.eu/eli/dir/2023/2413/oj/eng.
82 United Nations Development Programme, "People at the Center: Navigator for UNDP Programming and Partnerships," January 2025. [Online]. Available: https://www.undp.org/sites/g/files/zskgke326/files/2025-02/just_transition_external.pdf.

UNDP's work on Energy and Gender Equality

UNDP aims to close gender gaps in access to modern, sustainable energy. With an ambitious 'moonshot' of closing energy gaps for 500 million people by 2025, UNDP is working to ensure that at least half are women. This work includes:

- Leveraging energy access to unleash women's economic empowerment, ensuring that women gain ownership of energy assets and benefit from the productive use of energy. This also includes working with public and private firms to create opportunities for women across energy value chains and guiding national plans and budgets to include the jobs and services that women want.
- Supporting energy investments that reduce time poverty, especially pursuing strategies to ensure energy access and technology consider the needs and preferences of women, particularly in vulnerable households, as a tool to save women's time and obviate the need for additional chores. Clean cooking solutions such as electric and more efficient stoves and subsidies for appliances most often used by women are also key.
- Promoting the inclusion of women in energy governance, guiding 'energy democracy' that includes community control over energy management and consumption, such as through energy cooperatives. These can open opportunities for women in leadership and employment while making energy cheaper, more available, sustainable, and aligned with local needs.
- Galvanizing new knowledge to guide a just energy transition that contributes to gender equality, connecting policymakers, women and women's groups, and other stakeholders to pursue energy for development that is resilient, sustainable and equitable.

6.3 Positioning Thailand as a regional innovation hub for EV's by overcoming barriers to scaling up renewable energy solutions

EVs and renewable energy, particularly solar, have made impressive strides in Thailand in recent years. There are huge opportunities to further accelerate this transition. By refining regulatory frameworks, enhancing economic incentives, and expanding grid and charging infrastructure, Thailand can unlock even greater potential. Strengthening energy storage capacity, developing viable business models, and expanding skills in areas such as design, testing, planning, installation, and maintenance of renewable technologies will pave the way for a robust, sustainable energy ecosystem. These efforts present significant opportunities for growth, innovation, and job creation across the country.

UNDP has a proven track record in driving impactful change in this area, exemplified by its successful implementation of the SDG and EV Climate Credit Programme in collaboration with the Thai government.[83] With extensive experience supporting developing countries in scaling up renewable energy and e-mobility solutions, UNDP has been a pioneer in promoting sustainable urban mobility for over 20 years. The organization has played a leading role in delivering transformative transport solutions, including bus rapid transit systems, advanced traffic management, the adoption of fuel cell vehicles (FCVs), and the integration of digital tools. Additionally, UNDP has championed active mobility initiatives, such as cycling and walking, further advancing sustainable, inclusive urban mobility solutions.

Promoting Electric Vehicle Use with the SDG and EV Climate Credit Platform

UNDP, in collaboration with the Office of Transport and Traffic Policy and Planning (OTP) and the automotive network, with support from the Government of Japan, launched the SDG and EV Climate Credit Program platform in 2024.

This innovative tool monitors the carbon emissions of vehicles, with the goal of fostering sustainable transport policies that will help shape Thailand's future as a clean, pollution-free society including policies on incentivizing use of electric vehicles. other stakeholders to pursue energy for development that is resilient, sustainable and equitable.

Source: UNDP [84]

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By refining regulatory frameworks, enhancing economic incentives, and expanding grid and charging infrastructure, Thailand can scale up deployment of EVs and renewables.

In Thailand's case, UNDP can build on the current progress on EVs, to work closely with the government and business associations in assessing and analyzing barriers in regulatory frameworks for clean energy and green transport, identifying gaps and needs in energy infrastructure in order to:

- Pilot innovative business models such as energy as a service
- Support government in using market-based instruments to drive demand for renewable energy
- Connect Thai and international SMEs and start-ups, tech labs, innovation accelerators
- Deliver tailor-made training and mentoring programmes to empower young and female entrepreneurs in clean energy in Thailand.

This can help Thailand achieve its ambition of becoming a regional hub for renewable energy and EV's by strengthening its position in regional and global value chains of renewable energy products and services, catalyzing innovation and entrepreneurship in clean energy, harnessing trade, investment, and employment opportunities in renewable energy and e-mobility market.

UNDP has many successful examples of its support to effective EVs promotion, from which Thailand could draw. In Samoa in the South Pacific, for example, UNDP supports decarbonization of the land and maritime transport, including through the introduction of electric cars and boats. Sex-disaggregated data showed that over the 2004-2023 period, women only accounted for 25% of the driving licenses issued in Samoa, raising concerns over women's transport autonomy in a heavily car-dependent society which can restrict their livelihood opportunities, as well as road safety as many women end up driving without a license. In 2025, UNDP will support a women's driving license training coupled with awareness raising sessions on the benefits of lower carbon transport modes such as electric vehicles. While women in Samoa play a key role in household finance management, this initiative both contributes to bridge a gender gap to promote women's autonomy, while tapping into their potential as agents of change to convert to electric alternatives.

In Paraguay, a large-scale e-mobility project is targeting the deployment of at least 1,000 electric buses over 10 years, powered by renewable energy. The project, mobilized with support from the NAMA Facility , leverages USD 20 million in catalytic funding to scale up at least USD 150 million in investment. This includes VAT exemptions, de-risking mechanisms, and engagement with capital markets and development banks. For Thailand, this is another compelling model. With the right instruments and partnerships in place, a similar approach could help address transport emissions, reduce diesel imports, and promote inclusive access to low-carbon mobility across cities and regions.

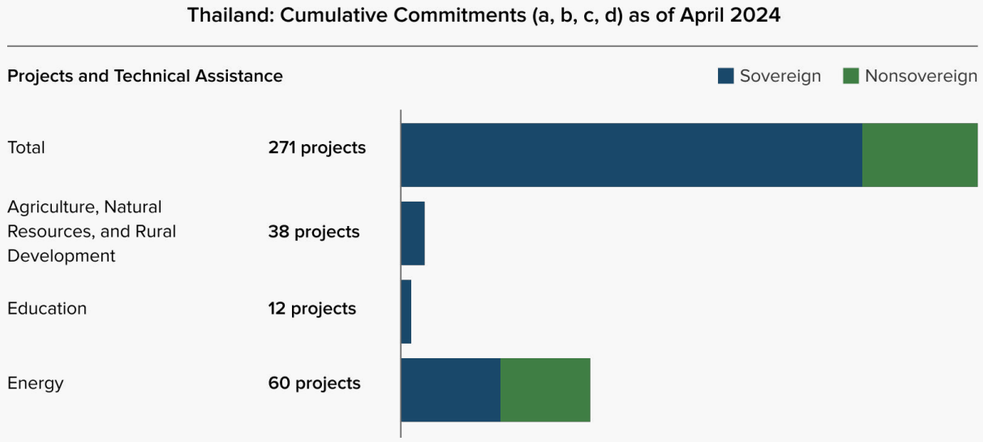
Thailand could also draw from Uruguay's strong example of how public policy, financial innovation, and institutional coordination can deliver inclusive energy transitions. With 97% of electricity from renewables, the country shifted focus to clean transport through the GEF-funded MOVÉS project (USD 1.7 million), supported by UNDP from 2018 to 2022. The project redirected fossil fuel subsidies to fund electric buses, benefiting over 800,000 people—57% of them women—and cutting 27,000 tons of CO_2, doubling its original target. It also led to a 90% rise in EV sales in 2022. UNDP supported fiscal analysis and helped mobilize over USD 14 million in private capital.

6.4 Unlocking transformative finance from public, private, and blended sources for Just Energy Transition

To fill in the finance and investment gap in renewable energy and sustainable transport in Thailand, UNDP can work with government and financial sector to develop economic and financial incentives, while addressing the particular needs of SMEs, women entrepreneurs, and rural communities. By fostering **public-private partnerships (PPPs)** including engaging **IFIs (ADB, AIIB, IFC, World Bank),** and **development partners**, UNDP can help to mobilize investment in renewable energy projects.

As one example, UNDP renewed its MOU with ADB in 2024, which provides a good framework for cooperation on energy and climate.[85] As demonstrated in the chart below, energy accounts for a large part of ADB's work in Thailand already. ADB launched the Innovative Finance Facility for Climate in Asia and the Pacific (IF-CAP) at COP29 as a new financial facility for Asia Pacific region, targeting total guarantees of $2.5 billion, which will go toward covering parts of ADB's existing loan portfolio.[86]

Figure 23. ADB's work in Thailand



Source : ADB website

Building on its work on sustainable finance, carbon finance, and energy finance, UNDP can help to de-risk clean energy investment through the **De-risking Renewable Energy Investment (DREI) Framework.** The DREI framework is an innovative tool that can help improve regulatory and market ecosystems and support in developing innovative financing models, such as green bonds and carbon finance mechanisms, to attract both domestic and international investors to clean energy projects.

UNDP can also facilitate the development of **Blended Finance Facilities** to connect national development Banks (NDBs) and Local Financial Institutions (LFIs), and use different financial instruments such as concessional loans, grants, carbon finance, securitization, and capital markets to structure cutting-edge financial instruments for sustainable energy.

UNDP's Derisking Renewable Energy Investment (DREI) Framework

Derisking Renewable Energy Investment (DREI) introduces an innovative, quantitative framework to assist policymakers in developing countries to cost-effectively promote and scale-up private sector investment in renewable energy.

The DREI framework systematically identifies the barriers and associated risks which can hold back private sector investment in renewable energy. It then assists policymakers to put in place packages of targeted public interventions to address these risks. Each public intervention acts in one of three ways: either reducing, transferring or compensating for risk. The overall aim is to cost-effectively achieve a risk-return profile that catalyzes private sector investment at scale. The end result is reliable, clean and affordable energy solutions in developing countries.

The DREI framework consists of a suite of publicly available methodologies, financial tools/models and resources. Current renewable energy sectors covered by the DREI framework are (i) utility-scale, (ii) on-grid rooftop PV, (iii) off-grid mini-grids, and (iv) solar home systems.

Source: UNDP [87]

UNDP, together with partners such as the Inter-American Development Bank, is advancing Financial Innovation Labs across Latin America and the Caribbean to help close the clean energy investment gap. The first LAB in Cuba was launched this month in partnership with the Central Bank, the Ministry of Energy, and UNDP, as part of a South-South Cooperation effort with LAB Brazil. The initiative will support the development of innovative financial instruments and regulatory pilots tailored to national priorities. UNDP is already piloting this model in the Caribbean and stands ready to scale up Financial Innovation Lab in Thailand—customized to its fiscal and development priorities.

UNDP supported Bolivia's Public Development Bank (BDP) in issuing its first thematic green bond in local currency, totalling approximately USD 15 million. This bond attracted a broad base of institutional investors and financial institutions. These funds will support sustainable energy initiatives, enhance efficiency, and reduce emissions—estimated at 1,200 tons of CO_2 equivalent.

83 United Nations Development Programme, "Promoting Electric Vehicle Use with the SDG and EV Climate Credit Platform," 16 September 2024. [Online]. Available: https://www.undp.org/press-releases/launch-EV-Climate-Credit-Program.

6.5 Boosting the green economy through private sector engagement and development

Many multinational corporations operating in Thailand are setting **Science Based Targets (SBTi)** for emissions reduction, creating a strong demand for renewable energy and energy efficiency solutions. As a regional manufacturing hub, Thai industries and companies are also responding to decarbonization regulations in overseas markets, such as the Carbon Border Adjustment Mechanism (CBAM) in the EU and UK, to improve competitiveness and secure exports opportunities.

As the backbone of Thailand's economy, SMEs play a pivotal role in advancing the energy transition. Their agility and adaptability could position them to lead in innovation, enabling the rapid development and deployment of new technologies and solutions. To fully unlock this potential, it is crucial to design financial support schemes specifically tailored to SMEs. These schemes should feature streamlined application processes—fast, simple, and requiring only essential information—to reduce barriers and encourage active participation. UNDP's role in facilitating SME engagement can be beneficial to accelerating Thailand's shift toward a sustainable energy future. By supporting accessible, SME-focused initiatives, UNDP can empower these dynamic enterprises to drive meaningful progress in the country's clean energy transformation.

Additionally, UNDP can facilitate partnerships between industrial companies and renewable energy providers to promote the use of clean energy in industrial operations. These partnerships can help in building capacities for industrial parks and clusters in conducting energy audits and implementing energy management systems, facilitating peer learning and exchanging on best practices in energy efficiency and purchasing clean energy. UNDP can also help industries and businesses, especially SMEs, understand and assess impacts of energy and climate regulations overseas, and support actions and initiatives to proactively respond to regulatory changes.

By doing this, UNDP can play an important role in helping Thailand reduce its greenhouse gas emissions across key industries, contributing to the country's climate goals. At the same time, this approach will enhance the competitiveness of Thai industries on the global stage, positioning them as leaders in sustainable practices. By driving innovation in low-carbon technologies and supporting industries in adopting cleaner, more efficient practices, UNDP can help Thailand not only meet environmental targets but also seize new market opportunities, attract green investments, and create sustainable, long-term growth.

▸ Leveraging Digital, Data and AI for Resilient and Smart Energy Systems

Given Thailand's archipelagic geography and its leadership in digital innovation, digital transformation can emerge as a key enabler of smart grids, resilient infrastructure, and inclusive energy services—especially for remote and underserved communities. Digital solutions are not peripheral—they are core infrastructure for resilient, equitable energy transitions, particularly for island, rural, and off-grid populations. Digital technologies, such as AI, the Internet of Things (IoT), and blockchain, offer transformative solutions to optimize energy systems, enhance efficiency, and ensure inclusivity.

▸ UNDP can support key strategies:

1. **Smart Grid Development:** Implementing AI-driven smart grids can enhance real-time monitoring and management of energy distribution, reducing losses and improving reliability, especially in remote areas.
2. **Predictive Maintenance:** Utilizing IoT sensors and AI analytics to predict equipment failures can minimize downtime and maintenance costs, ensuring continuous energy supply.
3. **Blockchain for Energy Transactions:** Adopting blockchain technology can facilitate transparent and secure energy trading, enabling peer-to-peer energy exchanges and empowering local communities.
4. **Data-Driven Planning for Equitable Energy Access:** AI and geospatial tools can identify underserved regions, vulnerable communities, and least-cost electrification pathways—prioritizing investment where it is needed most and ensuring a more equitable and data-driven energy transition in Thailand.

In partnership with IBM, UNDP has developed two digital tools that can be rolled out as pilots to support national partners in decision-making:

- **Clean Energy Equity Index**: UNDP, in partnership with IBM, has developed the Clean Energy Equity Index (CEEI), an innovative digital tool which combines geospatial analytics with social, economic, and environmental data to assess clean energy opportunities through an equity lens. The platform can enable users ranging from government, businesses, and communities by providing them with actionable information and supporting them in analyzing complex energy issues through advanced AI technology. This enables data-driven decision making for a just energy transition by helping them identify and prioritize the most pressing areas for clean energy development and access resources,

- **Forecasting Energy Access**: Another innovative digital tool developed by UNDP and IBM is the Forecasting Energy Access (FEA). This AI model forecasts electricity access for over 100 countries, using satellite data, population trends, and IBM's advanced machine learning technology. By offering future-looking projections, the tool gives decision-makers a powerful edge over static current-day estimates, which helps policymakers identify priority areas for investment.

84 United Nations Development Programme, "Promoting Electric Vehicle Use with the SDG and EV Climate Credit Platform," 16 September 2024. [Online]. Available: https://www.undp.org/press-releases/launch-EV-Climate-Credit-Program.

Considering the importance of ethical AI in driving ASEAN's digital economy. For Thailand, UNDP's support can entail further:

- **Data Governance:** Establishing robust data protection regulations to ensure privacy and security in energy data management.
- **Capacity Building:** Investing in digital literacy and skills development to enable local communities to participate actively in the energy transition.
- **Data Monitoring and Impact Tracking:** Through its Energy Moonshot Tracker, UNDP now monitors direct and indirect beneficiaries across 392 energy projects in 132 countries, using a globally aligned methodology. This system can allow Thailand to measure who is benefiting, how, and where gaps remain, ensuring accountability and inclusiveness in JET.
- **Policy Advisory:** Providing guidance on integrating digital technologies into national energy policies and ensuring alignment with ethical AI principles.
- **Technical Assistance:** Offering expertise in deploying digital tools and platforms tailored to Thailand's specific energy needs.

6.6 Leveraging UNDP's convening power to foster South-South and Triangular Cooperation

As a regional hub for energy trade and connectivity, Thailand plays an important role in regional energy cooperation in ASEAN and Asia. Many developing countries in the region share common challenges in achieving the just energy transition, including in policy design and implementation, value chain upgrading, economic diversification, skills and capacity, innovative finance, gender equality, and development imbalances between cities and communities.

UNDP is actively supporting **just energy transitions** across the Global South, by leveraging global platforms such as the G20, to ensure that the shift to low-carbon energy systems is equitable, inclusive, and sustainable. In this context, UNDP supported the development of the G20 Roadmap for stronger recovery and resilience in developing countries in LDCs and SIDS.

Specifically, in Indonesia UNDP assumed the leadership of the Just Transition WG of the Indonesia JETP Secretariat, supporting the definition of national principles of a just energy transition and spearheading the formulation of the Just Transition Framework which is an integral part of the Comprehensive Investment and Policy Plan (CIPP).

UNDP also collaborated with the Government of India as its knowledge partner on Digital Public Infrastructure (DPI) in the G20 Digital Economy Working Group, launching two knowledge products on DPI: a DPI SDG Compendium, presenting a global snapshot of the potential of DPI across all 17 SDGs; and the DPI Playbook, with practical resources on how countries can go about building their inclusive and rights-based DPI.

By harnessing UNDP's convening power as a trusted partner, the organization can facilitate meaningful dialogues and foster South-South and Triangular Cooperation on just energy transition efforts. UNDP can support regional initiatives to enhance energy trade and connectivity, while identifying and sharing Thailand's successful experiences on international platforms. With its extensive network of 24 country offices covering 36 countries in the Asia-Pacific, UNDP is uniquely positioned to strengthen South-South Cooperation and accelerate collaborative solutions to shared energy challenges in the region.

The Sustainable Energy Hub

The UNDP Sustainable Energy Hub (SEH) is a platform to convene and catalyze UNDP's work on energy for development. The SEH is a network of partners that work alongside countries to transform energy systems through an integrated agenda focused on the policy, technology and financial shifts that shape sustainable economic development. It helps countries build a net-zero society that puts people first and is driven by a just, sustainable energy transition that leaves no one behind.

The SEH will facilitate knowledge from across the organization and integrate energy considerations in UNDP's main intervention areas. It is intended to leverage internal and external capacities, through partnerships, by operating as a network of networks towards catalyzing policy change. Acknowledging that policy is critical to shift development pathways and widen the realm of possibilities for commitments to green infrastructure (and technology) development and deployment, and for investment in support of the necessary market system transformations, this adopts an energy nexus approach across the range of dimensions and policy areas that are essential for transitions.

The UNDP SEH Offer focus on three pillars to guide the "Sustainable Energy for Development" pathway: Closing the gap on energy access, Accelerating the just energy transition, and Increasing energy finance to support resilience in crisis and fragile contexts. This is achieved through service offerings on policy support, data analytics/technologies, energy leadership, and innovative business models and financial mechanisms, all to support the projects on the ground by UNDP Country Offices and local partners.

85 United Nations Development Programme, "ADB and UNDP renew partnership to accelerate sustainable development in Asia and the Pacific by 2030," 29 July 2024. [Online]. Available: https://www.undp.org/asia-pacific/news/adb-and-undp-renew-partnership-accelerate-sustainable-development-asia-and-pacific-2030.

86 Asian Development Bank, "ADB, Partners Signal Commitment to Climate Change Action at COP29 Event for IF-CAP," 12 November 2024. [Online]. Available: https://www.adb.org/news/adb-partners-signal-commitment-climate-change-action-cop29-event-if-cap.

87 United Nations Development Programme, "Derisking renewable energy investment framework," [Online]. Available: https://www.undp.org/energy/derisking-renewable-energy-investment-framework.

88 Office of National Higher Education Science Research and Innovation Policy Council, "MHESI launches EV initiatives to position Thailand as EV production hub," 21 February 2024. [Online]. Available: https://www.nxpo.or.th/th/en/23446/.

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Unlocking innovative, inclusive, and scalable financing solutions—across public, private, and blended sources—is critical to advancing Thailand's just energy transition.

Sustainable Energy Hub

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