STUDY

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Thailand's Climate and Energy Policy Landscape

A Policy Brief

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1. Overview of Thailand's Climate and Energy Context

1.1 Thailand's International Climate Commitments

As part of the global effort to address climate change, Thailand has progressively strengthened its commitments over the years. Thailand has been a member United Nations Framework Convention on Climate Change (UNFCCC) since 1992. Initially, Thailand pledged under its Nationally Appropriate Mitigation Actions (NAMA) to reduce greenhouse gas (GHG) emissions by at least 7 per cent below business-as-usual (BAU) levels by 2020. This target was followed by a more ambitious goal of reducing GHG emissions by 20–25 per cent by 2030, which was later revised to 30–40 per cent. At the COP26 summit in 2021, Thailand escalated its climate commitments with the goals of achieving carbon neutrality by 2050 and net-zero GHG emissions by 2065.

1.2 Current GHG Emission Profile and Current State of Energy Mix

As of 2022, Thailand's total emission, excluding Land Use, Land Use Change, and Forestry (LULUCF), officially stood at 385.94 MtCO2eq according to the 2024 Biennial Transparency Report submitted to the UNFCCC. This accounts for nearly 1 per cent of global emissions. The energy sector is the largest contributor, accounting for 65.89 per cent of the country's total emissions, followed by the agriculture, industrial processes and product use (IPPU), and waste sectors, which contributed 17.86 per cent, 10.50 per cent, and 5.75 per cent, respectively. While the LULUCF sector offset a portion of these emissions by removing 107.90 MtCO2eq, Thailand's emissions are projected to rise, peaking at 388 MtCO2eq by 2025 (Office of Natural Resources and Environmental Policy and Planning, 2022a; Department of Climate Change and Environment, 2024). However, some reports suggest that the country has already exceeded 440 MtCO2eq per year, raising concerns on the accuracy of official estimates (Climate Watch, 2024; Emissions Database for Global Atmospheric Research, 2024).

Since the energy sector accounts for around two-thirds of the country's total emissions, Thailand's carbon neutrality and net-zero GHG emission strategies are primarily focused on transforming the energy sector to significantly reduce emissions. Thailand's **final energy consumption** in 2022 amounted to 81.95 Mtoe. Of this, commercial energy accounted for 88.3 per cent, while renewable energy contributed 11.7 per cent. Petroleum products dominated the energy mix, representing 46.7 per cent of total final energy consumption (Department of Climate Change and Environment, 2024b). Meanwhile, in **energy production**, Thailand remains heavily dependent on fossil energy sources, namely coal, natural gas, and oil. In 2022, fossil energy accounted for 58.1 per cent of the country's total energy production, while renewable energy sources made up only 30.1 per cent. This means that if Thailand were to meet its climate goals, its energy policy needs to be shifted towards rapid energy transition, i.e. accelerating the adoption of renewable energy and significantly reducing its reliance on fossil fuels (Department of Climate Change and Environment, 2024b). The next section delves into several key climate and energy policies in Thailand.

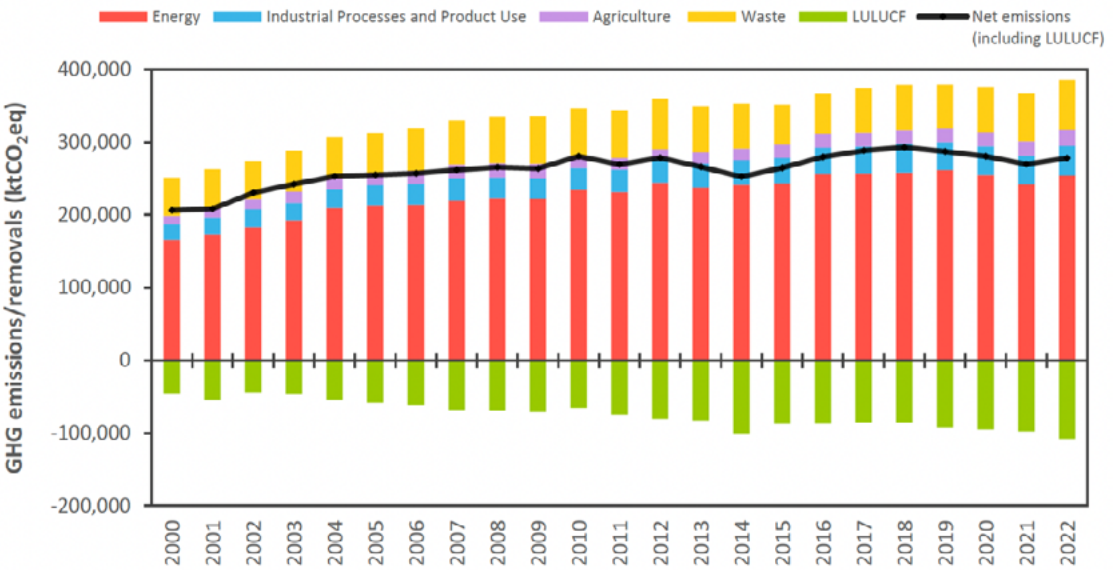

Figure 1 National GHG emissions by sector: 2000–2022 (BTR1, 2024)

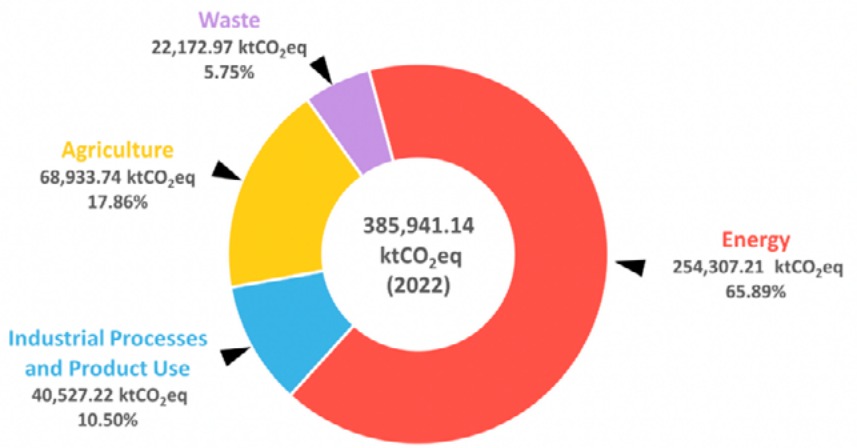

Figure 2 Total GHG emissions by sector (excluding LULUCF) in 2022 (BTR1, 2024)

2. Climate and Energy Policy Landscape and Alignment with Global Goals

2.1 Climate and Energy Policy Landscape in Thailand

Thailand acknowledges the imperative of collaborating with the international community to tackle the pressing issue of climate change. In response, the country has formulated a suite of national policies and strategic plans aimed at mitigating and adapting to the impacts of climate change. Thailand has also incorporated climate change considerations into its broader policy framework, ensuring alignment with global efforts and commitments with three levels of policies and plans (Institute for Sustainable Development of Natural Resources and Environment, 2023) as follows:

- → **1st Level:** 20-Year National Strategy
- → **2nd Level:** 12th National Economic and Social Development Plan
- → **3rd Level:** Climate Change Master Plan (CCMP), Thailand Nationally Determined Contribution (NDC) with Sectoral Action Plan, Thailand's National Adaptation Plan (NAP), Thailand's Long-Term Low Greenhouse Gas Emission Development Strategy (LT-LEDS)

Thailand's 20-Year National Strategy (2018–2037) incorporates climate action within its "eco-friendly development and growth" framework through three key dimensions. The mitigation strategy focuses on GHG reduction and carbon sequestration through agricultural optimization and forest restoration. Adaptation measures emphasize enhanced disaster management systems and preparedness for climate-induced health challenges. Enabling measures include database development, low-carbon product promotion, and climate-focused economic incentives and legislation. Within this framework, GHG emissions and bioeconomy metrics serve as primary indicators for measuring development progress.

The national GHG reduction target framework has established guidelines according to Thailand's LT-LEDS. The revised LT-LEDS is aligned with Thailand's long-term targets to achieving carbon neutrality by 2050 and net-zero emissions by 2065; the strategy outlines specific measures to contribute to limiting global temperature rise to 1.5°C while advancing toward carbon neutrality by 2050. This comprehensive strategy targets GHG emissions reductions across critical sectors including energy, transport, IPPU, waste management, agriculture, and LULUCF, which serves as the country's primary GHG removal sector. In short, the LT-LEDS is meant as a roadmap for relevant agencies and sectors to use as decarbonization guidelines. The strategy also establishes key performance indicators across major economic sectors; for example, the plan sets a renewable energy deployment target at 50 per cent share of total electricity generation by 2050, and a target of 65 per cent by 2060.

Thailand's climate change policy framework demonstrates a multifaceted approach to addressing environmental challenges while promoting sustainable development. The Climate Change Master Plan (CCMP) serves as a cornerstone of this framework, aligning with the nation's long-term strategic vision and economic development plans. This strategy aims to enhance national resilience to climate change impacts while fostering low-carbon growth. The CCMP delineates

long-term objectives for both climate adaptation and climate mitigation, providing a policy scaffold for the development of sector-specific and national-level tools and mechanisms. The plan establishes several critical indicators to monitor the nation's progress in addressing climate change challenges. The plan prioritizes GHG emissions reduction, targeting a 20–25 per cent decrease from projected business-as-usual levels by 2030. Key sectoral indicators include energy efficiency improvements, particularly in the industrial and transport sectors, with aims to reduce energy intensity by 30 per cent compared to 2010 levels.

Complementing the CCMP, the National Adaptation Plan (NAP) articulates a framework for climate change adaptation operations. This plan is designed to bolster resilience, mitigate vulnerability, and enhance adaptive capacity in alignment with sustainable economic, social, and environmental development principles. Collectively, these policy instruments form a cohesive and comprehensive strategy for addressing climate change in Thailand.

In addition, Thailand's NDC Roadmap establishes a framework for mitigation measures across key sectors, including Energy, Transport, Industrial Processes and Product Use (IPPU), and Waste. In order to operationalize these commitments, the NDC Sectoral Action Plans 2021–2030 have been formulated to ensure a targeted approach to GHG reduction (see Appendix A for details).

Since GHG emissions from the energy sector account for two-thirds of Thailand's total emissions, the energy transition plan is of special interest. To that end, Thailand's NDC Sectoral Action Plan for the Energy Sector (2021–2030) outlines several key strategies to reduce GHG emissions in Thailand's energy sector. This plan includes three primary initiatives: first, the Energy Efficiency Plan (EEP2015) targets a 30 per cent reduction in energy intensity by 2036 compared to 2010 levels, focusing on industrial, commercial, residential, and transport sectors. Second, the Alternative Energy Development Plan (AEDP2015) aims to increase renewable energy's share to 30 per cent of final consumption by 2036, through electricity, heat, and biofuels. Third and lastly, the Power Development Plan (PDP2018; the current draft is PDP2024 for use until 2037) promotes renewable energy, secures energy supply, and sets energy mix targets.

Together, these plans purportedly support the overarching goal to reduce GHG emissions by 82 million tons of CO_2 by 2030. The strategies emphasize GHG reduction, long-term planning, and collaboration across public and private sectors to achieve sustainable, climate-resilient energy development. More information and limitations of these plans, considering Thailand's climate commitments, are delineated in the following section.

As of February 2025, the Ministry of Energy is still developing Thailand's first National Energy Plan (NEP) which will consolidate five key plans announced earlier:

(1) Energy Efficiency Development Plan (EEDP)
(2) Alternative Energy Development Plan (AEDP)
(3) Power Development Plan (PDP)
(4) Oil Plan
(5) Gas Plan

In 2021, the draft NEP was approved by the National Energy Policy Committee, becoming the master plan for setting Thailand's energy direction and energy transition pathway, to ensuring the alignment of all energy-related initiatives under one comprehensive framework.

In first quarter of 2024, Thailand's first draft Climate Change Act was submitted to the public hearing process. As of February 2025, this draft is still under consideration by the National Economic and Social Development Council (NESDC). After approval from the NESDC, it will be presented to the Cabinet and subsequently to parliament for legislation into law. Once the law is passed, it can be implemented in all key sectors, including energy, transportation, industry, waste management, and agriculture (Thansettakij, 2024).

The Act is expected to be a milestone in Thailand's efforts to achieve carbon neutrality and meet the

goals of the Paris Agreement. The law establishes a comprehensive framework for reducing GHG emissions, focusing on the development of a Climate Change Master Plan and the establishment of a Climate Change Fund to support mitigation efforts. Key provisions include mandatory GHG reporting for businesses, the implementation of an Emission Trading Scheme (ETS), and the introduction of a carbon tax on specific products based on their GHG emissions. Further analysis of the draft Climate Change Act can be found in the following section.

2.2 Key Climate and Energy Policies in Thailand and their alignment with COP28 Goals

Draft Climate Change Act

In 2019 at COP25, Thailand announced its commitment to developing its first climate legislation, namely Climate Change Act. This law is aimed at supporting climate mitigation and adaptation efforts and represents a significant milestone for Thailand as it introduces key carbon pricing instruments, including ETS, carbon tax, and carbon credit, along with the establishment of the National Climate Change Fund. The Act also endorses the development of a Green Taxonomy (currently being spearheaded by the Thailand Taxonomy Working Group led by the Bank of Thailand and Securities and Exchange Commission) and requires businesses to record and report their GHG emissions according to a clear criteria for the first time (link).

Despite these ambitions, as of February 2025, the Act has not yet been submitted to parliament for legislation into law, thereby highlighting Thailand's slow progress in implementing comprehensive national climate policies. Moreover, the draft Act raised several questions on whether it is sufficient and timely to meet national climate goals.

As of December 2024, Thailand's carbon market operates only on a voluntary basis under the Thailand Voluntary Emission Reduction Program (T-VER) (Greenhouse Gas Mitigation Mechanism, 2016). The draft Climate Change Act would introduce a mandatory carbon market through the ETS, similar to the system employed by the European Union (EU). Under this system, businesses in designated GHG-emitting industries will be required to submit allowances for their emissions to the government annually. These allowances can be allocated, auctioned, or traded between businesses, providing flexibility in managing their carbon reduction obligations.

In addition to the ETS, the Act introduces a carbon tax, which will be calculated based on the GHG emissions generated throughout a product's life cycle. This tax will apply to both domestically produced and imported goods and is aimed at aligning closely with the European Union's Carbon Border Adjustment Mechanism (EU-CBAM). While Thailand currently imposes a CO2 emissions tax on vehicles through the Excise Department, the new legislation would extend this framework to cover a broader range of industries and products.

For adaptation efforts, the National Climate Change Fund is set to provide crucial financial support for GHG reduction across various sectors. It will target both public and private sectors, funding projects such as reforestation and other initiatives focused on carbon footprint measurement and certification. Moreover, the fund is expected to play a vital role in promoting the reduction of fossil fuel consumption, a key factor in lowering Thailand's GHG emissions and advancing its climate goals.

The Act also introduces mandatory GHG reporting, shifting from the current voluntary GHG measurement system, where publicly listed companies could include GHG data in their annual reports. Under the new framework, government agencies will have the authority to request GHG emissions data from specific industries to assess their carbon footprint. This regulation is likely to apply to 15 industries, including power generation, construction, transport, coal mining, oil and natural gas, non-metal manufacturing, chemicals, metals, fuel, electronics, ozone-depleting substances, electrical manufacturing, paper and pulp, food and beverage, and agriculture (Kaewhiran, 2024).

The Act is likely to increase operational costs for carbon-intensive industries, from carbon footprint assessments to participation in the ETS and compliance with the carbon tax. However, as GHG reduction becomes a standard business practice, investing in carbon footprint monitoring, renewable energy, and minimizing fossil fuel consumption will be essential for maintaining the competitiveness of Thai businesses in both domestic and international markets.

While the draft Climate Change Act introduces several initiatives and instruments to support climate mitigation and adaptation, several concerns remain. In the context of the carbon market, although the Act promotes carbon trading and carbon credits, it may lack adequate oversight provisions to prevent greenwashing, a common issue in carbon trading systems. As for the National Climate Change Fund, marginalized and vulnerable communities may be overlooked, as the current draft does not include specific provisions for addressing loss and damage, supporting vulnerable groups, or ensuring public engagement in fund management (Areerat, 2024). Additionally, slow implementation of the Act could hinder Thailand's ability to meet its NDC under the Paris Agreement.

Power Development Plan (PDP)

Thailand's overall energy mix is dictated by the Power Development Plan. The current plan in use is PDP2018, which predate Thailand's submission of its revised NDC in 2022 (this NDC includes an unconditional emissions reduction target of 30% and a conditional target of 40% by 2030 as compared to the business-as-scenario). The current draft Power Development Plan 2024 (PDP2024) marks a significant step towards reducing carbon emissions in line with NDC, targeting 51 per cent of the energy mix from renewable sources by 2037, up from the 36 per cent target in PDP2018. However, despite this progress, the plan still heavily depends on fossil fuels, particularly natural gas. PDP2024 stipulates adding 6,300 MW new gas-fired power plants between 2027 and 2037, making natural gas 41 per cent of the energy mix by 2037, the plan's final year.

In addition, 15 per cent in the 51 per cent "renewable energy" sources in PDP2024 is expected to come from imported hydropower from large dams in Laos, a decision that has sparked intense public debate. While hydropower is classified as renewable, large dams can have significant environmental and social impacts, including methane emissions from reservoirs, which contribute to global GHG emissions. Methane emissions from hydropower currently account for 5.2 per cent of all human-caused methane emissions. Furthermore, new hydropower tariffs for Laos projects surpass those of solar power with energy storage, making them economically less competitive. The higher costs of these new hydropower projects, coupled with environmental risks, raise questions about their long-term sustainability compared to other renewable alternatives.

The draft PDP2024 also reintroduces nuclear energy which is considered a carbon-free energy option, with plans to commission two 300 MW Small Modular Reactors (SMRs) by 2037. SMRs, an advanced nuclear technology, promise cost control and safety benefits over traditional reactors and could provide reliable baseload power to balance the intermittency of renewables like wind and solar. However, SMRs are still in development and face high costs, with estimated generation costs of 119 United States dollars per MWh in 2024— significantly higher than the cost of solar PV with storage, which stands at 50 United States dollars per MWh.

Moreover, PDP2024 proposes blending 5 per cent hydrogen into on-grid gas power plants by 2030 to reduce CO_2 emissions and lessen dependence on expensive liquefied natural gas (LNG) imports. While hydrogen is a promising low-carbon energy source, most hydrogen is currently produced using fossil gas, making it carbon-intensive. Blending hydrogen with natural gas only marginally reduces emissions and requires costly infrastructure upgrades. Additionally, draft PDP2024 does not specify whether the hydrogen will be gray, blue, or green, despite their differing carbon footprints. Given its high costs and limited efficiency, hydrogen blending appears less effective than other renewable energy solutions.

The projected cost of electricity under draft PDP2024 is 3.87 Thai baht per kWh, which is based on unspecified gas prices and excludes the costs of carbon capture and storage (CCS) and emission trading schemes mandated by the upcoming Climate Change Act. CCS, vital for reducing emissions, is projected to cost between 2,000 and 6,600 Thai baht per tonne of CO_2, with annual costs reaching 30.85 to 100.95 billion Thai baht from 2041 to 2050 (Ingkasit, and Junkrajang, 2024). Since draft PDP2024 still relies on fossil fuels for 48 per cent of the energy mix by 2037, including 6,300MW of new gas-fired power plants, these 'hidden costs' from continued fossil use that are necessary to bring down emissions will potentially raise electricity tariffs further. Transitioning to cheaper renewable energy sources could reduce the need for expensive CCS technology and lower carbon emissions more effectively.

Draft PDP2024 also highlights Thailand's heavy reliance on LNG for electricity generation, with gas power plants projected to make up 41 per cent of the energy mix by 2037. As domestic gas reserves dwindle, LNG imports are expected to supply at least 40 per cent of the demand by 2030 (Ingkasit, and Junkrajang, 2024). However, LNG price volatility, as seen during the COVID-19 pandemic and the Russo-Ukrainian War, raises concerns about long-term energy security. Expanding gas infrastructure may lock Thailand into a dependency on fossil fuels, delaying the transition to more sustainable and cost-effective energy alternatives while introducing economic risks due to price fluctuations.

Additionally, draft PDP2024 forecasts an excessively high reserve margin, leading to increased electricity costs for consumers. Historically, electricity demand has been overestimated, with the government justifying this due to the long construction times for power plants. By 2030, the country's total electricity capacity is projected to reach 65,326 MW, far exceeding the peak demand of 42,235 MW. By 2080, the reserve margin could double the peak demand. The plan to build 6,300 MW new gas-fired power plants will only exacerbate overcapacity, contributing to higher construction costs, carbon emissions, and environmental pollution.

In conclusion, Thailand's draft PDP2024 raises concerns about the nation's energy transition, particularly its continued reliance on fossil gas, unproven and expensive technologies such as hydrogen blending and SMRs, and environmentally disruptive hydropower imports. Despite Thailand's considerable solar potential and its low cost, only 17 per cent of the energy mix is allocated to solar by 2037, while controversial hydropower imports account for 15 per cent. Although the plan projects that 51 per cent of the energy mix will come from renewables by 2037, this falls short of the 68 per cent required by 2040, as outlined in the LT-LEDS to achieve carbon neutrality by 2050. Achieving a 17 per cent increase in renewables within just three years (2038 – 2040) seems overly ambitious.

Moreover, the continued reliance on fossil fuels, which will still make up 48 per cent of the energy mix, including LNG and coal, presents a significant barrier to achieving the net-zero emissions target. The dependence on LNG exposes Thailand to price volatility and market instability, while coal, with its high carbon intensity, contradicts the decarbonization efforts. PDP2024's reliance on these fossil fuels raises doubts about the feasibility of the net-zero goal, as it suggests the country may struggle to reduce its carbon footprint at the necessary rate.

While PDP2024 claims to align with the LT-LEDS and the NDC, the projections appear optimistic, raising doubts about the sustainability and feasibility of the plan's net-zero emissions goal by 2050. Over-reliance on expensive, volatile technologies and the continued dominance of fossil fuels further complicates its long-term effectiveness.

3. Key Actors and Their Roles in Climate and Energy Policies

Given that Thailand is currently developing two main climate and energy policies–the National Energy Plan (NEP) and the Climate Change Act–this brief therefore identifies two key actors involved in shaping these policies: the Ministry of Energy (MoE) and the Ministry of Natural Resources and Environment (MNRE). Within these ministries, various bodies are responsible for developing specific plans to support these initiatives.

For energy policy, **the Ministry of Energy** (MOE) is tasked with ensuring energy security and contributing to GHG reduction, given that the energy sector is responsible for two-thirds of Thailand's total GHG emissions. Each plan within the NEP requires endorsement by the National Energy Policy Council (NEPC)– which includes the Prime Minister, key ministers, and high-ranking officials– before submission to the Cabinet for final approval (Energy Policy and Panning Office, 2019; Just Power For All, 2024b). Regarding policy development, there are three main departments within the MOE that are responsible for specific sub-policies.

First, the Energy Policy and Panning Office (EPPO) oversees two policies, namely the PDP and the Gas Plan. Its sub-committee on Load Forecast estimates gross domestic product (GDP) and population growth trends to project electricity demand, incorporating a 15 per cent reserve margin. After forecasting, EPPO drafts the PDP and conducts public hearings to gather input from stakeholders and ensure a comprehensive review. The PDP is then forwarded through the Energy Regulatory Commission, the NEPC, and the Cabinet before being finalized and enacted (Just Power For All, 2024a).

For the Gas plan, which mainly focuses on ensuring an adequate natural gas supply for the petrochemical industry, transportation, and electricity generation, the EPPO is responsible for developing capacity assessment and management system, including domestic natural gas exploration and LNG imports.

Second, the Department of Alternative Energy Development and Efficiency (DEDE) has the mandate to formulate the EEP and the AEDP. For EEP, which aims to improve energy efficiency across buildings, industries, and households, the DEDE sets out demand-side management strategies to reduce overall energy demand, covering areas such as appliance standards and conservation measures.

For AEDP, which seeks to increase the renewable energy generation target and investment, the DEDE produces a plan for enhancing the use of renewable and alternative energy, including solar, wind, and biomass energy, in a bid to decrease energy dependency, and ensure energy security.

Thirdly, the Department of Energy Business (DOEB) develops the Oil Plan, which is coordinated with the other energy plans to ensure alignment. The Oil Plan includes upgrading refinery standards to EURO 5 and EURO 6, managing LNG and NGV supplies, promoting biofuel use in transportation, restructuring oil prices, and reducing biofuel costs.

For climate change policies, **the Ministry of Natural Resources and Environment (MNRE)** is the main government agency in charge of

implementing the policy decided by the National Committee on Climate Change Policy (NCCC), the main policy body. The MNRE Minister is the first vice chairperson of the NCCC, after the Prime Minister who acts as committee chairman. This committee has the mandate to design national climate policies and establish guidelines and mechanisms for international collaboration.

Regarding climate policy development, there are two main bodies within the MRNE that are responsible for specific sub-policies:

Firstly, the Office of Natural Resources and Environmental Policy and Planning (ONEP) was assigned to be a national focal point of the UNFCCC in 2004. The Climate Change Management and Coordination Division (CCMC) within ONEP is responsible for three main tasks: 1) advising and proposing policy, plan, and measures for climate change mitigation and adaptation; 2) tracking and coordinating public sectors and private sectors' works on climate change; 3) disseminating information relating to climate change policies, plans, initiatives, and activities. ONEP acts as a coordinator and information-sharing hub for climate change networking at national, regional, and international levels (Office of Natural Resources and Environmental Policy and Planning, 2022b, p. 195).

Secondly, the Department of Climate Change and Environment (DCCE), established in August 2023, is responsible for developing policies, plans, and measures for climate action, including GHG reduction and climate adaptation. Among its key initiatives, the DCCE has drafted the Climate Change Act, which aims to regulate GHG emissions and strengthen climate adaptation capacities across all sectors. It is worth highlighting that there are three additional versions of the Act, alongside DCCE's draft, will undergo review in Parliament before finalization.

4. Challenges in Thailand's Transition to a Low-Carbon Economy

To understand the key challenges in energy transition towards a low-carbon economy, it is crucial to gather insights from diverse stakeholders across the energy sector, including regulatory bodies, energy producers, industry associations, academic institutions, civil society organizations, and trade unions.

In 2023, Fair Finance Thailand (FFT) published a report titled "Thailand Taxonomy Guidelines to Advance a Just Energy Transition." The research team interviewed over two dozen stakeholders from various sectors to get their perspectives on the challenges and obstacles facing fossil fuel phase-out initiatives in Thailand's energy sector. Through in-depth interviews with key stakeholders, FFT gathered comprehensive insights that can serve as the primary reference for this brief.

4.1 Energy Policy Makers and Regulators: stability is key during energy transition

Thailand faces complex challenges in its efforts to phase out fossil fuels from its energy sector. Despite policy intentions to reduce fossil fuel dependency, various practical issues—exacerbated by recent economic disruptions—present obstacles to achieving a stable transition which significant delays in updating the country's PDP, the central framework for energy policy. One major concern among energy policymakers is the impact that phasing out fossil fuels may have on energy security and stability. policymakers indicate that a complete transition away from fossil fuels may require as long as 20 years. Thailand's dependency on natural gas as a primary energy source complicates this shift, as natural gas is still viewed as a necessary 'transition energy' while scaling up renewable sources for the foreseeable future.

While renewable energy sources are crucial to Thailand's energy future, they present limitations in terms of stability and geographic feasibility. Solar power production is constrained by weather conditions, which can cause significant output fluctuations. Wind power faces its own challenges, requiring extensive land areas and specific topographical conditions. Similarly, biomass energy depends heavily on agricultural outputs, which are vulnerable to climate change impacts. These constraints underscore the critical need for robust infrastructure development to ensure reliable renewable energy integration.

Furthermore, energy security is a primary concern for Thailand's regulatory agencies, as reliable energy supply is crucial for economic stability. In Thailand, agencies such as the NESDC and EGAT collaborate to estimate electricity demand for households, industries, and businesses over a 15-year period. A miscalculation in demand forecasts could lead to power shortages or widespread blackouts, underscoring the importance of precise demand management. For this reason, some policy makers advocate for maintaining a reserve capacity above projected demand as a buffer to ensure energy stability (Fair Finance Thailand, 2023).

4.2 Energy Producers: Need clear fossil phaseout timelines and energy market reform

Major fossil fuel companies in Thailand have set ambitious environmental targets, pledging to achieve net-zero emissions by 2050. To meet these goals, they have adopted multiple strategies, including expanding reforestation efforts for CO_2 absorption, participating in carbon credit trading through the Carbon Markets Club, and diversifying their portfolios with increased investments in renewable energy, anticipating a significant energy transition within the next two decades.

While these private sector initiatives demonstrate alignment with international GHG reduction targets, they stand in stark contrast to Thailand's current NDC. The NDC's goals of carbon neutrality by 2050 and net-zero emissions by 2065 have been criticized by industry stakeholders as outdated and disconnected from market realities. They say that Thailand's lack of legislated fossil phaseout timelines and the lack of clear renewable energy transition pathways have emerged as a major obstacle to achieving meaningful energy system transformation.

Minimum-take obligations in the current power purchase agreements compel government-owned EGAT, Thailand's centralized dispatcher, to purchase the contracted volume during peak consumption hours, with corresponding obligations during off-peak hours. Enforcing these obligations during off-peak periods can result in unnecessary costs and limit the acquisition of electricity from VREs, potentially leading to uneconomic curtailment. The International Energy Agency therefore advised in 2021 that Thailand relax the contractual offtake obligations from gas plants and accelerating the deployment of renewables; this would yield fuel cost savings in line with Thailand's energy security and affordability objectives.

The renewable energy sector faces challenges due to Thailand's continued emphasis on fossil fuels, especially natural gas. The existence of take-or-pay contracts and attendant long-term natural gas contracts for electricity generation have created institutional inertia, complicating efforts to reform energy policies. Therefore, renewable energy producers propose that energy regulators and government bodies renegotiate these contracts to reduce the volume and duration of fossil fuel purchases and to establish compensation mechanisms for affected energy providers. They also encourage the government to implement Third-Party Access (TPA) codes by major utilities, with an appropriate wheeling charge, to facilitate direct renewable energy procurement (Fair Finance Thailand, 2023).

4.3 Academia: energy transition must be just and properly managed to reduce burden for ratepayers

Academics, including energy experts, view that Thailand faces significant challenges in its transition away from fossil fuels, primarily stemming from policy ambiguity and implementation complexities. The foremost challenge lies in the absence of clear GHG reduction targets within Thailand's 20-year National Strategy, resulting in inconsistent policy implementation and continued fossil fuel investments. The lack of policy clarity on fossil phaseout not only impedes collaborative efforts toward achieving national emission reduction goals but also perpetuates ongoing investments in fossil fuel projects.

The complexity of fossil phaseout varies significantly between new and existing fossil fuel projects. While new projects can be terminated through policy adjustments with minimal stakeholder impact, existing operations present more complex challenges. For instance, the early retirement of facilities like EGAT's Mae Moh coal-fired power plant, currently scheduled to operate until 2040, would significantly affect various stakeholders, particularly businesses and workers within the fossil fuel supply chain.

Economic considerations further complicate the transition. Thailand's heavy reliance on domestic natural gas and coal resources for power generation raises concerns about electricity costs. Both

public and private sectors express apprehension about abandoning these relatively inexpensive domestic resources in favor of potentially more expensive renewable alternatives or imported energy sources.

Technical challenges also exist in carbon accounting and footprint assessment. The difficulties experienced even in developed nations like the United States in implementing Scope 1 and 2 emissions reporting highlight the complexities Thailand faces. Additional concerns include double-counting issues and verification challenges in GHG accounting methodologies. These technical barriers, combined with policy uncertainties and economic considerations, create a complex web of challenges that must be systematically addressed to achieve a successful energy transition (Fair Finance Thailand, 2023).

4.4 Civil Society Organizations: need to quickly ramp up decentralized renewable energy and address social and environmental impacts during transition

CSOs emphasized the urgent need to phase out fossil fuels, highlighting the Thai government's lack of clear transition policy. The absence of specific timelines and targets for both fossil fuel elimination and renewable energy expansion remains a critical gap. While recognizing energy security concerns, they suggested a minimum 10-year timeline for complete transition.

To accelerate the fossil fuel phase-out, the government should support small-scale renewable energy producers, helping break existing energy monopolies and improve public access to clean energy.

While previous research on Thailand's energy transition focused primarily on eliminating coal from electricity generation and ensuring energy security, it overlooked social impacts. Future studies should examine labor implications across the coal industry to ensure a just transition for affected workers and communities (Fair Finance Thailand, 2023).

4.5 Trade Unions: need proper support for fossil workers during the energy transition

As fossil fuel companies shift toward renewable energy, their employees face significant challenges in adapting to industry transformation. Job security stands as a primary concern, with many workers seeing their permanent positions converted to temporary contracts with reduced benefits and stability. This contractual uncertainty creates substantial anxiety about long-term career prospects.

The transition also creates operational pressures, as staff redistribution to renewable sectors leaves traditional units understaffed. Remaining employees must manage heavier workloads while adapting to industry changes. Additionally, workers face the demanding task of acquiring new skills for renewable energy roles while maintaining their current responsibilities.

The combination of job instability, increased workloads, and reskilling requirements significantly impacts employee morale and well-being. This complex transition highlights the need for organizations to implement comprehensive support systems for their workforce, ensuring that the human aspect of the low-carbon transition is managed as carefully as its technical and operational elements. (Fair Finance Thailand, 2023).

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List of Acronyms, Abbreviations, and Units

AEDP	Alternative Energy Development Plan
BAU	Business-As-Usual
BTR	Biennial Transparency Report
CCMC	Climate Change Management and Coordination Division
CCMP	Climate Change Master Plan
CCS	Carbon capture and storage
COP	Conference of the Parties
DEDE	Department of Alternative Energy Development and Efficiency
DOEB	Department of Energy Business
EEP	Energy Efficiency Plan
EPPO	Energy Policy and Panning Office
ETS	Emission Trading Scheme
EU	European Union
EU-CBAM	EU Carbon Border Adjustment Mechanism
FFT	Fair Finance Thailand
GDP	Gross Domestic Product
GHG	Greenhouse Gas
IPPU	Industrial Processes and Product Use
LNG	Liquefied natural gas
LT-LEDs	Long-Term Low greenhouse gas Emission Development Strategy
LULUCF	Land Use, Land-Use Change and Forestry
MNRE	Ministry of Natural Resources and Environment
MoE	Ministry of Energy
MtCO2eq	Million Tonnes of carbon dioxide equivalent
NAMA	Nationally Appropriate Mitigation Action
NAP	National Adaptation Plan
NCCC	National Committee on Climate Change Policy
NDC	Nationally Determined Contribution
NEP	National Energy Plan
NEPC	National Energy Policy Council
NESDC	National Economic and Social Development Council
ONEP	Office of Natural Resources and Environmental Policy and Planning
PDP	Power Development Plan
SMRs	Small Modular Reactors
T-VER	Thailand Voluntary Emission Reduction Program
UNFCCC	United Nations Framework Convention on Climate Change

Appendix A

Summary of Thailand's NDC Action Plan on Mitigation 2021–2030

Action Plan	Measures	Main agency	Supporting agency	Target values in 2030 (MtCo2E)	Implementation Start (Year)
Action Plan 1.1 GHG reduction in each sector				**184.832**	
	Energy sector			**124.597**	
	1. Energy conservation and increase in energy efficiency in electricity generation			**33.401**	
	1.1 Enforcing measures in conserving energy in factories and controlled buildings	DEDE	EGAT/ Office of Energy Regulatory Commission/ DIW/DPT/DCCE/ TGO	5.860	B.E.2564 (2021)
	1.2 Enforcing new building standards to conserve energy	DEDE	DPT/DCCE/TGO	0.660	B.E 2569 (2026)
	1.3 Determining standard labeling for machinery and materials to conserve energy	DEDE/EGAT	EGAT/TISI/ DCCE/TGO	9.630	B.E 2564 (2021)
	1.4 Enforcing using standard criteria in conserving energy for producers and distributing energy/ Energy Efficiency Resources (EERS)	EGAT/MEA/ PEA	DEDE/ Office of Energy Regulatory Commission / DCCE/TGO	0.201	B.E 2569 (2026)
	1.5 Supporting projects relating to energy conservation	DEDE	DCCE/TGO	9.050	B.E 2569 (2026)
	1.6 Increase efficiency in energy production	EGAT	Office of Energy Regulatory Commission / TISI/DCCE/TGO	8.000	B.E 2564 (2021)

Action Plan	Measures	Main agency	Supporting agency	Target values in 2030 (MtCo2E)	Implementation Start (Year)
	2. Alternative Energy Sector			90.196	
	2.1 Development of wind energy	DEDE	Office of Energy Regulatory Commission / MEA/PEA/DCCE/ TGO	1.110	B.E 2564 (2021)
	2.2 Development of solar energy	DEDE	Office of Energy Regulatory Commission / MEA/PEA/DCCE/ TGO	4.930	B.E 2564 (2021)
	2.3 Development of hydropower	DEDE/EGAT	Office of Energy Regulatory Commission / MEA/PEA/DCCE/ TGO	3.190	B.E 2564 (2021)
	2.4 Development of biomass energy	DEDE/EGAT	EGAT/MEA/PEA/ DLA/Bangkok/ Ministry of Agriculture and Cooperatives / DCCE/TGO	64.940	B.E 2564 (2021)
	2.5 Development of biogas	DEDE	EGAT/MEA/PEA/ DLA/Bangkok/ Ministry of Agriculture and Cooperatives / DCCE/TGO	3.790	B.E 2564 (2021)
	2.6 Development of waste to energy	DEDE	EGAT/MEA/PEA/ DIW/IEAT/DLA/ Bangkok/DCCE/ TGO	1.630	B.E 2564 (2021)
	2.7 Development of ethanol	DEDE	DOEB/OTP/ DCCE/TGO	3.790	B.E 2564 (2021)
	2.8 Development of biodiesel	DEDE	DOEB/OTP/ DCCE/TGO	4.790	B.E 2564 (2021)
	2.9 Development of new clean energy	DEDE	EPPO/DOEB/ OTP/DCCE/TGO	2.076	B.E 2569 (2026)
	3. Measures of technology in capturing and storing carbon dioxide			**1.000**	
	3.1 Pilot projects in capturing and storing CO2 at the Arthit, the natural gas site	DMF/ Entrepreneur	DCCE/RD/TGO/ Research institutes/ University	1.000	B.E 2570 (2027)

Action Plan	Measures	Main agency	Supporting agency	Target values in 2030 (MtCo2E)	Implementation Start (Year)
	Transportation sector			45.610	
	1. Group of measures in supporting the use of electric vehicles (Electrification of Transport)			**28.290**	
	1.1 Promoting the adoption of EV	BMTA/TCL	OTP/DLT/DEDE/ OIE/EPPO	-	
	1.2 Promoting the use of electric locomotive	SRI	OTP/DRT	28.290	B.E 2569 (2026)
	1.3 Promoting the use of electric boat	MD/Bangkok	OTP	-	
	1.4 Promoting of infrastructure supporting EVs	EPPO/ DOEB/MEA/ PEA	OTP/OIE/TISI	-	
	2. Group of measures in improving energy efficiency (Energy Efficiency Improvement)* **			**13.940**	
	2.1 Setting standards and providing information on energy efficiency and greenhouse gas emissions	DLT/TISI/ DIW/Excise Department/ PCD	OTP/OIE/DEDE/ DOEB	-	
	2.2 Improving the tax system to encourage the use of energy-efficient vehicles	DLT/Excise Department	OTP/ OIE/TISI/ PCD	13.940	B.E 2569 (2026)
	3. Group of measures in improving urban mobility			**1.780**	
	3.1 Improving public transportation infrastructure	SRT	OTP/ DLT / DRT/ Airports/DOH/ MD/CAAT Bangkok	1.780	
	3.2 Promoting shared mobility and multi-modal transport	SRT		-	
	3.3 Traffic management in the city	DLT/ Bangkok/ RTP	OTP/ DOH/PRD/ Private sector	-	
	4. Group of measures in improving inter-urban transport and green logistics			**1.600**	
	4.1 Development of rail transportation infrastructure	SRT/MRAT	OTP/ DRT	1.590	B.E 2564 (2021)
	4.2 Improve efficiency in water transportation	MD/FAA/ IEAT	OTP	0.010	B.E 2569 (2026)
	4.3 Promoting logistic management*	OTP/DLT	DEDE	-	

Action Plan	Measures	Main agency	Supporting agency	Target values in 2030 (MtCo2E)	Implementation Start (Year)
	5. Group of Measures in supporting alternative future energy for transport			-	
	5.1 Promoting the use of hydrogen for transportation (start operating after 2030)	EPPO/ DOEB/DEDE	OTP	-	
	5.2 Promoting Sustainable Aviation Fuel (SAF) at the airport (under MOEN and supporting its usage, especially for international air transport)	CAAT/FAA/ DOEB/DEDE	OTP	-	
	6. Group of Measures in developing basic infrastructure and transport sector (Transport Infrastructure and Support)			-	
	6.1 Development of environmentally friendly transport infrastructure	MD/ Airports/ FFA/EAT/ PAT/SRT/ MRTA	OTP/DEDE	-	
	6.2 Development of basic infrastructure supporting transport efficiency	DOH/ DMCR/ MD/ Airports/ FAA/EAT/ SRT/MRTA	OTP	-	
	Waste management and industrial wastewater sector			9.115	
	1. Group of measures in managing community waste			**9.110**	
	1.1 Burning landfill gas or using it for electricity generation	Bangkok/ LAO/Private sector	DLA/ PCD/ DEDE/ERC/ NSTDA/TGO/ OHEC/NESDC	1.860	B.E 2564 (2021)
	1.2 Waste to energy for electricity generation	DLA/ DEDE/ LAO/Private sector	PCD/ DCCE/ DLA/TGO/ NESDC	2.130	B.E 2564 (2021)
	1.3 Semi aerobic landfill	LAO		1.0 tCO2	B.E 2564 (2021)
	1.4 Composting and bio-extract	DLA/ Bangkok/ LAO/Private sector	PCD/ DCCE / PRD/OHEC/ NSTDA/ Department of Agriculture/ NESDC	0.440	B.E 2564 (2021)
	1.5 Anaerobic digestion	DLA/ Bangkok/ PCD	DEDE/OHEC/ NSTDA/NESDC	0.010	B.E 2564 (2021)

Action Plan	Measures	Main agency	Supporting agency	Target values in 2030 (MtCo2E)	Implementation Start (Year)
	1.6 Mechanic biological treatment	Bangkok/ LAO/Private sector	DLA/PCD/ DCCE /DEDE/OHEC/ NSTDA/NESDC	0.670	B.E 2564 (2021)
	2. Group of measures in wastewater management in the community			**0.005**	
	2.1 Increase integration of wastewater into the system and increase system units in treating wastewater from the community**	LAO/WMA/ Bangkok		0.005	B.E 2567 (2024)
	3. Group of measures in industrial wastewater management			**4.000**	
	3.1 Increasing the production of biogas from industrial wastewater by reusing methane gas	DIW/DEDE		4.000	B.E 2564 (2021)
	4. Group of measures in promoting GHG reduction in the communities and industrial wastewater			-	
	4.1 Reducing the amount of plastic waste, such as single-use plastics and food packaging foam	Government agencies/ Private sector	PCD/ DCCE	-	
	4.2 Reducing the amount of organic waste	Government agencies/ Private sector	PCD/ DCCE / LAO/Bangkok	-	
	4.3 Promoting eco-friendly products and services	Government agencies	PCD/DCCE	-	
	4.4 Encouraging the production of products following the circular economy principles through carbon footprint certification	TGO	PCD/DCCE	-	
	Increasing the use of municipal waste				
	4.5 Sorting municipal waste at the source for recycling	Government agencies	PCD /LAO/ Bangkok	-	
	4.6 Utilizing organic waste at the source, such as for animal feed, composting, and biogas production	Farm owners	DLA/LAO/ Bangkok	-	
	Stop open burning of waste				
	4.7 Stop open burning of waste	DLA/LAO	PCD	-	

Action Plan	Measures	Main agency	Supporting agency	Target values in 2030 (MtCo2E)	Implementation Start (Year)
	Community wastewater management				
	Reducing the amount of community wastewater at the source				
	4.8 Promoting the production and use of water-saving products			-	
	(1) Invite water-saving product manufacturers to register their products and services as environmentally friendly	TEI	PCD/DCCE	-	
	(2) Promote and encourage the use of water-saving products in government buildings, private sector facilities, and households	DCCE	PCD	-	
	(3) Advocate for the use of water-saving products through environmental impact assessment systems	ONEP	PCD	-	
	4.9 Promoting the production and use of wastewater treatment products with high-efficiency labels			-	
	(1) Develop a high-efficiency wastewater treatment product label			-	
	(2) Promote manufacturers of wastewater treatment products to seek certification for high-efficiency wastewater treatment tank labels	TEI/ PCD	DCCE /DPT /FTI /FFC	-	
	(3) Promote and encourage government buildings, private sector facilities, and households to choose high-efficiency wastewater treatment products with certification labels	TEI/ PCD	ThaiHealth/ DCCE /FFC/ wastewater treatment tank companies	-	
	(4) Advocate for the use of certified high-efficiency wastewater treatment products through environmental impact assessment systems	ONEP	PCD	-	

Action Plan	Measures	Main agency	Supporting agency	Target values in 2030 (MtCo2E)	Implementation Start (Year)
	Utilizing wastewater and sludge from community wastewater treatment systems				
	4.10 Encourage Local Administrative Organizations (LAOs) to reuse treated wastewater for their own operations and for private sector use	WMA/ PCD/ Bangkok	LAO/private and relevant agencies according to law	-	
	4.11 Utilize sludge from wastewater treatment systems	LAO/ Bangkok/ PCD/ Department of Health	LAO/private and relevant agencies according to law	-	
	Developing a system for assessing greenhouse gas emissions				
	4.12 Develop a system for data collection regarding the amount of GHG from relevant agencies	PCD	TGO/ DCCE	-	
	Industrial processes and product utilization sector			**1.400**	
	1. Group of measures in replacing clinker			1.000	
	1.1 The use of alternative materials to replace clinker in the production of hydraulic cement	DIW	DIW/MOC	0.900	B.E 2564 (2021)
	1.2 The use of alternative materials to replace cement in ready-mixed concrete	DIW	DIW/MOC	0.100	B.E 2564 (2021)
	2. Group of measures in replacing/changing refrigerant			**0.400**	
	2.1 Modifying refrigeration systems under the RAC NAMA (Refrigeration and Air Conditioning Nationally Appropriate Mitigation Actions) project	DIW	Entrepreneurs	0.300	B.E 2565 (2022)
	2.2 Proper disposal of refrigerants and the management of refrigeration systems in accordance with regulations	DIW	PCD/ Entrepreneurs	0.100	B.E 2569 (2026)
	Agricultural sector			**4.110**	
	1. Waste management measures in the livestock sector	DLD	OAE	3.000	B.E 2564 (2021)
	2. Measures to reduce the use of chemical fertilizers	IDD	OAE	0.100	B.E 2569 (2026)

Action Plan	Measures	Main agency	Supporting agency	Target values in 2030 (MtCo2E)	Implementation Start (Year)
	3. Measures for alternate wet and dry rice cultivation	Rice/RID	OAE	1.000	B.E 2565 (2022)
Total targets for GHG reduction in 2023				**184.823**	

Action Plan 1.2 Measures reducing greenhouse gas emissions in each sector by receiving international support. This action plan comprises 2 measures as follows:

1. Develop approaches to securing international support for potential projects aimed at reducing greenhouse gas emissions, as detailed in Table 6–3. This should include considering operations aligned with Development Guideline 5 and promoting international cooperation in greenhouse gas emission reductions through appropriate measures that benefit Thailand.

2. Facilitate the matching of project developers with potential sources of investment and technology from abroad that are suitable and appropriate for the projects.

Summary of important measures that require international support

Measures/Projects	Main agency	Supporting agency	Target values in 2030 (MtCO2e)
1. Projects that are in the process of requesting international support			1.120
1.1 Industrial processes and product use sector			0.100
- Using technology to reduce nitrous gas in industrial production	Entrepreneurs/ DCCE / MPs	TGO	0.100
1.2 Agricultural sector			1.020
- Enhancing rice cultivation capacity to adapt to climate conditions	Rice/RID/OAE	DOAE/DCCE/TGO	1.020
2. Projects that will be promoted to receive international support through various climate finance mechanisms			36.420
2.1 Energy sector			32.050
- Advance Renewable Electricity Production	DEDE	EPPO	26.970
- Transitioning to low carbon in the industrial sector	DEDE	EPPO/DIW	3.120
- Increasing efficiency in industrial machines	DEDE	EPPO/ DIW	1.870
2.2 Transportation sector			**2.470**
- Using advanced EV *not including 30@30 policy	OTP/EPPO	N/A	2.470
2.3 Measures/ Projects/ Technologies that are operating in addition to Action Plan 1.1			1.900
- Using technology in processing chemical industry	DIW	N/A	1.900
- Improving soil using biochar	OAE	N/A	
- Waste management in community and wastewater treatment in the industry	PCD/ DIW	N/A	
- Cross cutting operations	MPs	N/A	

Note: N/A refers to an unspecified agency as there is currently no existing operation, but the measures/ projects have mitigation potential and therefore should seek to receive international support

About the Author

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A financier by training, Sarinee Achavanuntakul is Bangkok-based sustainability researcher and social critic. After spending close to one decade in commercial and investment banking, she co-founded Sal Forest Co. Ltd. to focus on sustainable business research (http://www.salforest.com/) in 2013, co-founded Fair Finance Thailand coalition (www.fairfinancethailand.org) in 2017, and founded Climate Finance Network Thailand (www.climatefinancethai.com) (CFNT) in 2024. Since 2013, she has executed over 35 research projects on a range of topical sustainability issues in Thailand ranging from business and human rights, food supply chain mapping, sustainable banking, and just energy transition. She has also conducted human rights risk assessment for several large Thai conglomerates, as well as designed and delivered workshops on sustainability issues and human rights due diligence for over 1,500 participants from the government, business, and civil society sectors as of August 2025.

Sarinee also co-founded a number of other organizations including Thai Netizen Network (TNN, www.thainetizen.org) to advocate Internet freedom and online privacy, ThaiPublica (https://www.thaipublica.org), an online investigative news organization, and Salt Publishing (www.salt.co.th), a local publishing house. She holds an MBA in finance from Leonard Stern School of Business, New York University, and a BA in economics from Harvard University.

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Hataichanok is a researcher at Sal Forest, a Bangkok-based sustainability research organization. Their work spans climate change, energy transition, sustainable banking, human rights, and governance practices, with a focus on policy analysis, stakeholder engagement, and cross-sector dialogue to advance sustainability in Thailand. Previously, Hataichanok served as a policy analyst with the Move Forward Party, advising senior leaders on government policies, social impacts, and economic strategies. She also worked at the Thailand Development Research Institute on transportation and logistics policy, gaining expertise in both quantitative and qualitative policy evaluation. With experience across think tanks, political organizations, and sustainability research, Hataichanok brings a comprehensive perspective on the intersections of sustainability, governance, and public policy. She hold a Master's in Business Economics from NIDA and a Bachelor's in Applied Statistics from King Mongkut's Institute of Technology Ladkrabang.

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Trained in international relations with complementary expertise in public policy, Worrawit contributed to several research projects ranging from business and human rights, sustainable finance, and just energy transition during his time at Sal Forest. He later transitioned into humanitarian field with the focus on advocacy, taking on the role of Humanitarian Affairs Officer at Médecins Sans Frontières (MSF).

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