(UNOFFICIAL TRANSLATION)

NDC Action Plan on Mitigation 2021-2030

Department of Climate Change and Environment
Ministry of Natural Resources and Environment

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Chapter 1

Introduction

Thailand has demonstrated its commitment in addressing climate change issues by becoming a Party to the United Nations Framework Convention on Climate Change (UNFCCC) and the Paris Agreement. The country has set a national GHG emissions reduction target, known as the Nationally Determined Contribution (NDC), which is part of the international commitment to demonstrate cooperation in limiting the global average temperature increase to no more than 2 or 1.5 degrees Celsius depending on each country's context and capabilities. Thailand submitted its NDC to the UNFCCC Secretariat on October 1, 2015, aiming for a 20% reduction in GHG emissions compared to the business-as-usual (BAU) scenario by 2030. The level of contribution could increase up to 25% subject to adequate and enhanced access to technology development and transfer, financial resources, and capacity-building support under the UNFCCC.

The Office of Natural Resources and Environmental Policy and Planning (ONEP) was reorganized, with certain responsibilities transferred to the newly established Department of Climate Change and Environment (DCCE), as per the Ministerial Regulation on the Division of the Department of Climate Change and Environment B.E. 2566, issued by the Ministry of Natural Resources and Environment on August 17, 2023. As the UNFCCC National Focal Point, DCCE is responsible for coordinating Thailand's climate change activities and international participation. Following the submission of the country's first NDC, the Nationally Determined Contribution (NDC) Roadmap on Mitigation 2021-2030 was developed to ensure that the national target of reducing GHG emissions by 20-25% from the BAU scenario by 2030 is translated into the sectoral reduction targets. In addition, the NDC Roadmap also serves as the initial framework to assist relevant agencies in achieving Thailand's NDC target. The Cabinet approved the NDC Roadmap on May 23, 2017. Subsequently, the (Draft) Supportive Action Plan for Thailand's NDC Roadmap on Mitigation 2021-2030 was developed to enhance the operational capacity of relevant agencies by addressing limitations, support needs, and the system/framework for monitoring and reporting the implementation of mitigation measures. The National Committee on Climate Change Policy (NCCC) approved the (Draft) Supportive Action Plan on April 20, 2018. ONEP then submitted it to the Cabinet for further review and approval. Relevant agencies were instructed to use the (Draft) Supportive Action Plan as the framework for their operations and to report their progress to ONEP every six months to ensure comprehensive and integrated implementation of the plan. Additionally, the Budget Bureau, the Office of the Public Sector Development Commission, and other relevant agencies were tasked with providing budgetary support for the development of performance indicators, as well as monitoring and evaluating the performance of government agencies to ensure efficiency and alignment with the (Draft) Supportive Action Plan. Furthermore, in its 2nd/2017 meeting on July 13, 2017, the NCCC assigned the Sector Focal Points for specific sectors as follows: (1) the energy sector assigned to the Energy Policy and Planning Office (EPPO) under the Ministry of Energy; (2) the transport sector assigned to the Office of Transport and Traffic Policy and Planning (OTP) under the Ministry of Transport; (3) the IPPU and industrial wastewater sector assigned to the Department of Industrial Works (DIW) under the Ministry of Industry; and (4) the municipal waste

management sector assigned to the Pollution Control Department (PCD) under the Ministry of Natural Resources and Environment. Each Sector Focal Point was tasked with developing a sectoral action plan on mitigation in line with the targets outlined in Thailand's NDC Roadmap, with completion expected by 2018. Subsequently, in its 3rd/2018 meeting on November 19, 2018, the NCCC approved the NDC Sectoral Action Plan on Mitigation 2021-2030 for the energy, transport, IPPU and industrial wastewater, and municipal waste management sectors, which ONEP later submitted to the Cabinet for further review.

The Ministry of Natural Resources and Environment, through ONEP, submitted the (Draft) Supportive Action Plan for Thailand's NDC Roadmap on Mitigation and the NDC Sectoral Action Plan on Mitigation 2021-2030 to the Office of the National Economic and Social Development Council (NESDC) for consideration. This submission is in accordance with the approval process for all level-three plans, which are to be submitted to the Cabinet for review, as specified in the Cabinet Resolution on December 4, 2017. In the 2nd/2020 meeting of the Subcommittee on Promotion of Eco-friendly Growth, held under the National Economic and Social Development Council on February 13, 2020, the Subcommittee resolved that ONEP should revise and consolidate the (Draft) Supportive Action Plan with the NDC Sectoral Action Plan on Mitigation. This revision aimed to ensure the integration of the plans across sectors, promoting alignment and coordination among relevant agencies for more effective and efficient implementation. As per the Subcommittee's recommendation, the plan was renamed the "NDC Action Plan on Mitigation 2021-2030" to maintain consistency when submitting it for Cabinet consideration, in accordance with the Cabinet Resolution on December 4, 2020.

In 2021, Thailand, represented by Prime Minister General Prayut Chan-o-cha, announced at the World Leaders Summit during the 26th Conference of the Parties to the UNFCCC (COP26) its intention to strengthen the country's GHG emissions reduction target. The country has set a goal of achieving carbon neutrality by 2050 and net-zero GHG emissions by 2065. With full financial, technological, and capacity-building support provided through international cooperation and mechanisms under the UNFCCC, Thailand aimed to enhance its NDC target to 40%. Subsequently, on November 2, 2022, Thailand submitted its 2nd Updated NDC to the UNFCCC, setting a target to reduce GHG emissions by 30% from the BAU level by 2030 through domestic implementation. The country could potentially reduce emissions by up to 40%, contingent on access to international support mechanisms for technology development and transfer, financial assistance, and capacity building. Nevertheless, Thailand remains committed to achieving its long-term goals of carbon neutrality by 2050 and net-zero GHG emissions by 2065. To support these objectives, Thailand developed the NDC Action Plan on Mitigation 2021–2030, which integrates the (Draft) Supportive Action Plan and the NDC Sectoral Action Plan on Mitigation, in accordance with recommendations from the Subcommittee on Promotion of Eco-friendly Growth under the National Economic and Social Development Council. Moreover, sectoral targets and mitigation measures were established in line with the country's enhanced NDC target. The scope of implementation was expanded to encompass the energy, transport, IPPU, waste and industrial wastewater management, and agriculture sectors. Additionally, relevant data and supporting measures were also updated to ensure a more comprehensive and integrated approach to GHG mitigation, with the goal of helping Thailand achieve its emissions reduction target as outlined in the 2nd Updated NDC.

The NDC Action Plan will serve as a strategic framework for sectoral GHG emissions reduction and act as a tool to drive and support mitigation actions by relevant agencies, especially those facing limitations or lacking readiness. By addressing these challenges, the plan aims to enhance operational efficiency and effectiveness, ultimately ensuring that the country achieves its GHG emissions reduction target in a tangible and measurable manner.

Chapter 2

Alignment with the Three-Level Plan as per the Cabinet Resolution on December 4, 2017

Thailand's NDC Action Plan on Mitigation 2021–2030 has been developed as a framework for sectoral GHG emissions reduction and is in alignment with the country's NDC. The plan aims to achieve a 30-40% reduction in GHG emissions from the BAU scenario by 2030 through targeted actions in five key sectors: energy, transport, IPPU, waste and industrial wastewater management, and agriculture. The NDC Action Plan is categorized as a level-3 plan and aligns with the three-level plan framework as outlined in the Cabinet Resolution on December 4, 2017.

1. Level-1 Plan: National Strategy

National Strategy 5: Eco-friendly growth
Goal: Ensure balanced utilization of natural resources and environmental base by balancing development with ecosystem capacity
Indicators: GHG emissions, bio-based economy value
Key Strategy 3: Promote sustainable, climate-friendly based society (by mitigating GHG emissions and focusing on climate-friendly investments in public and private sectors' infrastructure development)

2. Level-2 Plan:

2.1 The Master Plan under the National Strategy

Key Issue 18: Sustainable growth
Goal: Improve Thailand's environmental quality in a sustainable manner
Indicator: Thailand's ranking in the Environmental Performance Index
Target: In 2028-2032, Thailand is ranked in the top 30 in the Environmental Performance Index under the subplan to create sustainable growth in a green society.
Development Strategies:
(1) Reduce GHG emissions
(2) Focus on climate-friendly investments in public and private sectors' infrastructure development

Subplan 18.3: Create sustainable growth in a green society
Goal: Reduce Thailand's GHG emissions and achieve the targets outlined in the subplans of the Master Plan
Indicator: Total GHG emissions in the energy, transport, IPPU, and waste management sectors are reduced ($MtCO_2$).
Target: GHG emissions in 2028–2032 are reduced by at least 30% from the BAU level.

2.2 The National Reform Plan for Natural Resources and the Environment

Reform on the Environment: Reform Point 3 – Push all sectors to solve climate change problems

Reform Point 3.1: Mandate that government investment projects assess the potential impacts and/or risks of climate change and develop strategies to mitigate them

Reform Point 3.2: Accelerate the development of a central database on GHG emissions in Thailand, along with spatial risk data related to climate change

Reform Point 3.3: Establish appropriate mechanisms to create economic incentives for the private sector to reduce GHG emissions

Reform Point 3.4: Encourage people to change their behavior in daily life in order to solve climate change problems

Reform on the Management of Natural Resources and the Environment

Reform Point 8: Reform laws related to natural resources and the environment – enact legislation to ratify commitments made under international agreements to which Thailand is a signatory (including those addressing climate change)

2.3 The 13th National Economic and Social Development Plan (2023 - 2027)

Development Target 3.1.4: Ensuring the transition of production and consumption towards sustainability (the sustainability of natural resources and the environment)

Indicator: GHG emissions

Target: In 2027, the overall GHG emissions (total including the energy, transport, IPPU, and waste management sectors) are reduced by at least 20% compared to emissions in the BAU scenario.

Milestone 10: Thailand is a circular economy and low-carbon society

Main Targets: Enhance value through a circular economy and efficient use of resources, while sustainably conserving, rehabilitating, and utilizing natural resources, and establish a low-carbon, sustainable society by implementing the following development strategies: (1) develop industries and services based on the principles of a circular economy and low-carbon society; (2) generate net incomes for communities, local entities, and farmers through the circular economy and low-carbon society; (3) rehabilitate natural resources and improve resource efficiency in line with the Sufficiency Economy Philosophy; (4) foster the development of technology, innovation, and mechanisms to support the circular economy and low-carbon society; and (5) encourage a shift in economic behaviors and lifestyles towards more sustainable ways of living.

Other related milestones

Milestone 2: Thailand is a sustainable quality-oriented tourist destination

Milestone 3: Thailand is the world's important electric vehicle manufacturing base

Milestone 5: Thailand is the region's key strategic trade, investment, and logistics gateway

Milestone 6: Thailand is ASEAN's hub for digital and smart electronics industry

Milestone 8: Thailand has smart cities as well as safe and livable regions with sustainable growth

Milestone 11: Thailand can mitigate risks and impacts of natural disaster and climate change

2.4 The National Security Policy and Plan

Policy 11: Maintaining natural resource and environmental security

Policy 12: Strengthening energy and food security

3. Level-3 Plan: Related Plans

3.1 The Climate Change Master Plan 2015-2050 of the Ministry of Natural Resources and Environment by the Office of Natural Resources and Environmental Policy and Planning

3.2 The Environmental Quality Management Plan 2023-2027 of the Ministry of Natural Resources and Environment by the Office of Natural Resources and Environmental Policy and Planning

3.3 The 5-Year Government Action Plan (2023-2027) of the Office of Natural Resources and Environmental Policy and Planning

3.4 The 5-Year Government Action Plan (2023-2027) of the Ministry of Natural Resources and Environment by the Office of the Permanent Secretary for Ministry of Natural Resources and Environment

3.5 The (Draft) National Energy Plan (2023) of the Ministry of Energy by the Energy Policy and Planning Office

3.6 The Transport Action Plan 2023-2027 of the Ministry of Transport by the Office of the Permanent Secretary for Ministry of Transport

3.7 The National Waste Management Action Plan Phase 2 (2022-2027) of the Ministry of Natural Resources and Environment by the Pollution Control Department

3.8 The 20-Year Pollution Management Strategy of the Ministry of Natural Resources and Environment by the Pollution Control Department

3.9 The Pollution Management Plan 2017-2021 of the Ministry of Natural Resources and Environment by the Pollution Control Department

3.10 The (Draft) Agricultural Action Plan for Climate Change Adaptation 2023-2027 of the Ministry of Agriculture and Cooperatives by the Office of Agricultural Economics

3.11 The Bangkok Master Plan on Climate Change 2013-2023 of the Bangkok Metropolitan Administration by the Environment Department

3.12 The 5-Year Government Action Plan (2023-2027) of the Ministry of Finance (Revised Edition)

4. Alignment with the Sustainable Development Goals (SDGs) of the United Nations

SDG 13: Take urgent action to combat climate change and its impacts

Thailand has submitted its NDC to the UNFCCC Secretariat, setting a minimum target to reduce GHG emissions by 30% from the BAU scenario and an ambitious target of a 40% reduction by 2030. This is outlined in the country's NDC Action Plan on Mitigation 2021-2030, which serves as a framework for relevant agencies to implement sectoral GHG emissions reduction and ensure that the country achieves its national GHG emissions reduction target in a tangible manner. Additionally, the NDC Action Plan aligns with the following SDG targets:

Target 13.1: Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries

Target 13.2: Integrate climate change measures into national policies, strategies, and planning

Target 13.3: Improve education, awareness-raising, and human and institutional capacity on climate change mitigation, adaptation, and early warning

(1) Target 13.A: Fulfill the commitment made by developed countries which are Parties to the UNFCCC to mobilize USD100 billion annually by 2020 from all sources to address the needs of developing countries through meaningful mitigation actions and transparent implementation and fully operationalize the Green Climate Fund (GCF) through its capitalization as soon as possible.

(2) Target 13.B: Promote mechanisms that increase the capacity for climate change-related planning and management in least developed countries and small island developing states, with a focus on women, youth, and local and marginalized communities.

The alignment and linkages between the policies and plans related to the NDC Action Plan on Mitigation 2021-2030 are shown in **Figure 2-1**.

<table>
<tr><td>Level 1 Plan</td><td>National Strategy (2018-2037)</td><td colspan="5">National Strategy 5: Eco-friendly growth
Goal: Ensure balanced utilization of natural resouces and environmental base by balancing development with ecosystem capacity
Indicators: GHG emissions, bio-based economy value
Key Strategy 3: Promote sustainable, climate-friendly based society (by mitigating GHG emissions and focusing on climate-friendly investments in public and private sectors' infrastructure development)</td></tr>
<tr><td rowspan="4">Level 2 Plan</td><td>The Master Plan under the National Strategy</td><td colspan="5">Key Issue 18: Sustainable growth Subplan 18.3: Create sustainable growth in a green society</td></tr>
<tr><td rowspan="2">The National Reform Plan</td><td colspan="5">Natural Resources and the Environment / Reform on the Environment</td></tr>
<tr><td colspan="3">The Environment
Reform Point 3: Push all sectors to solve climate change problems</td><td colspan="2">The Management of Natural Resources and the Environment
Reform Point 8: Reform laws related to natural resources and the environment</td></tr>
<tr><td>The 13th National Economic and Social Development Plan (2023-2027)</td><td colspan="5">Development Target 3.1.4: Ensuring the transition of production and consumption towards sustainability
Indicator: GHG emissions
Target: In 2027, the overall GHG emissions are reduced by at least 20% compared to emissions in the BAU scenario
Milestone 10: Thailand is a circular economy and low-carbon society</td></tr>
<tr><td>The National Security Policy and Plan</td><td colspan="3">Policy 11
Maintaining natural resource and environmental security</td><td colspan="2">Policy 12
Strengthening energy and food security</td></tr>
<tr><td rowspan="6">Level 3 Plan</td><td colspan="6">The Climate Change Master Plan 2015-2050</td></tr>
<tr><td colspan="2">Climate Change Adaptation</td><td colspan="2">GHG Reduction and Promotion of Low-Carbon Growth</td><td>Capacity Building for Climate Change Management</td></tr>
<tr><td>The Environmental Quality Management Plan 2023-2027</td><td>The 5-Year Government Action Plan of the Office of Natural Resources and Environmental Policy and Planning (2023-2027)</td><td>The 5-Year Government Action Plan of the Ministry of Natural Resources and Environment (2023-2027)</td><td>The (Draft) National Energy Plan (2023)</td><td colspan="2">The Transport Action Plan 2023-2027</td></tr>
<tr><td>The National Waste Management Action Plan Phase 2 (2022-2027)</td><td>The 20-Year Pollution Management Strategy</td><td>The Pollution Management Plan 2017-2021</td><td>The (Draft) Agricultural Action Plan for Climate Change Adaptation 2023-2027</td><td colspan="2">The Bangkok Master Plan on Climate Change 2013-2023</td></tr>
<tr><td rowspan="2">The 5-Year Government Action Plan (2023-2027) of the Ministry of Finance (Revised Edition)</td><td colspan="5">The NDC Action Plan on Mitigation 2021–2030</td></tr>
<tr><td>Energy</td><td>Transport</td><td>IPPU</td><td>Waste</td><td>Agriculture</td></tr>
</table>

Figure 2-1 Alignment and linkages between climate change policies and plans

Chapter 3

Concepts and Processes for Developing the NDC Action Plan

The NDC Action Plan on Mitigation 2021–2030 was developed as a strategic guideline for reducing GHG emissions. It aims to assist the Sector Focal Points and other relevant agencies in achieving the country's NDC target of reducing emissions by 30-40% from the BAU scenario by 2030. The NDC Action Plan consists of five key development strategies and 17 work plans, which together represent a potential reduction of 222 MtCO2e, or a 40% reduction from the BAU level by 2030. The implementation is divided into two categories: domestic actions and actions that require international support. Domestic actions have the potential to reduce emissions by 184.8 MtCO2e, which accounts for 33.3% of the target. On the other hand, actions that require international support could reduce emissions by 37.5 MtCO2e, or 6.7% of the target. The breakdown of the emissions reduction potential for domestic actions is as follows: (1) the energy sector has the potential to reduce emissions by 124.6 MtCO2e, or 22.4% of the target; (2) the transport sector can reduce emissions by 45.6 MtCO2e, or 8.2%; (3) the municipal waste and industrial wastewater management sector has a reduction potential of 9.1 MtCO2e, or 1.6%; (4) the IPPU sector has the potential to reduce emissions by 1.4 MtCO2e, or 0.3%; and (5) the agriculture sector has a potential reduction of 4.1 MtCO2e, or 0.7%. For actions requiring international support, the breakdown is as follows: (1) the energy sector has the potential to reduce emissions by 32.1 MtCO2e, or 5.8% of the target; (2) the transport sector can reduce emissions by 2.5 MtCO2e, or 0.4%; and (3) the municipal waste and industrial wastewater management sector, the IPPU sector, and the agriculture sector collectively have the potential to reduce emissions by 1.9 MtCO2e, or 0.3%.

The NDC Action Plan was developed through a collaborative effort between the DCCE under the Ministry of Natural Resources and Environment (MONRE) and the Sector Focal Points, which include the Energy Policy and Planning Office (EPPO), the Office of Transport and Traffic Policy and Planning (OTP), the Department of Industrial Works (DIW), the Pollution Control Department (PCD), and the Office of Agricultural Economics (OAE), along with other relevant agencies involved in defining and developing measures, projects, and activities aimed at reducing GHG emissions. These measures are aligned with the core missions of the aforementioned agencies and the National Strategy to promote eco-friendly growth and sustainable development. The process for developing the NDC Action Plan involved discussions among relevant agencies through the Working Group on GHG Mitigation Policy and Planning, which functions as a mechanism within the country's institutional framework. Each Sector Focal Point was responsible for gathering data on the work plans, activities, and projects related to GHG emissions reduction within their respective sectors, ensuring they met the targets set by the Working Group. This allowed the Sector Focal Points to assess their sectoral implementation plans and propose potential mitigation measures that align with their current and future operations. The proposed measures were reviewed internally by each Sector Focal Point. Once the Sector Focal Points had finalized their mitigation work plans, they submitted the work plans to the DCCE, which consolidated the data and drafted the NDC Action Plan on Mitigation 2021-2030. The plan was then submitted for review and approval in accordance with the country's institutional framework.

In addition to the review process based on the institutional framework, the DCCE organized workshops and discussion meetings to further develop the NDC Action Plan on Mitigation. These sessions served as key platforms for the DCCE to gather input and recommendations on setting the targets, mitigation measures, and strategies to drive the implementation of the Action Plan. The discussions also addressed sector-specific challenges and the support needed for effective implementation, ensuring that the NDC Action Plan would be comprehensive and actionable. Furthermore, the DCCE also facilitated the collection of feedback and suggestions through its website, allowing input from a broad range of stakeholders and ensuring that the needs of all sectors were fully considered. A summary of the NDC Action Plan's formulation process for consideration at the policy level is presented in Figure 3-1.

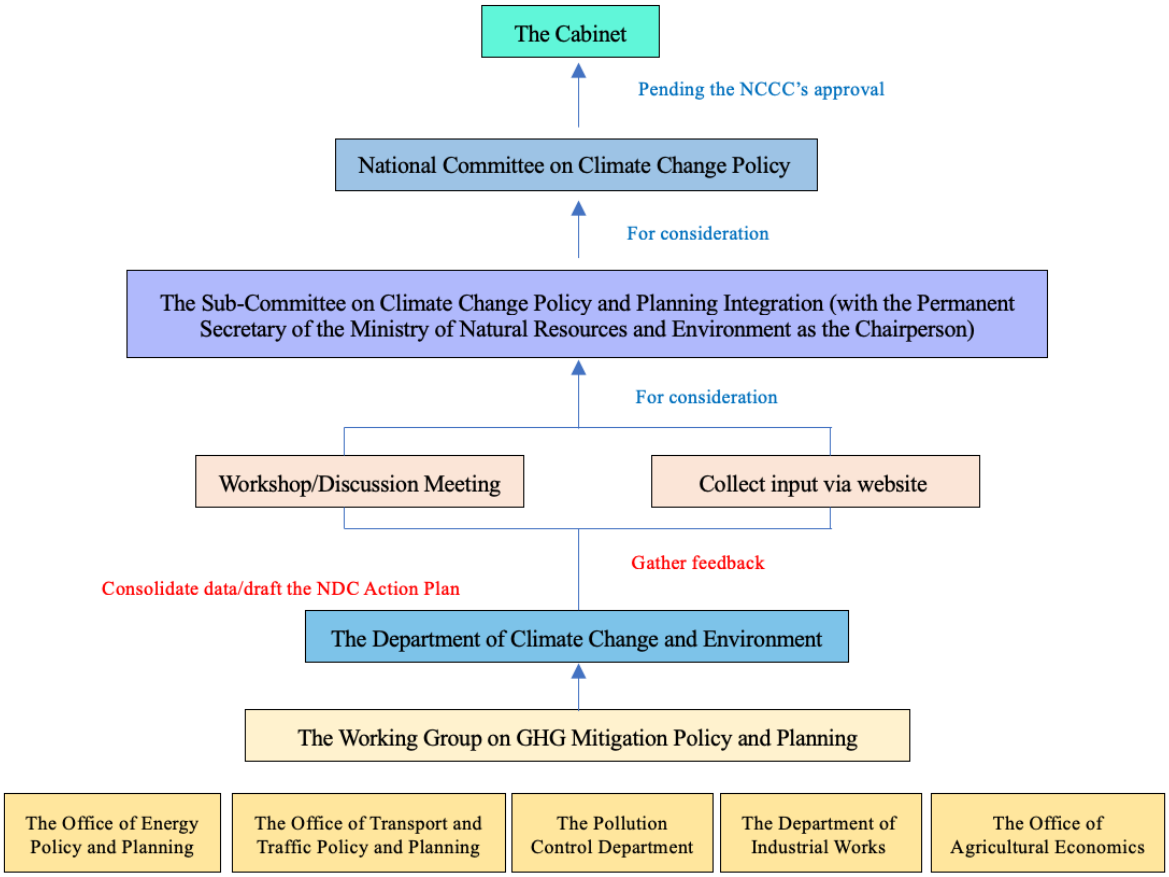


Figure 3-1 Formulation process for the NDC Action Plan on Mitigation 2021-2030

Chapter 4

Global and Thailand's Greenhouse Gas Situation

4.1 Global Greenhouse Gas Emissions Situation

Global GHG emissions have been on a continuous rise, reaching a total of 46,187 MtCO2eq in 2020. The top five countries with the highest GHG emissions in 2020 were: (1) The People's Republic of China, accounting for 26.6% of global emissions; (2) The United States of America, contributing 11.5%; (3) The Republic of India, responsible for 6.9%; (4) The European Union, at 6.4%; and (5) The Russian Federation, accounting for 3.4% of global emissions. Notably, these countries not only account for the largest share of emissions but also make up more than half of the world's population. Additionally, they are among the fastest-growing economies, with the majority of their emissions coming from electricity and heat production, transport, and agriculture. In comparison, Thailand ranks 20th in global GHG emissions, contributing 0.97% to the world's total.[1]

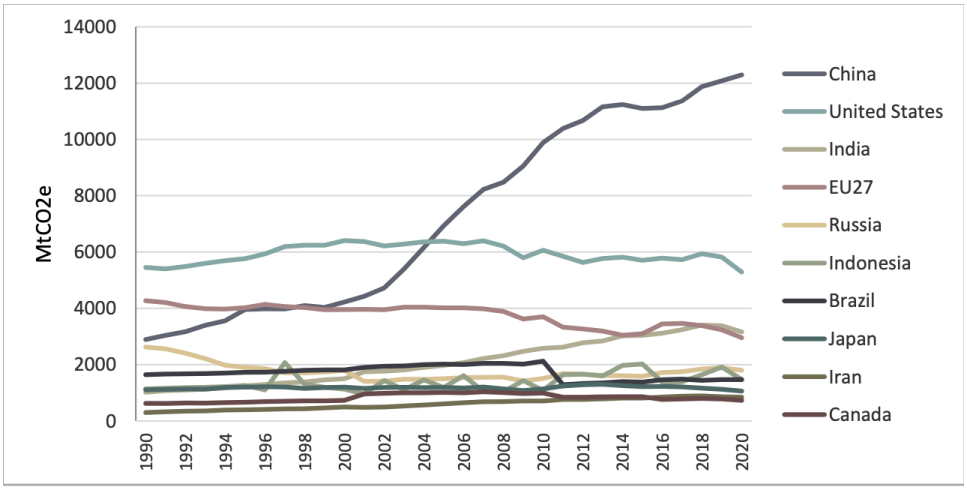


Figure 4-1 GHG emissions of different countries from 1990 to 2020 (total including LUCF)

The 2023 NDC Synthesis Report, prepared by the UNFCCC Secretariat, provides a comprehensive overview of global NDC implementation based on submissions from 168 countries. Of these, 153 reports included updated or new mitigation targets (data compiled as of September 25, 2023), collectively accounting for 94.9% of global GHG emissions in 2019 (52.6 GtCO2eq), excluding the forestry and land use sector (LULUCF). Each country outlined specific targets for reducing GHG emissions across various sectors, while also identifying co-benefits from adaptation actions and presenting economic diversification plans in response to climate

[1] https://www.climatewatchdata.org/ghg-emissions?source=Climate%20Watch

change impacts. The nature of these GHG reduction targets varies depending on the unique context of each country, with the majority setting clear quantitative targets such as absolute emission reductions, reductions relative to BAU baselines, and economy-wide emission targets. The implementation of these targets is further supported by Article 6 of the Paris Agreement, which facilitates carbon market cooperation. Article 6.2 enables international collaboration through agreements between countries, while Article 6.4 establishes a centralized international crediting mechanism overseen by the governing body of the Paris Agreement, including mechanisms for voluntary cooperation.

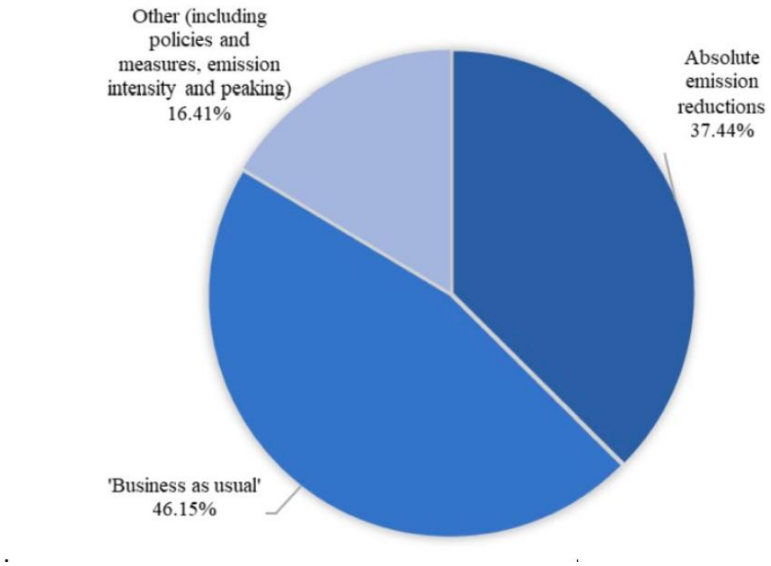


Figure 4-2 Proportion of GHG reduction target types submitted by each country to the UNFCCC[2]

[2] The 2023 NDC Synthesis Report. Accessible from https://unfccc.int/sites/default/files/resource/cma2023_12.pdf

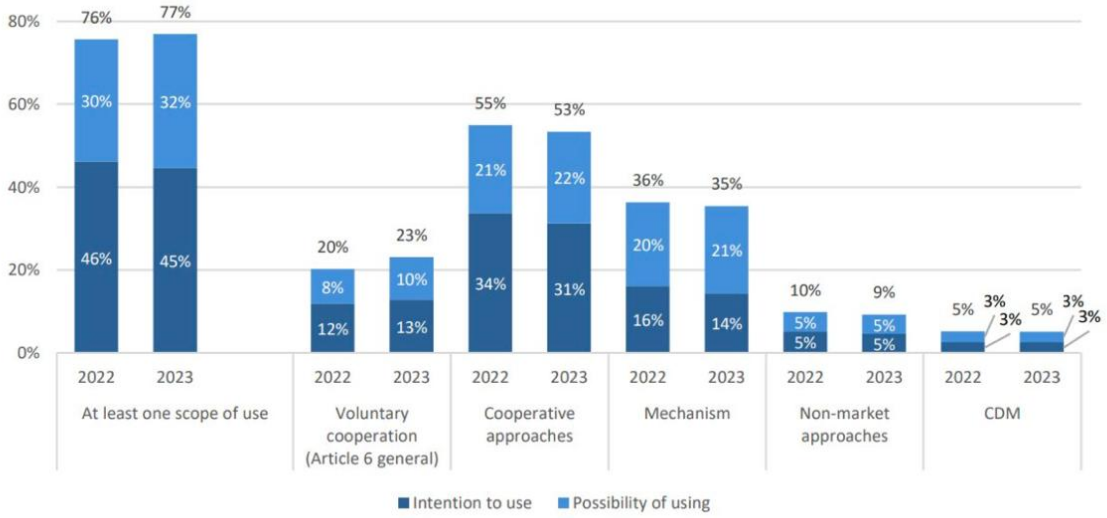


Figure 4-3 The use of Article 6 of the Paris Agreement as stipulated in the NDCs of different countries[3]

When considering the NDCs submitted by all countries alongside the findings from the IPCC Special Report: Global Warming of 1.5°C, which outlines the pathway for reducing global GHG emissions to limit the average global temperature increase to no more than 1.5°C (the 1.5°C Pathway), it is evident that the current NDC implementation remains insufficient to achieve this target. As a result, the global carbon budget has already been depleted by more than 80%, leaving only 70 GtCO2eq available after 2030. This underscores the urgent need for all countries to significantly enhance their NDC commitments, as global peak emissions must be reached before 2030. Setting emissions reduction targets for 2035 and beyond will become increasingly challenging and stringent in order to align with the 1.5°C Pathway. By 2035, global GHG emissions must be reduced by 60% compared to 2019 levels. However, achieving this goal will require several countries to actively pursue their conditional NDC targets, which rely on access to climate finance, technology transfer and technical cooperation, capacity-building support, the readiness of market-based mechanisms, and the carbon sequestration potential of the forestry sector.

[3] The 2023 NDC Synthesis Report 2023. Accessible from https://unfccc.int/sites/default/files/resource/cma2023_12.pdf

Figure 4-4 Carbon budget in alignment with the 1.5°C Pathway[4]

In their mitigation efforts, over 50% of countries will align their NDC targets with the transition to a low-carbon economy and society, taking into account the social, environmental, and economic factors, as well as the Sustainable Development Goals. Furthermore, mitigation targets should be integrated into national legislative processes as well as national policy and planning frameworks to ensure effective implementation. The most critical mitigation strategies involve expanding the use of renewable energy and enhancing energy efficiency. Many countries opt to implement mitigation measures based on the marginal abatement cost (MAC) of emissions, prioritizing actions with costs lower than USD 20 per tCO2eq. These measures account for more than half of the total GHG reduction potential projected for 2030 in line with the 1.5°C Pathway. Examples of high-potential GHG reduction measures include: solar energy, which could reduce emissions by 3.3 GtCO2eq per year; wind energy, with a potential reduction of 3.08 GtCO2eq per year; forest and ecosystem management, which could potentially reduce emissions by 2.28 GtCO2eq per year; enhancement of industrial energy efficiency, which could cut emissions by 1.14 GtCO2eq per year; and the reduction of fluorinated gas (F-gas) emissions, with a potential reduction of 0.94 GtCO2eq per year.

The global policy direction for reducing GHG emissions to limit global temperature rise, as outlined in the Paris Agreement, has led many countries to design economic and social development policies with greater consideration for the environment. These policies emphasize the integration of climate action with the SDGs, both of which are deeply interconnected. A key policy focus is on the transition to low-carbon development and achieving net-zero GHG emissions. While this goal is attainable, it requires immediate and urgent emissions reductions across all sectors of the economy. Near-term plans must target a 50% reduction in GHG emissions by 2030, while long-term efforts must focus on achieving full decarbonization. Moreover, research indicates that eco-friendly economic development can generate more jobs and foster stronger growth than traditional carbon-intensive development models. Raising awareness and fostering understanding across different sectors is crucial for a successful transition to a low-

[4] The 2023 NDC Synthesis Report. Accessible from https://unfccc.int/sites/default/files/resource/cma2023_12.pdf

carbon, climate-resilient society. In recent years, climate efforts have gained momentum, marked by technological advancements in low-emission solutions, the expansion of renewable energy, and the rapid growth of electric vehicles. These initiatives can be even more effective if global leaders make climate action a top priority. The continuous decline of the global carbon budget emphasizes the urgent need for action where further delays are no longer an option.[5]

Examples of different countries' NDCs and implementation strategies are shown in **Table 4-1**.

[5] Boehm, S., K. Lebling, K. Levin, H. Fekete, J. Jaeger, R. Waite, A. Nilsson, J.Thwaites, R. Wilson, A. Geiges, C. Schumer, M. Dennis, K. Ross, S.
Castellanos, R. Shrestha, N. Singh, M. Weisse, L. Lazer, L. Jeffery, L. Freehafer, E. Gray, L. Zhou, M. Gidden, and M. Gavin. 2021. State of Climate Action 2021: Systems Transformations Required to Limit Global Warming to 1.5°C. Washington, DC: World Resources Institute: https://doi.org/10.46830/wrirpt.21.00048.

Table 4-1 Examples of different countries' NDCs and implementation strategies

Country/ Description	European Union	United States of America	Japan	China	South Korea	Singapore	Vietnam	Cambodia	Indonesia	Malaysia	The Phillippines
Target Type	Absolute reduction	Absolute reduction	Absolute reduction	Carbon intensity	Absolute reduction	Fixed level target	Business as Usual	Business as Usual	Business as Usual	Carbon intensity	Business as Usual
Target	At least 55%	50-52%	46%	At least 65%	40%	60 MtCO2eq	15.8-43.5%	42%	31.89-43.2%	45%	2.71-72.29%
Target Year	2030 (Single-year target)	2030 (Single-year target)	2030 (Single-year target)	2030 (Single-year target)	2030 (Single-year target)	2030 (Single-year target)	2030 (Single-year target)	2030 (Single-year target)	2030 (Single-year target)	2030 (Single-year target)	2030 (Single-year target)
Base Year/ Reference Year	1990	2005	2013	2005	2018	2010	2014-2030	2010-2030	2010-2030	2005	2000-2030
Scope of Implemen-tation	Economy-wide	Economy-wide	Economy-wide	Not specified	Economy-wide	Economy-wide	Economy-wide	Economy-wide	Economy-wide	Economy-wide	Economy-wide
Peak Year	1979	2005	2013	Before 2030	2018	Before 2030	Not specified	Not specified	2030	Not specified	2030
Article 6 of the Paris Agreement	Not implemented, but the EU Emissions Trading Scheme (ETS) is in place	Not implemented	Joint Crediting Mechanism (JCM)	Not specified, but domestic carbon market mechanisms are in place	Voluntary cooperative approach under Article 6 of the Paris Agreement with K-ETS mechanism in place	International cooperation under Article 6 of the Paris Agreement	Not specified	Not specified	International cooperation under Article 6 of the Paris Agreement	Not implemented	International cooperation under Article 6 of the Paris Agreement
Conditional Target	None	None	None	None	None	None	27.7% - Requires approximately USD 65,093.4 million in financial support, with the largest allocations to	The majority of GHG reduction targets require financial support exceeding USD 5.8 billion, with the largest allocations to the forestry, waste,	11.31% - Requires support in finance, technology transfer, and capacity building, with the forestry and	None	72.28% - No clear specification of the sectors involved or the form of support to be received

Country/ Description	European Union	United States of America	Japan	China	South Korea	Singapore	Vietnam	Cambodia	Indonesia	Malaysia	The Phillippines
							the energy and agriculture sectors respectively	and energy sectors respectively	land use sector being the highest priority for support, followed by the energy sector		
Co-benefits between mitigation and adaptation	Not specified	Not specified	Not specified	Not specified	Not specified	Co-benefits of adaptation actions and/or economic diversification	Highlights the interrelation between adaptation efforts, GHG reduction, and socio-economic development across multiple levels, including their alignment with the SDGs	Highlights adaptation measures that provide co-benefits such as water management, the use of low-carbon technologies in agriculture, ocean waste management, and the development of low-carbon infrastructure	Highlights adaptation measures in the water resources, food security, and natural resources sectors that provide co-benefits for GHG reduction in the agriculture, forestry and land use, and energy sectors	Not specified	Highlights adaptation efforts that provide co-benefits for GHG reduction and support recovery from the COVID-19 pandemic
Integration with national policies and plans	National Energy and Climate Change Action Plan	Policies are translated into sectoral implemen-tation, encouraging investment in clean energy projects and pollution control measures	Plan for Global Warming Counter-measures	Action Plan for Peaking CO2 Emissions before 2030 to be implemented during the period covered by the 14th and 15th Economic Development Plans	Development of sectoral policies and strategies, along with national plans such as the Basic Plan for Carbon Neutrality and Green Growth, which align with national targets	Singapore Green Plan 2030 and the National Climate Change Plan, including revelant sectoral action plans	10-Year Socio-Economic Development Strategy 2021-2030 and the National Climate Change Strategy to 2050	Relevant national strategies and plans, including the development of the NDC Roadmap and Stakeholder Engagement Plan	NDC Implementation Strategy which incorporates sectoral adaptation targets with provision of financial support	Not specified	National Climate Change Action Plan 2011-2028

Country/ Description	European Union	United States of America	Japan	China	South Korea	Singapore	Vietnam	Cambodia	Indonesia	Malaysia	The Phillippines
Legislation	The European Climate Law and the Fit for 55 Package	Not specified, but mentions management by the U.S. federal government, state governments, and local governments	The Act on Promotion of Global Warming Counter-measures, along with revisions to relevant regulations to drive implemen-tation toward achieving GHG reduction targets	No specific legislation for GHG emissions reduction	The Carbon Neutrality Act	Not specified	No specific legislation for GHG emissions reduction, with an exception of the existing Law on Environmental Protection 2020	Not specified	Regulations regarding carbon pricing to achieve the NDC target and to limit GHG emissions	Not specified	The Climate Change Act of 2009
Linkage with LT-LEDS	Alignment with the pathway towards carbon neutrality by 2050	Alignment with the pathway towards net-zero GHG emissions by 2050	Alignment with the pathway towards net-zero GHG emissions by 2050	Alignment with the pathway towards carbon neutrality by 2060	Alignment with the pathway towards carbon neutrality by 2050	Alignment with the pathway towards net-zero GHG emissions by 2050	Alignment with the pathway towards net-zero GHG emissions by 2050	Not specified	Alignment with the pathway towards net-zero GHG emissions by 2060 or earlier	Alignment with LT-LEDS but has not yet submitted official report	Not specified
Share of global GHG emissions	6.22%	11.13%	2.24%	25.88%	1.29%	0.14%	0.96%	0.16%	3.11%	0.77%	0.48%
Submission date to the UNFCCC	October 19, 2023	April 22, 2021	October 22, 2021	October 28, 2021	December 23, 2021	November 4, 2022	November 8, 2022	December 30, 2020	September 23, 2022	July 30, 2021	April 15, 2021

Source: Data compiled from NDC Registry. Accessible from https://unfccc.int/NDCREG

4.2 Thailand's GHG Emissions Reporting and Status

As a Non-Annex I Party to the UNFCCC, Thailand is obligated to prepare and submit the National Communication (NC) and the Biennial Update Report (BUR) to the UNFCCC Secretariat. Additionally, as a Party to the Paris Agreement, Thailand is required to submit the Biennial Transparency Report (BTR) in place of the BUR. The purpose of these reports is to track the country's progress in reducing GHG emissions in accordance with its NDC. Parties must also provide information on their national GHG emissions, domestic adaptation efforts, financial support received or provided, capacity-building initiatives, and the transfer of climate-related technologies. The BTR can offer clarity regarding Thailand's approach to achieving its GHG reduction targets. Under the Paris Agreement, all countries are required to submit their first BTR in place of the BUR by December 2024. Currently, Thailand has already submitted four NCs in 2000, 2011, 2018, and 2022, as well as four BURs in 2015, 2017, 2020, and 2022 respectively.

Thailand's 4th BUR was submitted to the UNFCCC on December 29, 2022. The report provides an overview of the country's net GHG emissions, including removals from the forestry and land use sector (LULUCF), revealing a continuous upward trend. In 2000, Thailand's total GHG emissions were 200,455.96 GgCO2eq, and by 2019, this had increased to 280,728.34 GgCO2eq, reflecting a 1.79% rise as shown in **Figure 4-5**. When comparing GHG emissions by sector in 2000 and 2019, the energy sector (including electricity generation and energy use across various industries) remains the largest emitter. In 2000, the energy sector emitted 165,092.40 GgCO2eq, rising to 260,772.69 GgCO2eq in 2019, marking a 57.96% increase. The agriculture sector saw emissions grow from 49,065.40 GgCO2eq in 2000 to 56,766.32 GgCO2eq in 2019, an increase of 15.70%. The IPPU sector saw a substantial rise in emissions from 21,274.82 GgCO2eq in 2000 to 38,301.21 GgCO2eq in 2019, an increase of 80.03%. The waste sector's emissions increased by 61.24%, from 10,466.94 GgCO2eq in 2000 to 16,876.64 GgCO2eq in 2019. These trends are depicted in **Figure 4-6**.

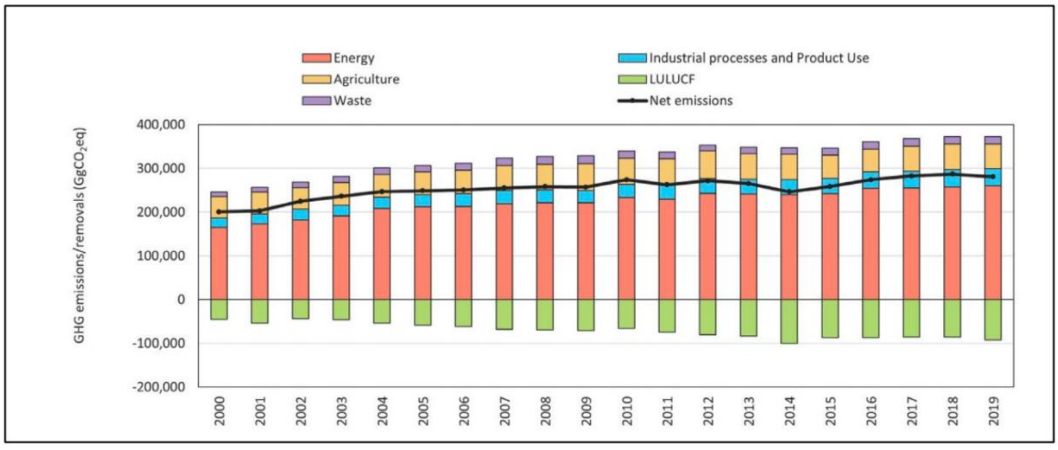


Figure 4-5 Thailand's overall GHG emissions trends from 2000 to 2019[6]

6 Thailand's Fourth Biennial Update Report

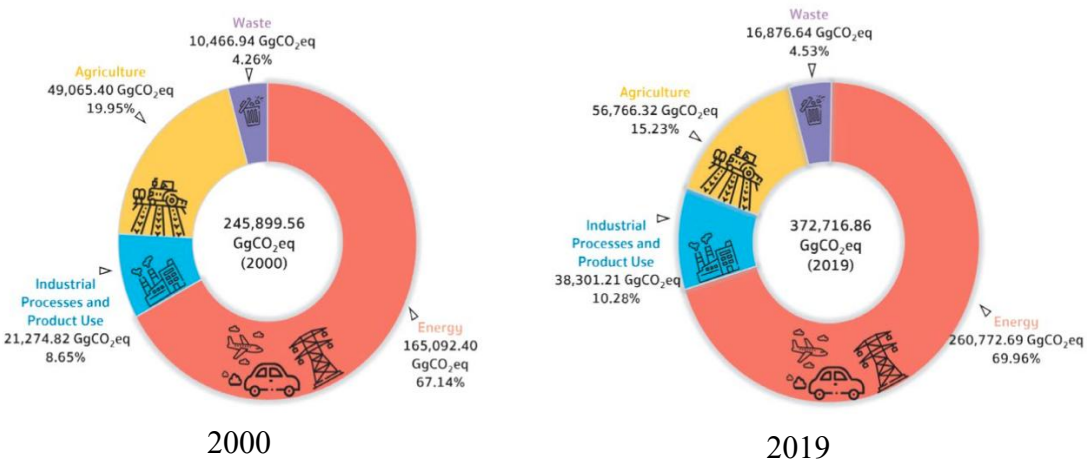


Figure 4-6 GHG emissions by sector in 2000 and 2019
(total excluding GHG removals from the forestry and land use sector)[7]

A breakdown of GHG emissions by sector in 2019 is as follows:

(1) Energy sector – The majority of GHG emissions in this sector come from fuel combustion, primarily from electricity and heat generation, which accounts for 36.63% of total emissions. The second-largest source is fuel combustion in transport, contributing 29.50%. This is followed by fuel combustion in manufacturing industries and construction, which accounts for 20.38%. Other sectors collectively contribute 6.47%, while fugitive emissions from fuels account for 4.02% of total emissions, as shown in **Figure 4-7**.

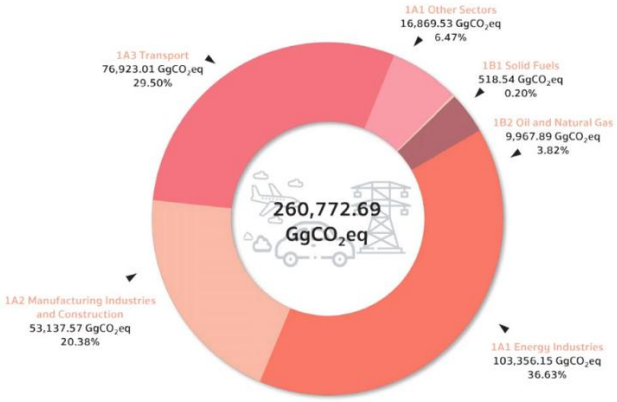


Figure 4-7 GHG emission activities in the energy sector in 2019[8]

[7] Thailand's Fourth Biennial Update Report

[8] Thailand's Fourth Biennial Update Report

(2) Agriculture sector – The agriculture sector is the second-largest contributor to GHG emissions, with rice cultivation being the primary source, accounting for 50.58% of emissions. Other major sources include methane emissions from enteric fermentation, which accounts for 18.97%, as well as direct and indirect nitrous oxide emissions from agricultural soils at 14.20% and 5.37% respectively. Methane and nitrous oxide emissions from manure management contribute 4.68% of emissions, while urea fertilization accounts for 2.62%. Open burning of crop residues contributes 2.50%, and lime application for soil improvement in cultivated areas accounts for 0.04% of emissions, as shown in **Figure 4-8.**

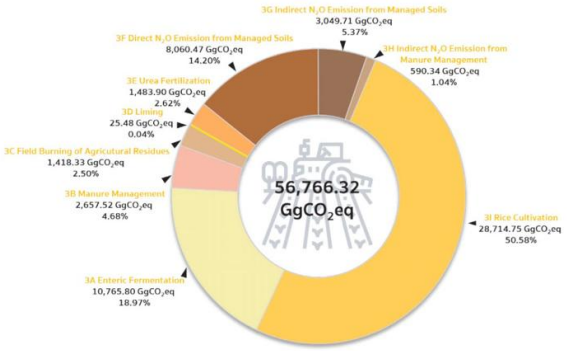


Figure 4-8 GHG emission activities in the agriculture sector in 2019[9]

(3) IPPU sector – GHG emissions in the IPPU sector arise not only from energy consumption in industrial production but also from emissions released during various industrial processes. The mineral industry is the largest contributor, accounting for 50.63% of emissions, followed by the chemical industry at 34.58%. The air-conditioning and refrigeration industry contributes 12.93%, while metal production accounts for 0.89%. Non-energy products from fuels and solvent use contribute 0.74%, and other product manufacturing and usage account for 0.23%, as shown in **Figure 4-9**.

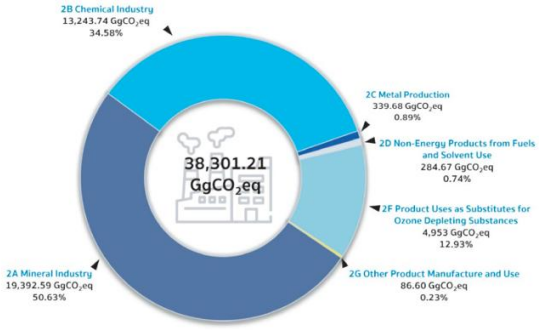


Figure 4-9 GHG emission activities in the IPPU sector in 2019[10]

[9] Thailand's Fourth Biennial Update Report

[10] Thailand's Fourth Biennial Update Report

(4) Waste sector – GHG emissions in the waste sector primarily originate from various activities. Wastewater treatment and discharge account for 48.67% of emissions, while solid waste disposal contributes 49.44%. Incineration and open burning of waste make up 0.98% of emissions, and biological treatment of solid waste accounts for 0.91%, as illustrated in **Figure 4-10**.

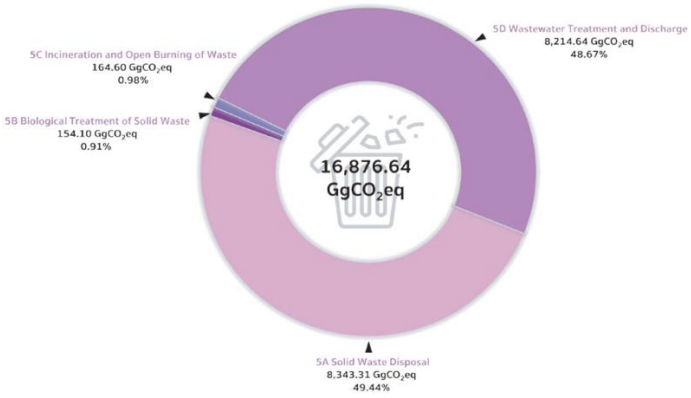


Figure 4-10 GHG emission activities in the waste sector in 2019[11]

Thailand's GHG emissions situation highlights that reducing emissions is not solely an environmental effort but requires active participation from sectors involved in economic and social development through a collaborative and integrated approach. To effectively drive emissions reduction, Thailand must prioritize the energy and transport sectors, particularly electricity generation, fuel combustion in transport, industrial energy consumption both from fuel combustion and electricity use, and household electricity consumption, as these activities account for a significant share of emissions. Moreover, the energy and transport sectors are fundamental to broader development efforts, including the development of low-carbon manufacturing industries and services, the transition to a more environmentally friendly economic structure, and the development of sustainable low-carbon cities. Therefore, it is crucial to develop infrastructure in these sectors to be low-carbon and environmentally friendly. Once established, such infrastructure will have an extended operational lifespan with long-term impacts on the country's GHG emissions patterns. Additionally, the energy and transport sectors are well-equipped to support emissions reduction efforts due to their systematic data collection, structured reporting mechanisms, and long-term strategic planning that delivers clear benefits, such as strengthening energy security, improving transportation efficiency, reducing air pollution, and enhancing public health.

The COVID-19 pandemic, which began in late January 2020 and continued until the Thai government declared it an endemic disease in July 2022, may have contributed to a slowdown in economic growth both globally and domestically. However, when examining Thailand's GHG emissions in 2020 (excluding the forestry and land use sector, which acts as a carbon sink) and comparing them to 2019 levels, the emissions were found to be nearly identical, with total emissions recorded at 372,648.77 GgCO2eq in 2020 and 372,716.86 GgCO2eq in 2019.

[11] Thailand's Fourth Biennial Update Report

4.3 Projection of Thailand's GHG Emissions under the BAU Scenario

Thailand's NDC aims to reduce GHG emissions by 30-40% by 2030 compared to the BAU scenario. Thailand's emissions are expected to peak at 368 MtCO2eq in 2025 and subsequently decline, reaching 333 MtCO2eq by 2030[12] **(Figure 4-11)**.

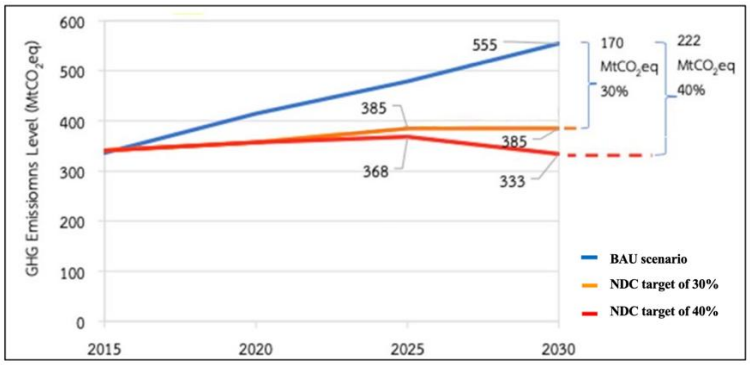


Figure 4-11 GHG emission levels in the BAU scenario and the scenario with Thailand's NDC implementation

The projection of Thailand's GHG emissions under the BAU scenario is based on historical activity data and past emissions reported in the national GHG inventory reports, including the National Communication (NC) and the Biennial Update Report (BUR). These projections also incorporate assumptions on economic growth and population increase at both macroeconomic and sectoral levels. Under the BAU scenario, Thailand's GHG emissions are expected to rise from 279.129 MtCO2eq in 2005 to 554.649 MtCO2eq in 2030, representing an average annual increase of 2.8%, as shown in **Figure 4-12** and **Table 4-2**.

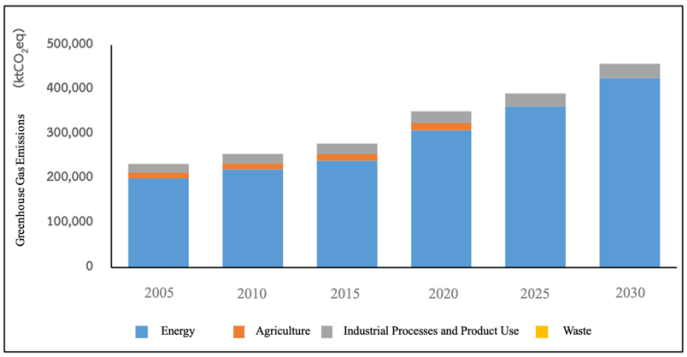


Figure 4-12 Projection of Thailand's GHG emissions under the BAU scenario

[12] Thailand's Long-Term Low Greenhouse Gas Emission Development Strategy: LT-LEDS (revised version). Accessible from https://unfccc.int/sites/default/files/resource/Thailand%20LT-LEDS%20%28Revised%20Version%29_08Nov2022.pdf

Table 4-2 Projection of Thailand's GHG emissions under the BAU scenario

Sector	Greenhouse Gas Emissions (MtCO2eq)						
	Year	**2005**	**2010**	**2015**	**20200**	**2025**	**2030**
Energy		200.329	220.856	240.332	308.587	362.107	425.649
Waste		12.878	13.011	12.489	16.135	17.968	20.010
IPPU		19.565	21.408	23.737	26.304	29.148	32.360
Agriculture		46.294	52.316	57.554	63.316	69.656	76.630
Total		**279.129**	**307.591**	**336.112**	**414.342**	**478.879**	**554.649**

Energy sector – Under the BAU scenario, GHG emissions primarily originate from electricity generation, household energy consumption, energy use in commercial and government buildings, energy consumption in manufacturing industries, and energy use in transport. The increase in GHG emissions aligns with the rising demand for end-use energy across these sectors. Emissions in the energy sector are projected to rise from 200.392 MtCO2eq in 2005 to 425.649 MtCO2eq in 2030, accounting for 71.8% of Thailand's total GHG emissions in 2005 and 76.7% in 2030. This represents an average annual increase of 3.1%, reflecting a continuous upward trend in emissions from the energy sector under the BAU scenario.

Waste sector – Under the BAU scenario, GHG emissions from the waste sector are projected to rise from 12.878 MtCO2eq in 2005 to 20.010 MtCO2eq in 2030, representing 4.6% of total emissions in 2005 and 3.6% in 2030. This reflects an average annual increase rate of 1.8%.

IPPU sector – Under the BAU scenario, GHG emissions from the IPPU sector are projected to increase from 19.565 MtCO2eq in 2005 to 32.360 MtCO2eq in 2030, accounting for 7% of Thailand's total GHG emissions in 2005 and 5.8% in 2030. This reflects an average annual increase rate of 2%.

Agriculture sector – Under the BAU scenario, GHG emissions from the agriculture sector are projected to increase from 46.294 MtCO2eq in 2005 to 76.630 MtCO2eq in 2030, accounting for 16.6% of Thailand's total GHG emissions in 2005 and 13.8% in 2030. This reflects an average annual increase rate of 2%.

4.4 Thailand's GHG Emissions Reduction

Thailand has participated in the global efforts to reduce GHG emissions and address climate change, both through voluntary actions under the UNFCCC prior to 2020 and through binding commitments under the Paris Agreement post-2020.

4.4.1 Actions taken prior to 2020 in accordance with Thailand's Nationally Appropriate Mitigation Action (NAMA)

Thailand has expressed its intention to implement the Nationally Appropriate Mitigation Action (NAMA) on a voluntary basis, as submitted to the UNFCCC Secretariat on December 29, 2014. The submission stated that "Thailand will reduce its domestic GHG emissions in the energy

and transport sectors by 7–20% from the BAU scenario by 2020. This reduction comprises a 7% reduction through domestically supported NAMAs and an additional 13% reduction through internationally supported NAMAs. However, the extent of implementation will depend on the level of international support received in terms of technology development and transfer, financial assistance, and capacity building."

The Ministry of Energy set operational targets for the energy sector and energy use in the transport sector, designating the Thailand Greenhouse Gas Management Organization (Public Organization), in collaboration with relevant agencies under the Ministry of Energy, as the coordinating body responsible for monitoring and evaluating progress. By the end of the NAMA period in 2020, Thailand successfully reduced GHG emissions by a total of 56.54 MtCO2eq, achieving a 15.40% reduction—meeting the NAMA target as pledged to the UNFCCC. The GHG mitigation results under Thailand's NAMA are presented in **Table 4-3**.

Table 4-3 Thailand's GHG mitigation results from the implementation of the Nationally Appropriate Mitigation Action (NAMA) in the target year 2020[13]

NAMA Measures	GHG Emissions Reduction in the Target Year 2020 (MtCO2eq)
1. Measures to generate electricity from natural renewable energy	6.41
2. Measures to generate electricity from bio-renewable energy	11.11
3. Measures to generate heat from natural renewable energy	0.03
4. Measures to generate heat from bio-renewable energy	23.10
5. Measures for biodiesel consumption in transport sector	5.04
6. Measures for ethanol consumption in transport sector	3.27
7. Measures to improve efficiency of electricity generation (natural gas and lignite power plants)	6.34
8. Measures for energy efficiency standard and label No.5	0.82
9. Measures for Mass Rapid Transit System Development	0.08
10. Measures to improve energy efficiency from waste heat recovery (generate electricity to be used in factories) from cement industry	0.44
Total estimated GHG emissions reduction (MtCO2eq)	**56.54**
Proportion of GHG emissions reduction in 2020 compared to BAU	**15.40%**

4.4.2 Actions taken between 2020 and 2030 under the First Nationally Determined Contribution (NDC1)

Thailand submitted its first NDC to the UNFCCC Secretariat on October 1, 2015, setting a minimum GHG reduction target of 20% from the BAU level by 2030. This contribution level could increase to 25%, depending on the availability of adequate and enhanced support mechanisms, including technology development and transfer, financial assistance, and capacity-building support under the UNFCCC. On October 26, 2020, Thailand submitted its first updated NDC to the UNFCCC Secretariat, reaffirming its GHG reduction target of 20-25% from the BAU

[13] Thailand's Fourth Biennial Update Report

scenario by 2030. The update also included revised information on adaptation efforts, national circumstances, past actions, equity considerations, and the country's support needs. Subsequently, on November 2, 2022, Thailand submitted its second updated NDC, raising its GHG reduction target to 30-40% from the BAU scenario by 2030, contingent upon receiving full and equitable support in finance, technology, and capacity building through international cooperation and mechanisms under the UNFCCC. The second updated NDC also expanded the scope of mitigation efforts to include the agriculture sector, in addition to the previously covered sectors of energy, transport, IPPU, and waste. Furthermore, this update aligns with Thailand's Long-Term Low Greenhouse Gas Emission Development Strategy (LT-LEDS), which serves as the framework for the development of future NDCs to be submitted to the UNFCCC every five years. Detailed mitigation measures and plans under Thailand's NDC are outlined in Chapter 6 of this document, the NDC Action Plan on Mitigation 2021-2030.

4.4.3 Implementation of Thailand's Long-Term Low Greenhouse Gas Emission Development Strategy

The Office of Natural Resources and Environmental Policy and Planning (ONEP) submitted Thailand's updated Long-Term Low Greenhouse Gas Emission Development Strategy (LT-LEDS) to the UNFCCC Secretariat on November 7, 2022. The LT-LEDS serves as the strategic framework for the country's long-term climate actions, aiming to achieve carbon neutrality by 2050 and net-zero GHG emissions by 2065. This strategy enhances Thailand's commitment to addressing climate change in collaboration with the global community and aligns with the Paris Agreement's goal of limiting global temperature rise to no more than 1.5°C. The LT-LEDS outlines key measures and technologies for reducing GHG emissions, as detailed below:

Table 4-4 Mitigation measures and technologies under Thailand's Long-Term Low Greenhouse Gas Emission Development Strategy[14]

Sector	Approaches/Measures	Relevant Agencies
Energy sector	**Electricity generation** - Enhance energy efficiency/transition to cleaner technologies such as CCS and CCUS - Increase the share of renewable energy in electricity generation to 68% by 2040 and 74% by 2050 (solar, wind, hydropower, and BECCS) - Phase out coal use **Transport** - Enhance energy efficiency/transition to cleaner energy technologies such as hybrid vehicles, EVs, and FCEVs - Increase the proportion of renewable energy use in vehicles (ethanol and biodiesel) - Reduce the use of internal combustion engines (ICE)	- Energy Policy and Planning Office - Department of Alternative Energy Development and Efficiency - Department of Mineral Fuels - Department of Energy Business - Electricity Generating Authority of Thailand - Office of Transport and Traffic Policy and Planning - Department of Industrial Works

[14] Thailand's Long-Term Low Greenhouse Gas Emission Development Strategy: LT-LEDS (revised version), https://unfccc.int/sites/default/files/resource/Thailand%20LT-LEDS%20%28Revised%20Version%29_08Nov2022.pdf

	Manufacturing industries - Enhance energy efficiency/transition to cleaner energy technologies - Increase the use of renewable energy for heat production such as energy from biomass and waste - Promote the use of green hydrogen fuel **Residential sector** - Enhance energy efficiency/transition to cleaner energy technologies - Increase the use of renewable energy for heat production such as solar and biomass energy **Commercial building sector** - Enhance energy efficiency/transition to cleaner energy technologies - Increase the use of renewable energy for heat production such as solar energy **Agriculture sector** - Enhance energy efficiency/transition to cleaner energy technologies - Increase the use of renewable energy such as solar energy	- Office of Industrial Economics - Industrial Estate Authority of Thailand - Federation of Thai Industries
Industrial Processes and Product Use Sector	**Clinker replacement** - Use of alternative materials to replace clinker in hydraulic cement production - Use of alternative materials to replace cement in ready-mixed concrete **Refrigerant substitution** - Switch to using natural or low-GWP refrigerants **Use of CCS technology in cement production industry**	- Department of Industrial Works - Office of Industrial Economics - Thai Cement Manufacturers Association - Federation of Thai Industries - Industrial Estate Authority of Thailand - Thai Air-Conditioning Traders Association
Waste Management Sector	**Municipal waste management** - Reduce amount of waste before entering disposal sites - Utilize landfill gas by either flaring it off or using it for beneficial purposes such as electricity generation - Waste-to-energy - Semi-aerobic landfill - Composting - Anaerobic digestion - Mechanical biological treatment - Phase out open burning and ensure proper waste disposal through incineration **Municipal wastewater management** - Increase wastewater collection and expand the number of community-wide wastewater treatment systems **Industrial wastewater management** - Increase the production of biogas from industrial wastewater through methane reutilization	- Pollution Control Department - Department of Local Administration - Wastewater Management Authority - Bangkok Metropolitan Administration - Department of Industrial Works - Industrial Estate Authority of Thailand - Federation of Thai Industries

Agriculture Sector	- Improve rice cultivation practices to reduce methane emissions - Production of biogas from animal manure using dome digesters - Improve feeds for ruminant animals to reduce methane emissions - Soil management practices - High genetic merit breed selection	- Office of Agricultural Economics - Department of Livestock Development - Department of Agriculture - Department of Agricultural Extension - Rice Department
Forestry and land use sector (carbon sink - 120 MtCO2eq)	In line with the goal to increase green area under the National Strategy (2018-2027) through the implementation of following measures: - Reforestation and rehabilitation of natural forests - Economic forest planting - Increasing green space in urban and rural areas - Prevention of forest encroachment and forest fires	- Royal Forest Department - Department of National Parks, Wildlife and Plant Conservation - Department of Marine and Coastal Resources - Forest Industry Organization

Chapter 5

A Study on the Impacts and Key Factors Driving the Achievement of Mitigation Targets under the Nationally Determined Contribution (NDC)

The implementation of mitigation strategies and measures to achieve Thailand's NDC target represents an economic cost that may lead to reductions in production and consumption, particularly in sectors with activities that are reliant on fossil fuel-based energy, such as electricity generation, transport, and industrial production. Additionally, low-income households may experience greater impacts compared to other sectors. The severity of these impacts will depend on the timeframe and the pace at which Thailand transitions towards long-term low-emission development, with the goal of achieving net-zero GHG emissions by 2065 in a manner that aligns with the country's national context. Therefore, the implementation of mitigation measures during the 2021–2030 period, which constitutes the framework for Thailand's first NDC, is of critical importance to the country's long-term economic and social development trajectory. This transition will drive changes across all dimensions of development, including the country's infrastructure, technology, investment and business models, consumption patterns, and citizens' lifestyles.

5.1 Economic and Social Impacts

Thailand's enhanced NDC target, increasing from a 20-25% to a 30-40% reduction in GHG emissions, has been thoroughly studied and analyzed for its economic and social implications through the project titled "The Revision and Update of Thailand's Long-Term Low Greenhouse Gas Emission Development Strategy (LT-LEDS) and Thailand's Nationally Determined Contribution (NDC)," conducted by the Thammasat University Research and Consultancy Institute (TU-RAC). The study primarily examines the national-level economic and social impacts from the implementation of mitigation measures to achieve the revised NDC target of a 40% emissions reduction from the BAU scenario by 2030. The analysis is conducted using the AIM/CGE mathematical model, which is based on the macroeconomic principles of computable general equilibrium (CGE) models. It also incorporates market price mechanisms to assess intersectoral relationships within the economy. Furthermore, the study evaluates the economic impacts of Thailand's economic policies using key data sources, including input-output tables, energy balance data, socio-economic statistics, energy and technology prices, and emission factors. A conservative approach is applied to estimate the economic impact of Thailand's mitigation measures in line with its revised NDC target, focusing on four key areas outlined below.

5.1.1 Impact on National Gross Domestic Product (GDP) – The analysis found that implementing GHG mitigation measures with 30% domestic efforts and 10% international support would result in a 0.7% reduction in the country's GDP by 2030. When considering the cumulative GDP change from 2010 to 2030, the total GDP decline would be 0.4%, which represents a smaller economic impact compared to a scenario where the country must achieve the full 40% emissions reduction target through domestic efforts alone. This is illustrated in **Figure 5-1** and **Figure 5-2**.

5.1.2 Impact on Household and Government Consumption – The study found that under a scenario where 30% of mitigation efforts are achieved through domestic actions, household consumption in 2030 would decrease by 57.8% compared to the BAU scenario. Additionally, cumulative household consumption from 2010 to 2030 would decline by 2.9% relative to the BAU scenario **(Figure 5-3)**. When considering cumulative government investment over the same period, the study found that public sector investment would increase by 8.3% compared to the BAU scenario. This highlights the crucial role of government investment in supporting GHG mitigation efforts, particularly in public infrastructure development across various sectors, such as electricity generation, road construction, and railway system expansion **(Figure 5-4)**. Overall, the total cumulative household and government consumption from 2010 to 2030 is projected to decrease by 0.6% compared to the BAU scenario primarily due to a decline in household consumption **(Figure 5-5)**.

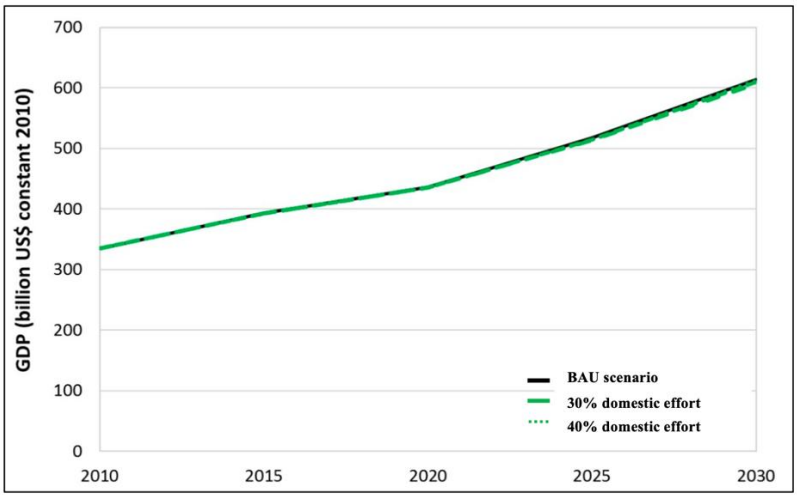


Figure 5-1 Cumulative change in Thailand's GDP from 2010 to 2030

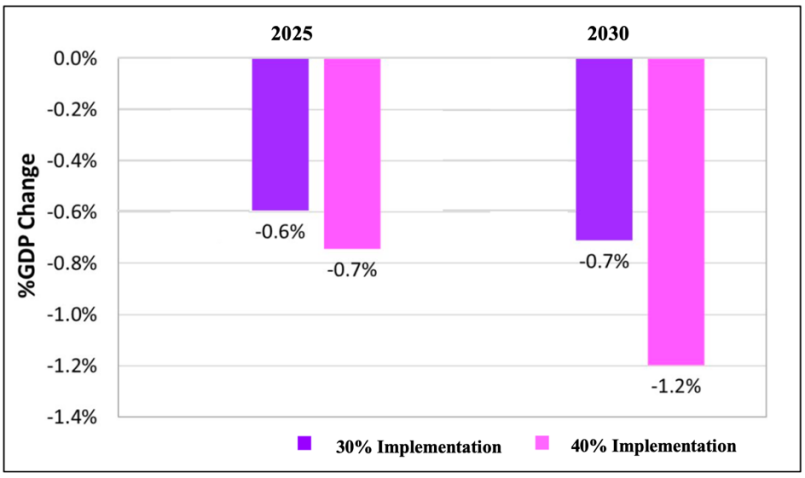


Figure 5-2 Changes in Thailand's Gross Domestic Product (GDP)

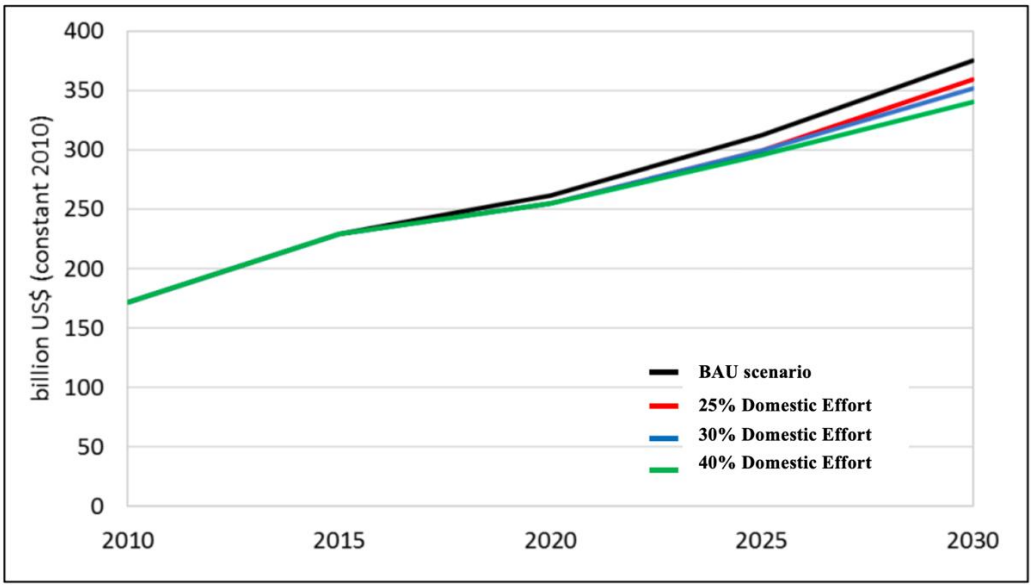


Figure 5-3 Thailand's household consumption value from 2010 to 2030 under different scenarios

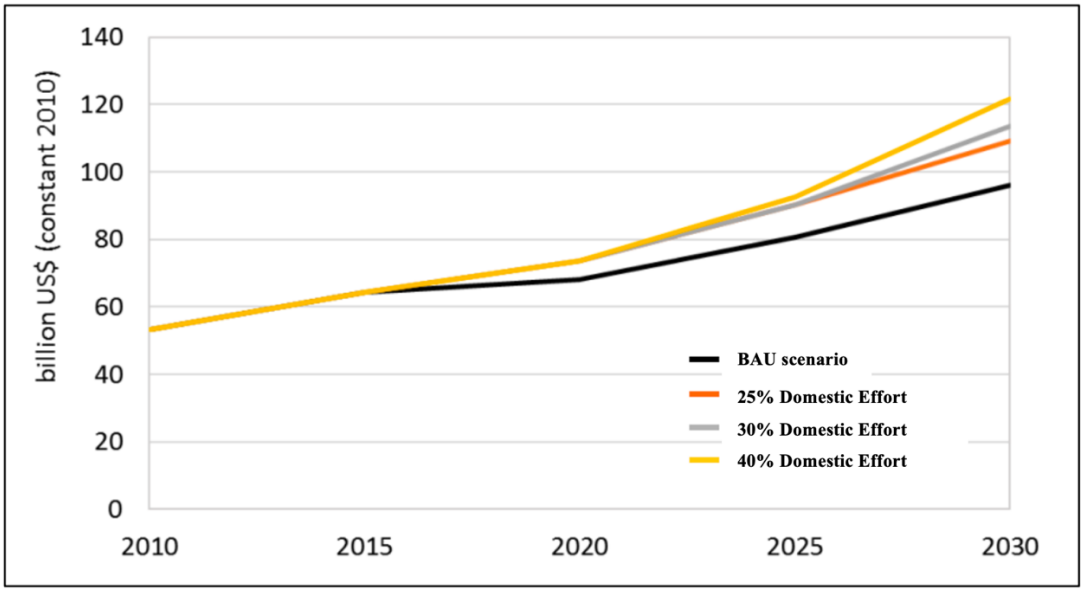


Figure 5-4 Thailand's government consumption expenditure from 2010 to 2030 under different scenarios

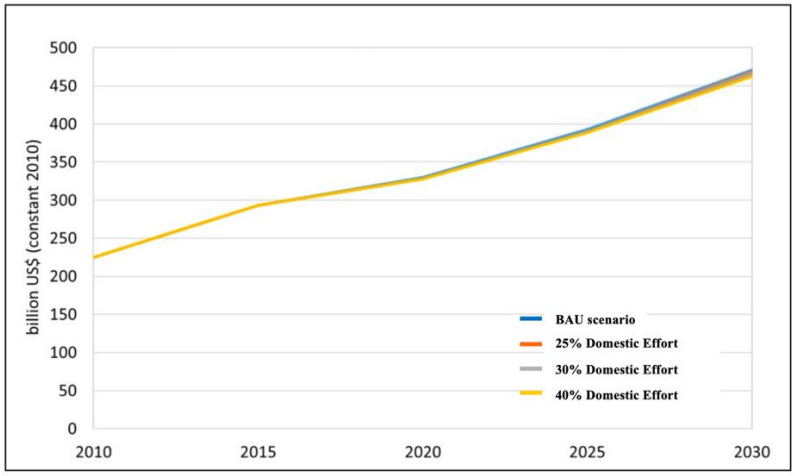


Figure 5-5 Thailand's household and government consumption expenditures from 2010 to 2030 under different scenarios

5.1.3 Welfare Loss – The study's findings indicate that the domestic implementation of GHG mitigation measures, with a reduction target of 30–40%, results in a cumulative increase in welfare loss throughout the study period (2010–2030) compared to the BAU scenario, with welfare loss rising by 2.4–3.0%. This increase is primarily attributed to a decline in household consumption due to the rapid implementation of GHG mitigation measures. Such measures have driven shifts in consumption behavior and lifestyle patterns toward greater sustainability. As a result, households spend less on goods and services while placing greater emphasis on long-term benefits, ultimately leading to improved market equilibrium. Additionally, increased awareness and participation among households in sustainable living, coupled with a heightened sense of environmental responsibility and more efficient resource allocation, further contribute to this transition. Moreover, the government's growing investment in GHG reduction initiatives—such as developing public infrastructure, expanding renewable energy systems, and improving public transportation networks—plays a crucial role in enhancing energy efficiency and reducing long-term costs for the general public. These combined factors ultimately contribute to the observed increase in overall welfare loss.[15]

Table 5-1 Changes in welfare in the case where 30-40% of implementation is carried out through domestic efforts

Proportion of domestic efforts	Changes in cumulative welfare loss (% loss cumulative) compared to the BAU scenario	
	2020-2030	2010-2030
30%	3.6	2.4
40%	4.7	3.0

[15] The variables that can be used to analyze the social impacts from the CGE model include household income and consumption. Many studies use these as indicators of household welfare, including the socio-economic model developed by the National Institute of Environmental Studies (NIES) that is used in this study. In economic theory, welfare is derived from the sum of producer surplus and consumer surplus. However, this is difficult to measure in practice. In various studies, alternative data such as actual income and consumption levels are often used as proxies for welfare. (Worapol Yamakka and Pharavi Maneejak, 2015; Deaton, A. 2010).

5.1.4 Variations in Carbon Price – The study results indicate that the average carbon price, or the cost of reducing GHG emissions, for domestic mitigation efforts contributing 30–40% toward achieving Thailand's NDC target by 2030 is approximately USD 33 per tCO_2eq.

Receiving support for the development and transfer of highly advanced technology from other countries would help Thailand reduce its GHG mitigation costs and enable more sustainable implementation of emissions reduction measures.

5.2 Impacts from Energy-Related Measures

Energy-related measures concerning energy consumption in the transport, industrial, household, and commercial building sectors primarily focus on improving energy efficiency, adopting advanced technologies, and promoting the use of renewable energy for electricity generation. The implementation of these measures is expected to have the following social impacts:

5.2.1 Population – Energy-related measures are expected to have both direct and indirect positive impacts on demographic factors, including birth rates, mortality rates, and migration. These measures are likely to promote greater use of clean, renewable energy in activities that form the backbone of the country's infrastructure. As a result, air quality and environmental conditions are expected to improve, leading to a reduced risk of deaths from pollution-related diseases and improved reproductive health. However, a key consideration is that the implementation of these energy-related measures to reduce GHG emissions may not lead to immediate improvements in environmental quality. Some of the expected positive effects may take at least 10 years to fully materialize.

5.2.2 Education and Human Capital Development – Energy-related measures to reduce GHG emissions are expected to have a positive impact on the country's education system and human capital development. By promoting energy efficiency, advancing renewable energy exploration, and encouraging the production of renewable energy-based products such as electric vehicles, these initiatives will push the country to place greater emphasis on energy technology research. As the demand for experts in this field grows, government agencies and educational institutions will need to adapt by developing training programs and curricula that can adequately produce a workforce equipped to meet the country's evolving energy needs and support the emergence of new professions driven by changes in energy consumption patterns.

5.2.3 Employment and Job Creation – The implementation of energy-related measures is expected to have a positive impact on job creation, particularly in the energy sector. These measures may also lead to the emergence of new professions within the renewable energy industry. According to a study by the International Labour Organization[16], the expansion of jobs in the renewable energy sector could provide greater opportunities for vulnerable groups, such as women and young workers, to enter the labor market.

[16] A.Klemmer (n.d.)

5.2.4 Consumption Patterns and Lifestyles – As is widely recognized, the consumption patterns and lifestyles of individuals and households are closely linked to current energy usage. At present, most energy consumption depends on fossil fuels, which are finite and contribute to the release of methane and carbon dioxide—both of which are harmful to the environment. Therefore, implementing measures that promote the use of renewable energy will generate positive impacts on the industrial sector and encourage the public to shift toward more affordable renewable energy sources.

5.2.5 Relationship between Individuals and Communities – The implementation of land-use measures for energy project development has the potential to trigger conflicts within local communities. Key concerns include compensation for land expropriation, which may not adequately address the needs of certain groups; the allocation of land to displaced individuals, which could lead to disputes with local residents; and disagreements over compensation payments for land, structures, and agricultural crops, which may not accurately reflect their fair market value.

5.3 Impacts on the Production of Goods and Services

The increasing severity and frequency of climate change events have led to the establishment of stricter environmental agreements and regulations. Consequently, various forms of trade barriers may arise, including environmental taxes such as carbon taxes on high-emission products, the integration of carbon footprint assessments into manufacturing processes, and legislation restricting the import of goods produced using environmentally harmful methods. Moreover, government policies in different countries play a crucial role in shaping the future of goods and services production. For instance, Thailand's implementation of its first NDC and its continued efforts under the Long-Term Low Greenhouse Gas Emission Development Strategy (LT-LEDS) are expected to influence production patterns in the following ways:

5.3.1 The rise in vehicle production and related products has accelerated the transition from internal combustion engine (ICE) vehicles to electric vehicles (EVs). This shift has led to a growing demand for EV components and the expansion of supporting infrastructure, such as charging stations and home charging units. Traditional automotive manufacturers, responding to this increasing demand—driven by both greater public awareness and government policies—are expanding their businesses. Over time, they are expected to play a more dominant role, surpassing the conventional automotive industry.

5.3.2 The transformation of the chemical supply chain has primarily focused on the cement and refrigerant industries. However, many chemicals used across various industrial sectors still contribute significantly to GHG emissions or act as short-lived climate pollutants, necessitating further adjustments in the future. Moving forward, the chemical industry is expected to increasingly adopt alternative substances and processes to mitigate GHG emissions. Examples include reducing the anode effect in aluminum production, implementing secondary catalyst technology in ammonia oxidation reactors for nitric acid manufacturing, and enhancing methane management efficiency in the ammonia-urea industry.

5.3.3 The rise of integrated waste management businesses is being driven by measures to improve community waste management systems, which promote the systematic segregation of recyclable waste, reduce dependence on incineration and landfill disposal, and mitigate long-term environmental impacts. Businesses will also be required to take responsibility for managing waste generated from their products—particularly battery components—which must be properly disassembled and disposed of using appropriate methods. Additionally, this transformation will stimulate the development of downstream supply chains such as the establishment of waste-to-energy plants, fostering a holistic waste management system that significantly reduces GHG emissions from waste disposal.

5.3.4 Access to renewable energy trading for small businesses – The gradual reduction in coal and oil consumption is expected to drive greater demand for electricity from renewable sources. Currently, power generation from hydropower plants, wind farms, and solar farms is predominantly managed by large-scale operators. However, in the future, the relaxation of regulations and the establishment of clear energy trading standards will enable households and commercial buildings to install solar panels and connect to the power grid. This shift will, in turn, create greater business opportunities for small-scale operators.

5.3.5 The transition to environmentally friendly materials in agriculture – In addition to adopting technologies that help reduce GHG emissions in agriculture and livestock, there will also be an upstream shift toward increased use of environmentally friendly materials, such as fertilizers, pesticides, and animal feed. This transition will enhance the alignment between the agricultural sector and national policies, particularly the future implementation of the BCG Economy Model.

5.3.6 Emergence of GHG assessment and verification businesses – The enforcement of stringent policies, along with the monitoring and evaluation requirements, will require businesses to assess their GHG emissions for various purposes. These may include implementing emissions reduction measures, calculating emissions and removals for participation in carbon markets, or evaluating projects to qualify for green loans from financial institutions. This increasing demand presents a significant opportunity for both domestic and international consulting firms to play a greater role in GHG assessment and verification. Clear standards and guidelines from government agencies, along with certification exams for assessors, will further support this development.

5.4 Risk Factors that may Affect the Achievement of NDC Target

The formulation of strategies to reduce GHG emissions requires a comprehensive assessment of potential risk factors in order to evaluate their impact on the successful implementation of mitigation measures under Thailand's NDC Action Plan on Mitigation 2021-2030. This assessment should encompass both internal factors, such as operational weaknesses or challenges that may arise during implementation, and external factors, such as regulatory constraints or environmental barriers that could hinder mitigation efforts. The goal is to develop preventive measures and action plans to mitigate these risks in the future. Although Thailand's NDC Action Plan on Mitigation has been carefully analyzed and planned, the study has identified potential risk factors, as outlined below.

5.4.1 Risk Factors Affecting the Achievement of NDC Target in the Energy and Transport Sectors

GHG reduction efforts in the energy and transport sectors are categorized into five types of energy consumption: electricity generation, household energy use, energy consumption in commercial buildings (including government buildings), energy use in manufacturing industries, and energy consumption in transport. The key GHG mitigation measures under the NDC Action Plan focus on three main strategies: enhancing energy efficiency, promoting the use of renewable energy, and pioneering the adoption of carbon capture and storage (CCS) technology. However, factors such as current fuel prices and technological advancements play a crucial role in determining the success of these measures and the achievement of NDC target. Based on the data collected, the potential risk factors that may impact the achievement of NDC target in the energy and transport sectors are summarized as follows:

(1) Volatility of fossil fuel prices, particularly fluctuations in global crude oil prices, may impact domestic fuel prices, including gasoline and diesel, which are widely used in Thailand's transport sector. Additionally, fluctuations in natural gas prices can affect energy consumption across households, transport, and industrial sectors. For instance, a decline in global crude oil prices at certain times may reduce incentives to promote alternative energy sources for transport, such as gasohol or biodiesel. Furthermore, lower fuel prices could lead to increased private vehicle usage, potentially hindering the achievement of GHG emissions reduction targets.

(2) Importation of natural gas – Thailand currently imports a significant amount of natural gas for electricity generation, transport, and industrial use. This heavy reliance on natural gas results in the country’s low energy security. Any disruptions in natural gas imports could affect electricity production, transportation, and industrial activities, necessitating the use of alternative fossil fuels. This, in turn, would lead to increased GHG emissions, making it more challenging for Thailand to achieve its GHG reduction targets under the NDC Action Plan on Mitigation 2021–2030.

Chapter 6

The NDC Action Plan on Mitigation 2021–2030

6.1 Vision

Thailand achieves its GHG reduction target of 30–40% by 2030 in line with its commitments under the Paris Agreement, with the aim of transitioning to net-zero GHG emissions by 2065.

6.2 Mission

(1) Support the implementation of GHG mitigation actions in accordance with the sectoral work plans, engaging both lead agencies and supporting agencies, along with other relevant sectors.
(2) Develop and enhance the effectiveness of tools and mechanisms to support the implementation of GHG mitigation efforts.
(3) Enhance capacity and awareness across different sectors to facilitate the effective implementation of GHG mitigation actions.
(4) Promote participation, build networks, and foster collaboration to advance national GHG mitigation efforts.
(5) Enhance readiness for the implementation of GHG mitigation measures to support the achievement of the country's long-term goals.

6.3 Goal

Goal: The country's GHG emissions are reduced.
Target: The country's GHG emissions are reduced by at least 30% from the BAU scenario by 2030, equivalent to a total reduction of 184.8 MtCO2eq, which represents a 33.3% reduction from the BAU scenario in 2030.

(1) Energy sector – GHG emissions are reduced by 124.6 MtCO2eq.
(2) Transport sector – GHG emissions are reduced by 45.6 MtCO2eq.
(3) Municipal waste and industrial wastewater management sector – GHG emissions are reduced by 9.1 MtCO2eq.
(4) IPPU sector – GHG emissions reduced by 1.4 MtCO2eq.
(5) Agriculture sector – GHG emissions are reduced by 4.1 MtCO2eq.

A summary of the mitigation targets under the NDC Action Plan is presented in **Table 6-1**.

Table 6-1 Summary of mitigation targets by sector in 2030 under the NDC Action Plan

Sector	Mitigation targets in 2030					
	Domestic Efforts		International Support[a]			
			Under Implementation[b]		In Need of Support	
	MtCO2e	Percentage	MtCO2e	Percentage	MtCO2e	Percentage
1. Energy	124.6	22.5	-	-	32.0	5.8
2. Transport	45.6	8.2	-	-	2.5	0.4
3. Municipal waste and industrial wastewater management	9.1	1.6	-	-	1.9	0.3
4. IPPU	1.4	0.3	0.1	0.02		
5. Agriculture	4.1	0.7	1.0	0.18		
Total	**184.8**	**33.3**	**1.1**	**0.2**	**36.4**	**6.5**
			37.5 MtCO2e or 6.7%			
	222.3 MtCO2e or 40%					

Note

a. International support can be obtained in various forms, such as grants, soft loans, and others. The outcomes of these efforts must be measurable and demonstrable in terms of GHG emissions reduction.

b. The maximum feasible GHG emissions reduction target.

6.4 Indicator

GHG emissions are reduced by at least 167.88 MtCO2e, equivalent to a 30% reduction from the BAU scenario.

6.5 Implementation/Development Strategies

Achieving Thailand's GHG reduction targets will not be possible without the cooperation and active participation of all sectors, along with the development of supporting mechanisms, capacity-building initiatives, and international collaboration. Most importantly, Thailand must establish clear strategies to ensure sustained progress in GHG reduction, in alignment with the country's long-term mitigation goals. This Action Plan outlines five key development strategies and 17 specific work plans as follows:

Development Strategy 1: Drive and monitor the progress of sectoral GHG emissions reduction. This strategy consists of four key work plans as outlined below.

Work Plan 1.1 – Sectoral GHG emissions reduction through domestic efforts, implemented via mitigation work plans across five key sectors: energy, transport, municipal waste and industrial wastewater management, industrial processes and product use (IPPU), and agriculture. The details are as follows:

1.1.1 Work Plan for Activities/Projects in the Energy Sector

The GHG reduction target for the energy sector is set at 124.597 MtCO2e by the end of the target year. This target will be achieved through the implementation of mitigation measures in three main areas: energy conservation, renewable energy, and carbon capture and storage technologies. These measures comprise a total of 16 sub-measures as detailed below.

Mitigation Measure Group 1 – Energy conservation and efficiency enhancement in electricity generation

1.1 Enforcement of Building Energy Code (BEC) for factories and regulated buildings
1.2 Enforcement of Building Energy Code (BEC) for newly constructed buildings
1.3 Establishment of standards and labeling for equipment, machinery, and materials for energy conservation
1.4 Enforcement of Energy Efficiency Resource Standards (EERS) for energy producers and distributors
1.5 Provision of support and subsidies for energy conservation initiatives
1.6 Electricity generation efficiency improvement

Mitigation Measure Group 2 – Renewable energy

2.1 Development of wind energy
2.2 Development of solar energy
2.3 Development of hydropower energy
2.4 Development of biomass energy
2.5 Development of biogas energy
2.6 Development of energy from waste
2.7 Development of ethanol fuel
2.8 Development of biodiesel fuel
2.9 Development of new clean energy

Mitigation Measure Group 3 – Carbon capture and storage technologies

3.1 The Arthit Carbon Capture & Storage Pilot Project or Arthit CCS

The implementation of mitigation measures in the energy sector is designated as part of the operations under the (Draft) National Energy Plan 2023.

1.1.2 Work Plan for Activities/Projects in the Transport Sector

In the transport sector, the GHG reduction target by the end of the target year is set at 45.61 MtCO2e. This will be achieved through the implementation of mitigation measures across six key areas: electrification of transport, vehicle energy efficiency improvement, development of urban mobility systems, advancement of inter-urban transport and green logistics, promotion of future energy for transport, and enhancement of transport infrastructure and support. These areas encompass 16 specific sub-measures, detailed as follows:

Mitigation Measure Group 1 – Electrification of transport
1.1 Promotion of electric vehicle (EV) adoption and usage
1.2 Promotion of electric locomotive usage
1.3 Promotion of electric boat usage
1.4 Development of infrastructure to support electric vehicle adoption

Mitigation Measure Group 2 –Vehicle energy efficiency improvement
2.1 Establishment of standards and dissemination of information on energy efficiency and GHG emissions
2.2 Reform of tax systems to promote the use of energy-efficient vehicles

Mitigation Measure Group 3 – Development of urban mobility systems
3.1 Development of urban public transport infrastructure
3.2 Promotion of shared mobility and multimodal transport
3.3 Implementation of urban traffic management system

Mitgation Measure Group 4 – Advancement of inter-urban transport and green logistics
4.1 Development of railway transport infrastructure
4.2 Enhancement of efficiency in waterborne freight transport
4.3 Promotion of freight transport logistics management systems

Mitigation Measure Group 5 – Promotion of future energy for transport
5.1 Promotion of hydrogen fuel adoption in the transport sector
5.2 Promotion of sustainable aviation fuel (SAF) adoption in the aviation sector

Mitigation Measure Group 6 – Enhancement of transport infrastructure and support
6.1 Development of environmentally friendly transport infrastructure
6.2 Development of infrastructure to enhance transport efficiency

1.1.3 Work Plan for Activities/Projects in the Municipal Waste and Industrial Wastewater Management Sector

The municipal waste and industrial wastewater management sector aims to reduce GHG emissions by 9.115 MtCO2e by the end of the target year. This will be achieved through the implementation of mitigation measures across four key areas: (1) municipal waste management; (2) municipal wastewater management; (3) industrial wastewater management; and (4) supporting measures for GHG emissions reduction in the municipal waste and industrial wastewater management sector. These measures comprise 20 specific sub-measures, as outlined below.

Mitigation Measure Group 1 – Municipal waste management
1.1 Utilization of landfill gas through flaring or for beneficial purposes, such as electricity generation
1.2 Incineration of municipal solid waste for electricity generation (waste-to-energy)

1.3 Disposal of municipal solid waste using semi-aerobic landfills
1.4 Processing of organic waste into compost and liquid bio-fertilizer
1.5 Anaerobic digestion of organic waste with an emphasis on the beneficial utilization of the generated gas
1.6 Utilization of mechanical-biological treatment for processing organic waste

Mitigation Measure Group 2 – Municipal wastewater management
2.1 Expansion of wastewater collection and centralized treatment systems in local communities

Mitigation Measure Group 3 – Industrial wastewater management
3.1 Increasing biogas production from industrial wastewater through methane recovery and utilization

Mitigation Measure Group 4 – Supporting measures for GHG emissions reduction in the municipal waste and industrial wastewater management sector

Reduction of municipal solid waste to enhance waste management efficiency
4.1 Reduction in the use of single-use plastics and foam food containers
4.2 Reduction of organic waste generation
4.3 Promotion of eco-friendly products and services
4.4 Promotion of product manufacturing in accordance with circular economy principles through the application for carbon footprint labeling of circular economy products

Increased utilization of municipal solid waste
4.5 Promotion of participation in waste reduction and source segregation
4.6 Utilization of organic waste at the source for purposes such as animal feed, composting, and liquid bio-fertilizer production

Elimination of open burning
4.7 Elimination of open burning

Municipal wastewater management

Reduction of pollutant loads in municipal wastewater at the source
4.8 Promotion of the production and use of water-efficient products
(1) Encourage manufacturers of water-efficient products to register their environmentally friendly products and services
(2) Promote the use of water-efficient products in government buildings, private sector establishments, and households
(3) Promote the adoption of water-efficient products through an environmental impact assessment system
4.9 Promotion of the production and use of wastewater treatment products certified with the high-efficiency septic tank label
(1) Develop a certification label for high-efficiency septic tanks

(2) Encourage manufacturers of wastewater treatment products to obtain certification for high-efficiency septic tanks
(3) Promote the use of wastewater treatment products certified with the high-efficiency septic tank label in government buildings, private sector establishments, and households
(4) Promote the adoption of wastewater treatment products certified with the high-efficiency septic tank label through an environmental impact assessment system

Reuse of effluent and sludge from centralized community wastewater treatment systems
4.10 Supporting the Department of Local Administration (DLA) in promoting the reuse of treated water through local government initiatives and private sector participation
4.11 Utilization of sludge from wastewater treatment systems

Development of GHG emissions assessment system
4.12 Development of a system for collecting and monitoring data on GHG emissions and their quantities from relevant agencies

1.1.4 Work Plan for Activities/Projects in the IPPU Sector

The IPPU sector has set a GHG reduction target of 1.400 MtCO2e by the end of the target year. This includes implementing mitigation measures in two key areas: (1) clinker substitution; and (2) refrigerant replacement. These measures consist of four specific sub-measures as follows:

Mitigation Measure Group 1 – Clinker substitution
1.1 Use of alternative materials to replace clinker in hydraulic cement production
1.2 Use of alternative materials to replace cement in ready-mix concrete

Mitigation Measure Group 2 – Refrigerant replacement
2.1 Refrigerant replacement under the RAC NAMA Project
2.2 Proper disposal of waste and degraded refrigerants

1.1.5 Work Plan for Activities/Projects in the Agriculture Sector

The agriculture sector has set a GHG reduction target of 4.110 MtCO2e by the end of the target year. This target will be achieved through the implementation of three key measures: (1) manure management; (2) reduction in the use of chemical fertilizers; and (3) adoption of the alternate wetting and drying method for rice cultivation.

A summary of mitigation measures across all sectors, including the reduction targets for each measure by the end of the implementation year in 2030, as well as the responsible and supporting agencies, is presented in **Table 6-2**. Detailed information on the measures and annual GHG reduction targets can be found in **Appendix A**.

Table 6-2 Summary of mitigation measures and targets by sector in 2030

Work Plan	Measures	Lead Agencies	Supporting Agencies	Target in 2030 (MtCO2e)
Work Plan 1.1 Sectoral GHG emissions reduction				**184.832**
	Energy sector			**124.597**
	1. Energy conservation and efficiency enhancement in electricity generation			**33.401**
	1.1 Enforcement of Building Energy Code (BEC) for factories and regulated buildings	DEDE	EGAT / ERC / DIW / IEAT / DPT / DCCE / TGO	5.860
	1.2 Enforcement of Building Energy Code (BEC) for newly constructed buildings	DEDE	DPT / DCCE / TGO	0.660
	1.3 Establishment of standards and labeling for equipment, machinery, and materials for energy conservation	DEDE/EGAT	EGAT / TISI / DCCE / TGO	9.630
	1.4 Enforcement of Energy Efficiency Resource Standards (EERS) for energy producers and distributors	EGAT/MEA/PEA	DEDE / ERC / DCCE / TGO	0.201
	1.5 Provision of support and subsidies for energy conservation initiatives	DEDE	DCCE / TGO	9.050
	1.6 Electricity generation efficiency improvement	EGAT	ERC / TISI / DCCE / TGO	8.000
	2. Renewable energy			**90.196**
	2.1 Development of wind energy	DEDE	ERC / EGAT / MEA / PEA / DCCE / TGO	1.110
	2.2 Development of solar energy	DEDE	ERC / EGAT / MEA / PEA / DCCE / TGO	4.930
	2.3 Development of hydropower energy	DEDE / EGAT	ERC / MEA / PEA / DCCE / TGO	3.190
	2.4 Development of biomass energy	DEDE	EGAT / MEA / PEA / DGA / BMA / MOAC/ DCCE / TGO	64.940
	2.5 Development of biogas energy	DEDE	EGAT / MEA / PEA / DGA / BMA / MOAC / DCCE / TGO	3.790
	2.6 Development of energy from waste	DEDE	EGAT / MEA / PEA / DIW / IEAT / DGA / BMA / DCCE / TGO	1.630
	2.7 Development of ethanol fuel	DEDE	DOEB / OTP / DCCE / TGO	3.740
	2.8 Development of biodiesel fuel	DEDE	DOEB / OTP / DCCE / TGO	4.790

Work Plan	Measures	Lead Agencies	Supporting Agencies	Target in 2030 (MtCO2e)
	2.9 Development of new clean energy	DEDE	EPPO / DOEB / OTP / DCCE / TGO	2.076
	3. Carbon capture and storage technologies			**1.000**
	3.1 The Arthit Carbon Capture & Storage Pilot Project	DMF / Private sector businesses	DCCE / BMC / TGO / Research institutes / Academic institutions	1.000
	Transport sector			**45.610**
	1. Electrification of transport			**28.290**
	1.1 Promotion of electric vehicle (EV) adoption and usage	BMTA / TCL / Excise Department	OTP / DLT / DEDE / OIE / EPPO	28.290
	1.2 Promotion of electric locomotive usage	SRT	OTP / DRT	-
	1.3 Promotion of electric boat usage	MD / BMA	OTP	-
	1.4 Development of infrastructure to support electric vehicle adoption	EPPO / DOEB / MEA / PEA	OTP / OIE / TISI	-
	2. Vehicle energy efficiency improvement			**13.940**
	2.1 Establishment of standards and dissemination of information on energy efficiency and GHG emissions	TISI / DIW / Excise Department / PCD	OTP / DLT / OIE / DEDE / DOEB	13.940
	2.2 Reform of tax systems to promote the use of energy-efficient vehicles	DLT / Excise Department	OTP / OIE / TISI / PCD	-
	3. Development of urban mobility systems			**1.780**
	3.1 Development of urban public transport infrastructure	SRT / MRTA / DTP / NHA	OTP / DLT / DRT / DOA / DOH / MD / CAAT / BMA	1.780
	3.2 Promotion of shared mobility and multimodal transport	OTP / DLT / MD / BMTA / SRT / MRTA / PAT / BMA / DGA		-
	3.3 Implementation of urban traffic management system	MDES / BMA / RTP	OTP / DLT / DOH / PRD / Private sector organizations	-
	4. Advancement of inter-urban transport and green logistics			**1.600**
	4.1 Development of railway transport infrastructure	SRT	OTP / DRT	1.590
	4.2 Enhancement of efficiency in waterbourne freight transport	MD / PAT / IEAT	OTP	0.010
	4.3 Promotion of freight transport logistics management systems	OTP / DLT	DEDE	-
	5. Promotion of future energy for transport			**-**
	5.1 Promotion of hydrogen fuel adoption in the transport sector	EPPO / DOEB / DEDE	OTP	-
	5.2 Promotion of sustainable aviation fuel (SAF) adoption in the aviation sector	CAAT / AOT / DOEB / DEDE	OTP	-

Work Plan	Measures	Lead Agencies	Supporting Agencies	Target in 2030 (MtCO2e)
	6. Enhancement of transport infrastructure and support			**-**
	6.1 Development of environmentally friendly transport infrastructure	MD / DOA / AOT / EXAT / PAT / SRT / MRTA	OTP / DEDE	-
	6.2 Development of infrastructure to enhance transport efficiency	DOH / DMCR / MD / DOA / AOT / EXAT / PAT / SRT / MRTA	OTP	-
	Municipal waste and industrial wastewater management sector			**9.115**
	1. Municipal waste management			**5.110**
	1.1 Utilization of landfill gas through flaring or for beneficial purposes, such as electricity generation	BMA / DGA / Private sector	DLA / PCD / DEDE / ERC / NSTDA / TGO / ONEP	1.860
	1.2 Incineration of municipal solid waste for electricity generation (waste-to-energy)	DLA / DEDE / DGA / Private sector	PCD / DIW / TGO / ONEP	2.130
	1.3 Disposal of municipal solid waste using semi-aerobic landfills	DGA	PCD / DCCE / DLA / TGO / ONEP	0.000
	1.4 Processing of organic waste into compost and liquid bio-fertilizer	DLA / BMA / DGA / Private sector	PCD / DCCE / PRD / NSTDA / DOA / ONEP	0.440
	1.5 Anaerobic digestion of organic waste with an emphasis on the beneficial utilization of the generated gas	DLA / BMA / PCD	DEDE / NSTDA / ONEP	0.010
	1.6 Utilization of mechanical-biological treatment for processing organic waste	BMA / DGA / Private sector	DLA / PCD / DCCE / DEDE / NSTDA / ONEP	0.670
	2. Municipal wastewater management			**0.005**
	2.1 Expansion of wastewater collection and centralized treatment systems in local communities	DGA / WMA / BMA	ONEP / PCD	0.005
	3. Industrial wastewater management			**4.000**
	3.1 Increasing biogas production from industrial wastewater through methane recovery and utilization	DIW / DEDE		4.000
	4. Supporting measures for GHG emissions reduction in the municipal waste and industrial wastewater management sector			-
	Reduction of municipal solid waste to enhance waste management efficiency			
	4.1 Reduction in the use of single-use plastics and foam food containers	Public/private sector organizations	PCD / DCCE	-
	4.2 Reduction of organic waste generation	Public/private sector organizations	PCD / DCCE / DGA / BMA	-
	4.3 Promotion of eco-friendly products and services	Public sector organizations	PCD / DCCE	-

Work Plan	Measures	Lead Agencies	Supporting Agencies	Target in 2030 (MtCO2e)
	4.4 Promotion of product manufacturing in accordance with circular economy principles through the application for carbon footprint labeling of circular economy products	TGO	PCD / DCCE	-
	Increased utilization of municipal solid waste			
	4.5 Promotion of participation in waste reduction and source segregation	Public sector organizations	PCD / DGA / BMA	-
	4.6 Utilization of organic waste at the source for purposes such as animal feed, composting, and liquid bio-fertilizer production	Source / Farm owners	DLA / BMA / DGA	-
	Elimination of open burning			
	4.7 Elimination of open burning	DLA / DGA	PCD	-
	Municipal wastewater management			
	Reduction of pollutant loads in municipal wastewater at the source			
	4.8 Promotion of the production and use of water-efficient products			-
	(1) Encourage manufacturers of water-efficient products to register their environmentally friendly products and services	Thailand Environment Institute	PCD / DCCE	-
	(2) Promote the use of water-efficient products in government buildings, private sector establishments, and households	DCCE	PCD	-
	(3) Promote the adoption of water-efficient products through an environmental impact assessment system	ONEP	PCD	-
	4.9 Promotion of the production and use of wastewater treatment products certified with the high-efficiency septic tank label			-
	(1) Develop a certification label for high-efficiency septic tanks	Thailand Environment Institute / PCD	TISI / ThaiHealth / Department of Health / TGO	-
	(2) Encourage manufacturers of wastewater treatment products to obtain certification for high-efficiency septic tanks	Thailand Environment Institute / PCD	DCCE / DPT / FTI / Foundation for Consumers	-
	(3) Promote the use of wastewater treatment products certified with the high-efficiency septic tank label in government buildings, private sector establishments, and households	Thailand Environment Institute / PCD	ThaiHealth / DCCE / Foundation for Consumers / Septic tank manufacturing companies	-
	(4) Promote the adoption of wastewater treatment products certified with the high-efficiency septic tank label through an environmental impact assessment system	ONEP	PCD	-

Work Plan	Measures	Lead Agencies	Supporting Agencies	Target in 2030 (MtCO2e)
	Reuse of effluent and sludge from centralized community wastewater treatment systems			
	4.10 Supporting the Department of Local Administration (DLA) in promoting the reuse of treated water through local government initiatives and private sector participation	WMA / PCD / BMA	DGA / Private sector and agencies with legally mandated duties and authority	-
	4.11 Utilization of sludge from wastewater treatment systems	DGA / BMA / PCD / Department of Health	Private sector and agencies with legally mandated duties and authority	-
	Development of GHG emissions assessment system			
	4.12 Development of a system for collecting and monitoring data on GHG emissions and their quantities from relevant agencies	PCD	TGO / DCCE	-
	Industrial processes and product use sector			**1.400**
	1. Clinker substitution			**1.000**
	1.1 Use of alternative materials to replace clinker in hydraulic cement production	DIW	DCCE / MOC	0.900
	1.2 Use of alternative materials to replace cement in ready-mix concrete	DIW	DCCE / MOC	0.100
	2. Refrigerant replacement			**0.400**
	2.1 Refrigerant replacement under the RAC NAMA Project	DIW	Private sector businesses	0.300
	2.2 Proper disposal of waste and degraded refrigerants	DIW	PCD / Private sector businesses	0.100
	Agriculture sector			**4.110**
	1. Manure management	DLD	OAE	**3.000**
	2. Reduction in chemical fertilizer use	LDD	OAE	**0.100**
	3. Adoption of the alternate wetting and drying method for rice cultivation	RD / RID	OAE	**1.000**
GHG Emissions Reduction Target in 2030				**184.832**

Work Plan 1.2 – Sectoral GHG emissions reduction through international support. This work plan consists of two key measures as follows:

1. Development of a framework to secure international support for projects with GHG reduction potential, as outlined in **Table 6-3**. These projects will be assessed based on their alignment with Development Strategy 5, which promotes international cooperation in GHG mitigation, the suitability of the selected mitigation measures, and the benefits they will provide to the country.
2. Facilitating the matching of project developers with potential funding sources or suitable foreign technologies.

Table 6-3 Summary of key measures that require international support

Measure/Project	Lead Agencies	Supporting Agencies	Target in 2030 (MtCO2e)
1. Projects in the process of securing international support			**1.120**
1.1 Industrial processes and product use sector			**0.100**
- Utilization of technology to reduce nitrous oxide emissions in manufacturing processes	Private sector businesses / DIW / DCCE	TGO	1.100
1.2 Agriculture sector			**1.020**
- Capacity enhancement for climate-resilient rice cultivation	RD / RID / OAE	DOAE / DCCE / TGO	1.020
2. Projects to be advocated for international support through different climate finance mechanisms			**36.420**
2.1 Energy sector			**32.050**
- Electricity generation from advanced renewable energy sources	DEDE	EPPO	26.970
- Adoption of low-carbon fuels in industry	DEDE	EPPO / DIW	3.210
- Enhancement of industrial machinery efficiency	DEDE	EPPO / DIW	1.870
2.2 Transport sector			**2.470**
- Use of advanced electric vehicles (Advanced EV) **excluding the 30@30 policy*	OTP / EPPO	n/a	2.470
2.3 Additional measures/projects/technologies beyond Work Plan 1.1			**1.900**
- Utilization of technology in chemical industry production processes	DIW	n/a	1.900
- Soil improvement through biochar application	OAE	n/a	
- Municipal waste and industrial wastewater management	PCD / DIW	n/a	
- Implementation of cross-cutting initiatives across multiple sectors	DCCE	n/a	

Note: N/A means that the responsible organization has not yet been specified, as there is no ongoing activity at present. However, it is a measure/project with potential that should be advocated for international support.

Work Plan 1.3 – GHG emissions reduction through carbon credit management mechanisms under the international cooperation frameworks

To achieve a GHG reduction target of more than 30–40% by 2030, Thailand will need to rely on international cooperation and support while also encouraging participation in GHG emissions reduction efforts across all sectors, with a particular focus on private sector involvement. This will enable the country to adopt mitigation technologies that have high abatement costs, advancing its its long-term emissions reduction goals.

The carbon credit management mechanisms under the international cooperation framework, as established by the Paris Agreement, introduce Article 6 to promote voluntary collaboration and facilitate cooperative approaches between countries in achieving their NDC targets. Article 6 defines two market-based mechanisms: Article 6.2, which enables cooperation and agreements between countries, and Article 6.4, which operates through a centralized international crediting mechanism overseen by the governing body of the Paris Agreement. Additionally, this includes initiatives such as the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA). However, the authorization of international transactions or transfers of mitigation outcomes, along with the methodologies for project development and the allocation of carbon credits for Thailand, must comply with the **"Carbon Credit Management Guidelines and Mechanisms"** or other regulations as approved by the National Committee on Climate Change Policy. These processes must be implemented in accordance with the following scope and key principles:

- Supporting Thailand in achieving its conditional NDC with additional GHG emissions reductions beyond those attained through domestic efforts, while preventing double counting or double claiming of mitigation outcomes. The implementation must not create risks that could compromise Thailand's ability to meet its unconditional NDC or mitigation target set out to be achieved domestically.

- Ensuring that mitigation measures align with the country's sustainable development goals or contribute positively to the environment.

- Generating economic benefits for the country through investments in mitigation technologies.

This Action Plan sets a target of reducing GHG emissions by up to 3% through carbon credit management mechanisms under the international cooperation frameworks. This reduction is in addition to the unconditional target (of 30%) that Thailand aims to achieve through domestic efforts. Additionally, at least 10% of the total carbon credits accumulated throughout the transfer period will be retained. This retained portion will be deducted from the total amount of carbon credits to be transferred in the final year (the NDC target year) to facilitate corresponding adjustments, preventing double counting in order to ensure that this measure does not hinder the achievement of the Action Plan's targets. Furthermore, projects implemented under Article 6 must continue to operate in a sustainable and ongoing manner beyond the carbon credit transfer period. As a result, mitigation activities under these projects will contribute to further reductions in Thailand's national GHG inventory, complementing the mitigation measures outlined in this

Action Plan. These efforts will enable Thailand to transition to high-cost GHG reduction technologies and initiatives before 2030 while also delivering long-term benefits beyond 2030. Ultimately, this will help drive Thailand toward achieving its long-term GHG reduction goals of carbon neutrality by 2050 and net-zero emissions by 2065.

Work Plan 1.4 – Development of a measurement, reporting, and verification (MRV) system to comprehensively track and report the country's GHG mitigation efforts in alignment with international standards.

This work plan consists of seven measures as follows:

(1) Development of an information system and database for measuring, reporting, and verifying the implementation of the country's mitigation measures.
(2) Development and enhancement of methods for calculating mitigation outcomes to ensure comprehensive coverage of all measures and sectors.
(3) Assessment of Thailand's country-specific emission factors (CSEF) based on various mitigation activities in accordance with IPCC guidelines.
(4) Capacity building for personnel in relevant agencies responsible for implementing the country's mitigation measures, with a focus on activity data collection and GHG reduction calculations.
(5) Development of an MRV training curriculum for personnel at both national and local levels, with annual training sessions to update and equip both new and existing staff, ensuring continuity of operations and addressing personnel turnover, particularly in local agencies.
(6) Development of platforms such as applications for data reporting.
(7) Study and development of methodologies and indicators for tracking GHG reductions (NDC Tracking) to ensure alignment with Thailand's national GHG inventory.

Details of the measures under Work Plan 1.4 – Development of a measurement, reporting, and verification (MRV) system to comprehensively track and report the country's GHG mitigation efforts in alignment with international standards – are presented in **Table 6-4**.

Table 6-4 Measures under Work Plan 1.4: Development of a measurement, reporting, and verification (MRV) system to comprehensively track and report the country's GHG mitigation efforts in alignment with international standards

Measure	Lead Agencies	Supporting Agencies	Indicator
1. Development of an information system and database for measuring, reporting, and verifying the implementation of the country's mitigation measures.	DCCE	TGO	An information system is in place to track the country's GHG emissions reduction progress.
2. Development and enhancement of methods for calculating mitigation outcomes to ensure comprehensive coverage of all measures and sectors.	DCCE	TGO	Comprehensive methods for calculating mitigation outcomes are established, covering all sectors included in the country's mitigation measures.
3. Assessment of Thailand's country-specific emission factors (CSEF) based on various mitigation activities in accordance with IPCC guidelines.	DCCE	TGO / Sector-specific GHG reduction agencies	Thailand's country-specific emission factors are regularly updated to reflect current conditions.
4. Capacity building for personnel in relevant agencies responsible for implementing the country's mitigation measures, with a focus on activity data collection and GHG reduction calculations.	DCCE	TGO / Sector-specific GHG reduction agencies	Regular training activities are conducted for personnel of relevant agencies on related topics.
5. Development of an MRV training curriculum for personnel at both national and local levels, with annual training sessions to update and equip both new and existing staff, ensuring continuity of operations and addressing personnel turnover, particularly in local agencies.	DCCE	TGO / Sector-specific GHG reduction agencies	Training courses on calculation methods and the MRV process are developed and available for both central and local personnel.
6. Development of platforms such as applications for data reporting.	DCCE	TGO / Sector-specific GHG reduction agencies	A platform for data reporting is established and operational.
7. Study and development of methodologies and indicators for tracking GHG reductions (NDC Tracking) to ensure alignment with Thailand's national GHG inventory.	DCCE	TGO / Sector-specific GHG reduction agencies	Methodologies and indicators for tracking GHG emissions reduction (NDC Tracking) are established in alignment with Thailand's national GHG inventory.

Development Strategy 2: Develop and enhance the efficiency of tools and mechanisms to support GHG mitigation efforts. This strategy consists of four work plans and 25 measures as outlined below.

Work Plan 2.1 – Development and enhancement of mitigation mechanisms
Work Plan 2.2 – Promotion of laws and standards for GHG mitigation
Work Plan 2.3 – Provision of financial support for GHG mitigation efforts
Work Plan 2.4 – Promotion of market mechanisms and incentives for GHG mitigation
Details of the measures under this work plan are shown in **Table 6-5**.

Development Strategy 3: Enhance capacity, participation, and collaboration networks across the public, private, and civil society sectors. This strategy consists of four work plans and 16 measures as follows:

Work Plan 3.1 – Enhancement of national capacity for GHG mitigation
Work Plan 3.2 – Public awareness and advocacy for GHG reduction
Work Plan 3.3 – Development of public-private-civil society collaboration networks
Work Plan 3.4 – Promotion of inclusive participation in mitigation policymaking and implementation across all sectors
Details of the measures under this work plan are shown in **Table 6-6**.

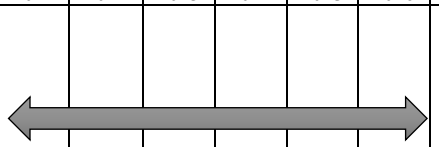
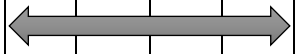
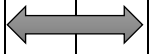
Development Strategy 4: Prepare for the implementation of mitigation measures to achieve the country's long-term goals. This strategy consists of three work plans and 17 measures as follows:

Work Plan 4.1 – Research and development
Work Plan 4.2 – Readiness for the adoption of carbon capture, utilization, and storage (CCUS) technologies
Work Plan 4.3 – Promotion of GHG reduction and sequestration in the forestry sector
Details of the measures under this work plan are shown in **Table 6-7**.

Development Strategy 5: Promote international cooperation in GHG mitigation. This strategy consists of two work plans and six measures as follows:

Work Plan 5.1 – Mobilization of international support for funding and assistance
Work Plan 5.2 – Promotion of international cooperation and partnerships in GHG mitigation
Details of the measures under this work plan are shown in **Table 6-8**.

Table 6-5 Development Strategy 2: Develop and enhance the efficiency of tools and mechanisms to support GHG mitigation efforts

Work Plan	Measure	Lead Agencies	Supporting Agencies	Indicator	Near-Term					Long-Term				
					2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Work Plan 2.1 – Development and enhancement of mitigation mechanisms	1. Drafting and development of the National Climate Change Act, including mechanisms in Chapter 4 (Climate Fund), Chapter 6 (Greenhouse Gas Data), Chapter 8 (Emissions Trading System), Chapter 9 (Carbon Border Adjustment Mechanism – Thailand CBAM), Chapter 11 (Carbon Credits), and other relevant provisions.	DCCE		A draft Climate Change Act (B.E. ....) has been developed.										
	2. Enhancement of the roles and regulations of relevant funds, such as the Environmental Fund and ESCO Fund, to expand support for mitigation activities through grants or loans.	DCCE	DEDE	Mitigation outcomes from projects funded by all relevant financial mechanisms.										
	3. Revision of public procurement regulations to incorporate certified high-efficiency products that contribute to GHG reduction, including updates to product lists under green procurement policies.	CGD	DCCE/PCD/ JSCCIB/ Private sector businesses	Increased proportion of GHG-reducing products in public sector procurement.										
	4. Revision of public construction procurement regulations to include cement products with new alternative materials.	CGD	DCCE/PCD/ JSCCIB/ Private sector businesses	Procurement regulations revised to allow the use of cement products with new alternative materials.										
	5. Revision of laws and regulations regarding the designation of mineral resource areas for cement raw materials.	CGD	DCCE/PCD/ JSCCIB/ Private sector businesses	Laws and regulations on the designation of mineral resource areas for cement raw materials have been revised and updated.										
	6. Revision of annual vehicle tax rates under the Land Transport Act and the Motor Vehicle Act B.E. 2522 to incorporate GHG emissions and environmental impact considerations, encouraging vehicle owners to maintain vehicle efficiency and transition to newer, more environmentally friendly vehicles.	DLT	DCCE/OTP	Annual vehicle tax is collected based on emission levels.										

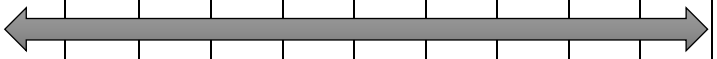
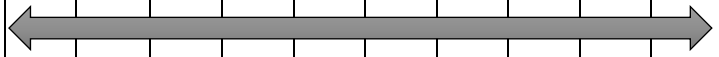
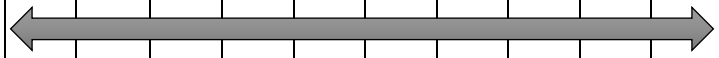
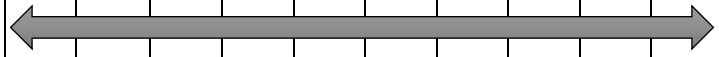
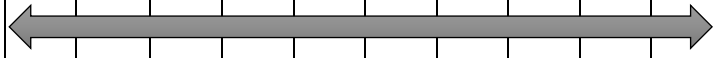
Work Plan	Measure	Lead Agencies	Supporting Agencies	Indicator	Near-Term					Long-Term				
					2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
	7. Revision of municipal waste and wastewater management fees under the Cleanliness and Orderliness Act (No. 2) B.E. 2560 to align with actual waste disposal volumes and costs, encouraging behavioral changes in waste segregation and reducing wastewater discharge into public water sources.	DLA/BMA/ DGA	PCD/WMA/ DCCE	Local administrative organizations collect waste and wastewater management fees based on actual waste generation and disposal costs in the community.										
	8. Expansion of BOI support for GHG reduction technologies to ensure comprehensive coverage and long-term implementation.	BOI		BOI support for GHG reduction has been expanded to ensure comprehensive and long-term implementation.										
	9. Technical study to define GHG emissions control measures and develop an Emissions Trading Scheme (ETS).	DCCE/ TGO	NRCT/TISTR /TSRI/DEDE	Technical proposals for establishing measures and mechanisms for the GHG Emissions Trading Scheme (ETS) have been developed, along with a draft ministerial regulation.										
	10. Study and development of a carbon tax system.	Excise Department	DCCE	High GHG-emitting products have been identified and classified, with a draft ministerial regulation or relevant guidelines developed.										
	11. Development and implementation of tax measures to incentivize investment in mitigation projects and activities.	Revenue Department/ Excise Department	DCCE	Tax measures have been implemented to incentivize investment in GHG mitigation.										

Work Plan	Measure	Lead Agencies	Supporting Agencies	Indicator	Near-Term					Long-Term				
					2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Work Plan 2.2 – Promotion of laws and standards for GHG mitigation	1. Enforcement of the Ministerial Regulation on building types, sizes, standards, criteria, and methods for energy-efficient building design under the Energy Conservation Promotion Act B.E. 2552, in accordance with the Building Control Act B.E. 2522.	DEDE/DPT	DCCE	Newly constructed buildings are in compliance with the Ministerial Regulation on building types, sizes, and standards for energy-efficient design.										
	2. Development and implementation of urban planning measures to guide the transition to low-carbon cities and promote mitigation activities at the community level.	DPT/BMA/DGA	DCCE/TGO	An increasing number of municipalities are enforcing low-carbon urban planning measures.										
	3. Promotion of labels and certification standards for GHG reduction across a wider range of products and services—such as the Number 5 Energy Efficiency Label, High-Efficiency Energy Label, Eco-Labeling, and Carbon Reduction Footprint—to incentivize businesses to produce low-GHG products and services while providing consumers with more sustainable choices.	EGAT/ DEDE/ TGO/TISI/TPSO	DCCE/MOC (DIT/DBD)	Increased number of certified low-GHG products and services.										
	4. Issuance of a ministerial announcement under the Factory Act B.E. 2535 to prohibit the establishment of factories producing high-GWP HFCs.	DIW	DCCE/TGO	A draft ministerial announcement under the Factory Act B.E. 2535 has been prepared to prohibit the establishment of factories producing high-GWP HFCs.										
	5. Revision of regulations on the destruction and disposal of high-GWP refrigerants under the authority of the Draft Waste Electrical and Electronic Equipment (WEEE) Management Act, B.E. …	PCD/DIW		Regulations are in place for the destruction and disposal of high-GWP refrigerants.										
	6. Advocating for the establishment of Thai Industrial Standards (TIS) for new types of cement and cement-based products with low GHG emissions.	TISI	DIW/ Private sector businesses	Thai Industrial Standards (TIS) have been established for new types of cement and cement-based products with low GHG emissions.										

Work Plan	Measure	Lead Agencies	Supporting Agencies	Indicator	Near-Term					Long-Term				
					2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
	7. Revision of public construction standards to incorporate the use of hydraulic cement and cement with a lower clinker content in construction projects.	DPT	DIW/DCCE/ PCD	The market share of certified products and services with labels or standards is increasing.										
Work Plan 2.3 – Provision of financial support for GHG mitigation efforts	1. Development of an integrated climate change budget to support agencies in preparing for and implementing action plan measures in accordance with the annual guidelines set by the Budget Bureau.	BB	DCCE	An integrated climate change budget has been allocated to relevant agencies for implementing mitigation measures.										
	2. Provision of financial support and incentives for modifying production machinery and equipment to adopt low-GWP refrigerants.	DIW	Private sector businesses	An increasing number of production machinery and equipment have been modified to use low-GWP refrigerants.										
Work Plan 2.4 – Promotion of market mechanisms and incentives for GHG mitigation	1. Provision of incentives for consumers to purchase products and services that reduce GHG emissions through pricing mechanisms and tax benefits, enabling buyers to claim income tax deductions.	MOF/MOC (DIT/DBD)/T PSO	DCCE/TGO	Consumers have access to tax benefits for purchasing products or services that contribute to GHG emissions reduction.										
	2. Development of domestic and international carbon market mechanisms to incentivize GHG reduction and create revenue opportunities for businesses and local communities through carbon credit-generating activities.	TGO/ DCCE	JSCCIB/ Private sector businesses	The volume of GHG trading under various carbon market mechanisms is increasing.										
	3. Enhancement of waste reduction mechanisms and efficient waste management before disposal, including packaging fees, deposit-refund systems, and the reinforcement of the 3Rs principle (Reduce, Reuse, Recycle).	DLA/BMA/D GA	PCD/DCCE/ Private sector businesses	Decrease in per capita waste generation.										
	4. Development of mechanisms to promote low-carbon transportation and incentivize sustainable travel behavior, including enhanced public transit connectivity and an integrated ticketing system.	OTP	BMA/SRT/ MRTA/DCCE	Increased public adoption of low-carbon travel behaviors.										

Work Plan	Measure	Lead Agencies	Supporting Agencies	Indicator	Near-Term					Long-Term				
					2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
	5. Investment promotion in biogas energy technology for industrial facilities through a dedicated fund supporting biogas production from wastewater and industrial waste for thermal energy, electricity generation, and compressed biomethane production.	DEDE	DIW	A fund has been established to promote the adoption of biogas energy in the industrial sector.										

Table 6-6 Development Strategy 3: Enhance capacity, participation, and collaboration networks across the public, private, and civil society sectors

Work Plan	Measure	Lead Agencies	Supporting Agencies	Indicator	Near-Term					Long-Term				
					2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Work Plan 3.1 – Enhancement of national capacity for GHG mitigation	1. Capacity building and knowledge enhancement for local administrative organizations to effectively implement mitigation measures and accurately monitor their outcomes, such as reducing emissions from community waste and promoting energy production from clean technologies.	DCCE/ TGO	DLA/BMA	Local administrative organization personnel have the capacity to implement mitigation measures and accurately monitor their outcomes.										
	2. Capacity building for the industrial sector to implement mitigation measures.	DIW/ JSCCIB	DCCE/TGO	The industrial sector successfully implements mitigation measures and accurately monitors their outcomes.										
	3. Enhancement of public awareness and understanding to encourage participation in GHG mitigation efforts, including waste management, household energy conservation, and low-carbon travel behaviors.	DCCE	DLA/BMA/ TGO	All sectors actively support and engage in GHG mitigation efforts.										
	4. Advocacy for the Ministry of Education to develop and integrate climate change and GHG reduction content into curricula and educational activities across all levels of learning—formal, non-formal, and informal—from primary to higher education, to ensure accurate knowledge and understanding while enhancing youth capacity as a key force in addressing climate change and contributing to national GHG mitigation efforts.	MOE/IPST	DCCE/TGO	Climate change and GHG reduction education is incorporated into all levels of learning, including formal, non-formal, and informal education systems.										
	5. Empowerment of youth as a key driving force in addressing climate change and reducing GHG emissions.	DCCE		Establishment of youth networks and an annual increase in the number and diversity of youth-led projects.										
	6. Enhancement of awareness and understanding among relevant agencies to support GHG mitigation efforts in the industrial sector.	DIW	DCCE/TGO	Relevant agencies have the knowledge and understanding to support GHG mitigation efforts in the industrial sector.										

Work Plan	Measure	Lead Agencies	Supporting Agencies	Indicator	Near-Term					Long-Term				
					2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Work Plan 3.2 – Public awareness and advocacy for GHG reduction	1. Dissemination of knowledge and development of methodologies and tools for calculating the carbon footprints of products, organizations, and individuals to enhance awareness of GHG emissions.	TGO	DCCE	Dissemination and adoption of methodologies and tools for measuring carbon footprints.										
	2. Training programs for mass communication personnel to enhance their knowledge of climate change and Thailand's climate actions.	DCCE/ TGO	PRD	Training programs for mass communication personnel are conducted.										
	3. Enhancement of collaboration with mass communication agencies to promote GHG mitigation efforts through television, radio, print, and digital media, while leveraging information technology to disseminate knowledge and raise public awareness of the importance of reducing GHG emissions nationwide.	DCCE/ PRD	TGO/ Ministry of Culture	Continuous dissemination of public awareness materials on GHG reduction through various media channels to effectively reach the public.										
Work Plan 3.3 – Development of public-private-civil society collaboration networks	1. Fostering partnerships among the public, private, and civil society sectors to support GHG reduction initiatives, including corporate social responsibility (CSR) activities through carbon credit purchases from local mitigation projects and private sector investment in mitigation efforts within public sector spaces.	DCCE/ TGO/DGA	JSCCIB/ Private sector	GHG emission reductions achieved through CSR activities.										
	2. Promotion of GHG reduction target setting for the private sector and local authorities.	DCCE/ TGO	Private sector/DGA	Increase in the number of private sector entities and local authorities with established GHG reduction targets.										
	3. Facilitating the establishment of citizen networks and community representative groups to enhance participation in GHG reduction efforts, foster awareness, and disseminate knowledge on the implementation of mitigation measures.	DCCE	DLA/TGO/ OPS-MNRE (PONRE)	GHG emission reductions achieved by citizen networks.										
	4. Promotion of cooperation and participation of industrial factories and relevant sectors in implementing GHG mitigation efforts within the industrial sector.	DIW/IEAT	Provincial industries/ Industrial factories	Establishment of a collaboration network within the industrial sector.										

Work Plan	Measure	Lead Agencies	Supporting Agencies	Indicator	Near-Term					Long-Term				
					2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Work Plan 3.4 – Promotion of inclusive participation in mitigation policymaking and implementation across all sectors	1. Establishment of channels for communicating GHG mitigation policies and collecting public feedback.	DCCE		Number of public recommendations on GHG mitigation policies.	⟷	⟷	⟷	⟷	⟷	⟷	⟷	⟷	⟷	⟷
	2. Promotion of collaboration on energy crop development and the sustainable management of cultivation areas to ensure stable bioenergy production while protecting existing ecosystems, food security, and economic stability.	OAE/ DEDE	DCCE	The proportion of energy crops allocated for renewable energy production is sufficient, appropriately managed, and does not adversely affect existing ecosystems, food security, or economic stability.				⟷	⟷	⟷	⟷			
	3. Strengthening the role of urban areas and local administrative organizations in implementing mitigation measures, enhancing capacity, fostering collaboration, and monitoring the outcomes of initiatives such as waste reduction, community wastewater management, and household energy efficiency improvements.	DLA/BMA/ DGA	DCCE/TGO	GHG emissions reduction resulting from the activities of urban areas and local administrative organizations.			⟷	⟷	⟷	⟷	⟷	⟷	⟷	⟷

Table 6-7 Development Strategy 4: Prepare for the implementation of mitigation measures to achieve the country's long-term goals

Work Plan	Measure	Lead Agencies	Supporting Agencies	Indicator	Near-Term					Long-Term				
					2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Work Plan 4.1 – Research and development	1. Formulation of a national technology development plan for GHG reduction, along with a capacity-building plan for personnel to support comprehensive technological advancements across all sectors.	NXPO	NSTDA/ NRCT/TISTR /TSRI/DCCE	A national technology development plan for GHG reduction and a capacity-building plan for personnel are developed and implemented.										
	2. Long-term national research and development of GHG reduction technologies, with a focus on advancing new clean energy technologies such as hydrogen, HyBlend, and energy storage.	NXPO/ EGAT/PTT/ Private sector businesses	NSTDA/ NRCT/TISTR /TSRI	GHG reduction technology research is implemented and incorporated into the operational plans of relevant agencies.										
	3. Research and development of cost-effective waste management technologies for residential areas in Thailand.	NXPO	NSTDA/ NRCT/TISTR /TSRI	Prototype technology for residential waste management in Thailand is developed.										
	4. Research and development of strategies for waste prevention at the source, food waste collection, and best practices for managing expired food.	NXPO	NSTDA/ NRCT/TISTR /TSRI	Strategies for waste management at the source, food waste collection, and best practices for managing expired food are developed.										
	5. Research and development of strategies for scaling up the production of waste-derived products, along with the development of new waste-based products beyond those currently available on the market.	NXPO	NSTDA/ NRCT/TISTR /TSRI	Strategies for scaling up the production of waste-derived products are established, along with approaches for developing additional waste-based products.										
	6. Assessment of the GHG reduction potential from industrial waste residues.	DIW	Private sector businesses	The GHG reduction potential from industrial waste residues is assessed and quantified.										
	7. Research on strategies for developing electric motors for large vessels.	MD	OTP/DEDE MIND/ NSTDA/ NRCT/TISTR /TSRI	Strategies for developing electric motors for large vessels are formulated.										

Work Plan	Measure	Lead Agencies	Supporting Agencies	Indicator	Near-Term					Long-Term				
					2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
	8. Research and development of technologies and machinery for small-scale field operations to reduce open burning.	DOA	OAE	Recommendations, technologies, and machinery for small-scale field operations to reduce open burning are developed.										
	9. Assessment of the GHG reduction potential of biochar application in agriculture and industrial processes.	DCCE/ OAE/DIW	DOA/ Private sector businesses	The GHG reduction potential of biochar application in agriculture and industrial processes is assessed and quantified.										
	10. Support for research and demonstration of industrial wastewater treatment technologies with low GHG emissions.	TSRI/ NXPO	Research institutes / Academic institutions	A pilot technology for industrial wastewater treatment with low GHG emissions is developed.										
	11. Support for research and demonstration of hydraulic cement and low-clinker cement applications in structural construction to enhance user confidence, as well as research and demonstration of low-carbon concrete products for the development of environmentally friendly buildings and infrastructure.	NSTDA/ TSRI	Research institutes / Academic institutions/ Private sector businesses	Research on low-carbon cement and concrete products is conducted.										
Work Plan 4.2 – Readiness for the adoption of carbon capture, utilization, and storage (CCUS) technologies	1. Promotion of the Arthit Carbon Capture & Storage Pilot Project.	DMF/ PTTEP	DCCE	Implementation of a carbon capture and storage (CCS) project in a pilot area.										
	1.1 Develop a pilot project for carbon capture and storage (CCS) that is technically feasible and aligned with widely accepted standards.	DMF/ PTTEP	DCCE/TGO/ Research institutes/ Academic institutions	A suitable project development plan is established, and carbon storage is implemented accordingly.										
	1.2 Develop legal, regulatory, and operational frameworks for the implementation of a pilot project on CCS, including relevant laws such as the Petroleum Act and the National Environmental Promotion and Protection Act.	DMF/ PTTEP	DCCE/ONEP /TGO/ Research institutes	Effectiveness of pilot project implementation is evaluated to support legal improvements for future operations.										

Work Plan	Measure	Lead Agencies	Supporting Agencies	Indicator	Near-Term					Long-Term				
					2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
	1.3 Promote and support pilot project development by fully compensating investment costs through a double deduction of petroleum income tax expenses or the provision of tax credits.	DMF/ PTTEP	DCCE/TGO/ Research institutes/ Academic institutions	Approaches for developing investment promotion measures and investment compensation for project implementation are established.										
	2. Development of strategies for implementing CCS at industrial sites in the eastern region, along with the establishment of a strong foundation for the long-term growth of the CCS industry, encompassing upstream CCS activities at petroleum production sites and downstream CCS activities in general industries.	DMF/ DOEB/ Private sector businesses	DCCE/TGO/ IEAT/ERC	Findings on strategies for CCS at industrial sites in the eastern region are produced, along with the establishment of a foundation for the long-term development of the country's CCS industry.										
	2.1 Study and assess the carbon storage potential in the Upper Gulf of Thailand.	DMF/ Private sector businesses	DOEB/DCCE /ONEP	Assessment results on the carbon storage potential of the geological formations in the Upper Gulf of Thailand have been obtained.										
	2.2 Develop legal and regulatory frameworks to govern CCS operations in petroleum areas and other designated zones.	DMF/ DOEB/ Private sector businesses	Research institutes/ Academic institutions/ DCCE/TGO/ IEAT/ERC	Legal and regulatory frameworks governing CCS operations have been established.										
	2.3 Support and promote CCS project development across the entire value chain through appropriate measures, such as tax incentives and subsidies.	MOF	MOE/ MONRE	Appropriate support measures for CCS project development have been established and put into practice.										
Work Plan 4.3 – Promotion of GHG reduction and sequestration in the forestry sector	1. Development of an action plan to expand green areas to achieve 55% green space coverage by 2037, in line with the 20-Year National Strategy, and to support the goal of sequestering 120 $MtCO_2e$.	DNP/RFD/ DMCR/FIO/ DOL/ ALRO/ Treasury Department/ LDD/ DSDW/ DOAE	DCCE/BMA/ DGA/DPT/ TGO	Implementation of the action plan for expanding green areas, with measurable performance outcomes achieved in accordance with the plan.										

Work Plan	Measure	Lead Agencies	Supporting Agencies	Indicator	Near-Term					Long-Term				
					2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
	2. Promotion of diverse forest plantation initiatives in designated state forest areas, including those authorized under Section 64 of the National Park Act B.E. 2562, Section 121 of the Wildlife Preservation and Protection Act B.E. 2562, and degraded forest land under the National Reserved Forest Act B.E. 2507.	DNP/RFD	DCCE/TGO	Expansion of reforestation efforts and enhanced maintenance of forest areas.										
	3. Promotion of forest plantations for carbon credits on private land or outside designated forest areas.	RFD/DNP	TGO/DCCE	Increase in forested areas outside designated forest zones.										
	4. Promotion of economic tree planting on ALRO-designated land.	FIO/ALRO	DNP/RFD/ DCCE/TGO	Increase in the area of economic tree plantations on ALRO-designated land.										

Table 6-8 Development Strategy 5: Promote international cooperation in GHG mitigation

Work Plan	Measure	Lead Agencies	Supporting Agencies	Indicator	Near-Term					Long-Term				
					2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Work Plan 5.1 – Mobilization of international support for funding and assistance	1. Development and updating of national needs data to secure support for GHG mitigation efforts, particularly for NDC measures, to help the country achieve its 30–40% target.	DCCE	Sector-specific GHG reduction agencies	Plans for securing support for GHG mitigation efforts have been developed in alignment with agency needs.				⟷	⟷	⟷	→			
	2. Facilitation of access for domestic agencies to financial support from international funds, both under and outside the UNFCCC framework.	DCCE	Sector-specific GHG reduction agencies	Number of GHG mitigation projects supported by international financial mechanisms.	⟷	⟷	⟷	⟷	⟷	⟷	⟷	⟷	⟷	→
	3. Enhancement of guidelines and mechanisms for carbon credit management under Article 6 of the Paris Agreement to align with the national context.	DCCE	TGO/ Sector-specific GHG reduction agencies	A strategy for implementing Article 6 of the Paris Agreement has been established.			⟷	⟷	⟷	⟷	→			
Work Plan 5.2 – Promotion of international cooperation and partnerships in GHG mitigation	1. Participation in global and regional alliances or cooperative initiatives for GHG reduction.	DCCE	Sector-specific GHG reduction agencies	An increase in international collaborations or cooperative activities on GHG reduction at both global and regional levels.	⟷	⟷	⟷	⟷	⟷	⟷	⟷	⟷	⟷	→
	2. Promotion of domestic research institutes and educational institutions in establishing academic cooperation with international partners for knowledge exchange and research on GHG reduction.	DCCE/ Academic institutions		An increase in academic collaborations with international institutions for knowledge exchange and research on GHG reduction.	⟷	⟷	⟷	⟷	⟷	⟷	⟷	⟷	⟷	→
	3. Promotion of collaboration between private sector entities or between the private sector and international organizations for GHG reduction or the establishment of net-zero emission targets.	DCCE/ JSCCIB	Private sector	Established cooperation between private sector entities or between the private sector and international organizations.	⟷	⟷	⟷	⟷	⟷	⟷	⟷	⟷	⟷	→

Chapter 7

Strategies for Driving the NDC Action Plan

The implementation of GHG mitigation efforts to achieve the targets set in Thailand's NDC Action Plan on Mitigation 2021–2030 requires integrated collaboration among relevant agencies and sectors at all levels—national, regional, and local—to ensure policy alignment, interconnectivity, and stakeholder engagement. To effectively drive the implementation of the NDC Action Plan, the following strategies are proposed to translate commitments into concrete actions and achieve the established GHG reduction targets.

7.1 Institutional Arrangement for NDC Action Plan Implementation

7.1.1 National Mechanism – The National Committee on Climate Change Policy (NCCC), chaired by the Prime Minister, serves as the national policymaking and oversight body for climate change governance. Comprising permanent secretaries from relevant ministries, the NCCC is responsible for formulating policies, overseeing their implementation, and monitoring climate change and GHG mitigation efforts across key ministries. Their mandate ensures that these activities align with national plans and contribute to the achievement of the GHG reduction targets set in the national climate action framework. To support its mandate, the NCCC has established the following subcommittees: (1) The Subcommittee on Climate Change Policy and Planning Integration, which advises on the formulation and integration of climate policies, strategies, and action plans while proposing mechanisms and measures to drive climate action as well as monitoring and evaluating the effectiveness of policy implementation; (2) The Subcommittee on Climate Change Knowledge and Database, which provides recommendations on the development of the national GHG inventory, the establishment and maintenance of climate knowledge databases, and technical guidance on the measurement, reporting, and verification (MRV) of GHG mitigation measures, while also supporting research and knowledge development; and (3) The Subcommittee on Climate Law, which advises on policy development related to the enactment, revision, amendment, or repeal of climate-related laws to ensure alignment with national priorities and international commitments. It also oversees the drafting and proposal of legal frameworks, regulations, directives, and other legislative instruments to support climate action. Additionally, the subcommittee reviews and provides expert opinions on legal and technical issues, offers guidance on the enforcement of climate-related laws, and evaluates legal interpretations and inquiries related to climate change governance.

7.1.2 Working Groups – To support climate change mitigation efforts, two key working groups have been established. The Working Group on GHG Mitigation Policy and Planning, operating under the Subcommittee on Climate Change Policy and Planning Integration, is responsible for providing recommendations and insights on the formulation and review of Thailand's GHG reduction targets. Additionally, it monitors and evaluates the implementation of mitigation policies, strategies, and action plans to ensure their effectiveness. Meanwhile, the Working Group on GHG Inventory and Mitigation Measures, under the Subcommittee on Climate Change Knowledge and Database, is responsible for providing recommendations on methodologies for the measurement, reporting, and verification (MRV) of GHG inventory data

and mitigation measures across different sectors. Additionally, the working group reviews and provides expert opinions on emissions assessments and the evaluation of GHG reduction outcomes under sector-specific mitigation measures, ensuring their accuracy and alignment with national GHG reduction targets.

7.1.3 The Department of Climate Change and Environment (DCCE) – As Thailand's National Focal Point to the UNFCCC, DCCE serves as the central coordinating body responsible for overseeing the implementation of measures aligned with Thailand's NDC Action Plan on Mitigation 2021–2030, as well as other related climate initiatives. Additionally, DCCE is tasked with coordinating activities under the UNFCCC framework and supporting projects related to climate change adaptation and GHG mitigation.

As Thailand's National Designated Authority (NDA) for the Green Climate Fund (GCF), DCCE is responsible for coordinating and facilitating access to climate finance for relevant stakeholders under the UNFCCC framework, with the aim of enhancing opportunities to secure financial support from UNFCCC financial mechanisms to advance national efforts in climate change mitigation and adaptation. Additionally, this includes strengthening the role and expanding the scope of financial support provided by the Environmental Fund (under the Office of Natural Resources and Environmental Policy and Planning – ONEP) to cover a wider range of activities that contribute to GHG emissions reduction at the local and sectoral levels.

As Thailand's National Focal Point for Action for Climate Empowerment (ACE) under the UNFCCC framework, DCCE is responsible for promoting the systematic integration of climate education, training, public awareness and participation, and access to information across all activities related to GHG mitigation and climate change adaptation under both the UNFCCC and the Paris Agreement (PA). Additionally, DCCE plays a key role in coordinating efforts among relevant stakeholders across all sectors to facilitate the dissemination of climate-related knowledge and information, ensuring inclusive engagement in national climate action.

7.1.4 Sector Focal Points are responsible for establishing ministerial-level working groups comprising representatives from both responsible and supporting agencies for each strategy, measure, work plan, and project. These working groups are tasked with implementing sector-specific mitigation measures, developing methodologies for activity data collection and GHG emissions reduction calculations, as well as overseeing, monitoring, and evaluating the implementation of the NDC Action Plan. The results of these efforts are then reported to policy-level mechanisms for further review.

7.1.5 The Thailand Greenhouse Gas Management Organization (Public Organization) (TGO) is responsible for supporting the assessment of GHG emission reductions, enhancing the capacity of relevant public and private sector entities in GHG management, as well as disseminating and promoting awareness on GHG management. Additionally, TGO plays a key role in promoting and supporting climate change initiatives, contributing to national efforts in both mitigation and adaptation.

7.1.6 The Office of the National Higher Education, Science, Research and Innovation Policy Council (NXPO), as Thailand's National Designated Entity (NDE) for climate technology development and transfer, is responsible for conducting research and developing domestic climate technologies to support the implementation of measures under the NDC Action Plan. Additionally, the Office of the Science, Research, and Innovation Promotion Committee (TSRI) plays a key role in promoting and supporting research initiatives that drive national efforts toward achieving GHG reduction targets.

7.2 Development of NDC Tracking System to Monitor GHG Emission Reductions in Alignment with the Guidelines Set by the UNFCCC Secretariat and the Paris Agreement

The monitoring and evaluation process for GHG mitigation efforts is a critical mechanism to ensure that the implementation of mitigation measures aligns with the NDC Action Plan and that emission reductions are reflected proportionally in the national GHG inventory. To achieve this, key indicators are established to track and assess progress, with mitigation outcomes analyzed in conjunction with national GHG inventory data. The analysis results are then presented to policymakers for acknowledgment and to inform adjustments to implementation strategies as appropriate. Additionally, a structured GHG mitigation monitoring process is established based on the following strategies.

7.2.1 DCCE, in collaboration with TGO and Sector Focal Points, develops methodologies for tracking GHG emission reductions, establishes indicators for monitoring and reporting, and ensures comprehensive coverage of all measures and sectors. The tracking system adheres to the Paris Agreement's guidelines, enabling continuous data reporting every two years in alignment with Thailand's submission of the Biennial Transparency Report (BTR).

7.2.2 DCCE develops a national institutional framework to define the roles and responsibilities of relevant agencies in tracking GHG emission reductions. This framework is systematically integrated with the existing institutional structure that governs sectoral GHG mitigation efforts.

7.2.3 DCCE facilitates the establishment of ministerial-level working groups within the Sector Focal Points and relevant supporting agencies involved in implementing mitigation measures under the NDC Action Plan. These working groups are systematically integrated into the national institutional framework to ensure a coordinated approach to tracking GHG emission reductions.

7.2.4 The Sector Focal Points develop a database system for tracking GHG emission reductions from measures, work plans, and projects implemented under the NDC Action Plan.

7.3 Awareness Raising and Inclusive Participation in GHG Mitigation Across all Sectors

Achieving GHG reduction targets requires collaboration from all sectors, starting with fostering knowledge, understanding, and awareness among executives of all relevant agencies, as well as officials, personnel, and the general public. This includes raising awareness of climate change issues, enhancing preparedness for climate change impacts, and promoting active

participation in climate policymaking and the development of appropriate solutions. The key strategies to achieve this are as follows:

7.3.1 DCCE is responsible for communicating and fostering awareness and understanding among agencies and government bodies at all levels—national, regional, and local—as well as relevant private sector entities regarding the importance of the country's GHG reduction targets. These targets are outlined in key strategies such as the Long-term Low Greenhouse Gas Emission Development Strategy (LT-LEDS), the Nationally Determined Contributions (NDCs), and national mitigation approaches and measures. Additionally, DCCE shall ensure that relevant agencies understand their roles and responsibilities in achieving these targets.

7.3.2 DCCE is responsible for communicating and raising awareness among the general public and the private sector regarding the country's GHG reduction targets, including key national strategies such as the LT-LEDS, the NDCs, and national mitigation approaches and measures. In addition, DCCE shall work to enhance understanding among both groups regarding the potential positive and negative impacts of implementing the NDC Action Plan, ensuring that all relevant stakeholders are well-informed and prepared to respond effectively.

7.3.3 DCCE is responsible for fostering knowledge, understanding, and awareness among the public to encourage climate-conscious actions in daily life such as waste management, reducing household energy consumption, and adopting more sustainable travel habits that help lower emissions. Additionally, DCCE shall develop communication tools, including public guidelines and digital platforms like websites and mobile applications, to share progress on the implementation of the NDC Action Plan and provide educational resources on climate change. These efforts seek to enhance public awareness, encourage active participation, and strengthen engagement in GHG mitigation initiatives.

7.4 Personnel Support and Capacity Building

Effective GHG mitigation efforts require sector-specific expertise and a multidisciplinary approach, encompassing everything from national policy formulation to the implementation of technological measures and operational support. Agencies responsible for implementing the NDC Action Plan must assess whether their workforce has the necessary expertise and capacity to ensure efficient execution. The following strategies outline key steps to achieve this:

7.4.1 DCCE and sectoral agencies shall coordinate with the Office of the Public Sector Development Commission (OPDC) to establish strategies for expanding workforce capacity and enhancing personnel competencies within government agencies, particularly for those responsible for data collection, GHG mitigation reporting, and performance evaluation. A key strategy involves developing integrated or shared key performance indicators (KPIs) across relevant agencies to foster collaboration and strengthen motivation for successful implementation. To reinforce accountability, agencies responsible for specific KPIs under the NDC Action Plan should work with relevant authorities to formally incorporate these indicators into their strategic and operational performance plans.

7.4.2 DCCE, in collaboration with TGO, shall enhance the capacity of personnel from relevant agencies involved in implementing measures under the NDC Action Plan, with a focus on activity data collection and GHG emissions reduction calculations.

7.4.3 DCCE, in collaboration with TGO, shall strengthen the capacity and enhance the understanding of local government personnel to ensure the effective implementation of GHG reduction measures and the accurate monitoring of their progress.

7.5 Mobilization and Allocation of Financial Resources for NDC Action Plan Implementation

The implementation of GHG mitigation measures, supporting initiatives, and related activities essential for driving the NDC Action Plan into concrete action requires sufficient and appropriate budget allocation. The following strategies outline how this can be effectively achieved:

7.5.1 Advocate for the integration of the NDC Action Plan into the national budget framework by coordinating with the Budget Bureau to develop an integrated climate change budget for relevant agencies. This funding will support preparedness efforts, the implementation of specific measures under the NDC Action Plan, as well as data collection and reporting on GHG emission reductions.

7.5.2 Coordinate with the Environmental Fund (under ONEP) to enhance its role and revise regulations to include GHG mitigation activities.

7.5.3 Coordinate with international funding sources to secure financial support under the UNFCCC framework, including assistance through multilateral and bilateral cooperation.

7.6 National Preparedness for Long-Term GHG Mitigation Implementation

Setting targets and implementing GHG mitigation measures under the NDC Action Plan are integral to Thailand's national emissions reduction goals, which aim to achieve carbon neutrality by 2050 and net-zero GHG emissions by 2065. Additionally, Thailand is required to submit its second NDC to the UNFCCC Secretariat by 2025. To ensure effective progress toward these long-term commitments, the country must undertake the necessary preparations and strategic actions. The following strategies outline the key steps to achieve this:

7.6.1 Utilize relevant institutional mechanisms as a platform for inter-agency discussions to develop appropriate measures for Thailand's long-term GHG mitigation. Particular emphasis should be placed on advanced technologies and carbon removal and storage measures, including carbon capture, utilization, and storage (CCUS), forestry initiatives, and nature-based solutions (NbS) to support the country's long-term emissions reduction efforts.

7.6.2 Facilitate access to climate change technology support mechanisms under the UNFCCC and the Paris Agreement to secure assistance in technology, funding, and relevant expertise. This support will help Thailand strengthen its preparedness and overcome technological

barriers in both the short and long term. NXPO, as Thailand's National Designated Entity (NDE) for climate technology development and transfer, will serve as the central coordinating body in collaboration with the Climate Technology Centre and Network (CTCN).

7.6.3 The proposed Climate Change Act B.E. … is being developed as a key legislative instrument to strengthen Thailand's climate efforts. Its primary objective is to drive and transform activities across various sectors, facilitating the transition to a low-carbon economy and society while ultimately achieving net-zero GHG emissions in line with Thailand's national development plans. The Act will introduce effective economic measures and policy instruments that align with public needs, employing an integrated, full-cycle approach across critical economic activities. This legislation aims to promote environmental conservation, reduce GHG emissions, and foster the development of sustainable, high-value economic activities. Additionally, it will support Thailand's compliance with international commitments, establish an enabling environment by enhancing financial and technical support mechanisms for relevant stakeholders, and create transparent frameworks for climate-related data disclosure. These efforts seek to enhance public awareness, ensure accurate understanding, and encourage inclusive participation in shaping national climate policies and measures. Currently, DCCE is drafting the Climate Change Act, as existing legislation does not comprehensively address GHG mitigation efforts. A mandatory regulatory framework is necessary to govern key activities, including emissions reporting, carbon sequestration and removal, and the implementation of carbon pricing mechanisms such as carbon credits, emissions trading systems, and carbon taxation. The Act will also introduce appropriate administrative penalties to ensure effective compliance with climate regulations. The draft Climate Change Act is expected to be submitted for Cabinet approval by 2024.

To achieve the GHG reduction targets outlined in Thailand's NDC Action Plan on Mitigation 2021–2030, it is crucial to accelerate implementation, particularly during the 2021–2025 period. Urgent action should focus on advancing key flagship projects, which should be incorporated into the strategic plans and annual budgets of the Ministry of Natural Resources and Environment (MNRE) and other relevant agencies. This integration will establish a dedicated budgetary mechanism to support agencies in effectively driving national GHG reduction efforts. A list of key flagship projects is provided in **Annex B**.

Chapter 8

Monitoring and Evaluation of the NDC Action Plan

The monitoring and evaluation of Thailand's NDC Action Plan on Mitigation 2021–2030 aim to assess the effectiveness of its measures, work plans, projects, and activities, as well as to evaluate progress against the KPIs and targets established under the plan. Additionally, this process seeks to identify challenges, obstacles, and constraints encountered during implementation, providing critical insights for the review and refinement of the plan in subsequent phases. The detailed approach to monitoring and evaluation is outlined below.

1. The Sector Focal Points for each sector shall report the implementation progress of measures and work plans under Thailand's NDC Action Plan on Mitigation 2021–2030, as well as the results of GHG reduction assessments from sector-specific measures, to the Department of Climate Change and Environment on an annual basis. These reports shall be submitted through the national GHG mitigation monitoring and evaluation system. The Department of Climate Change and Environment shall compile and analyze the progress data before submitting it to policy-level mechanisms for continuous oversight and evaluation of the plan's implementation. This process shall be conducted through the Working Group on Integration of GHG Mitigation Policy and Planning and the Subcommittee on Climate Change Policy and Planning Integration, both of which will provide feedback and recommendations on the implementation results. Furthermore, the implementation progress shall be reported to the National Committee on Climate Change Policy for acknowledgment.

2. The Department of Climate Change and Environment, as the lead agency driving GHG mitigation efforts, shall prepare an annual assessment report on GHG reductions achieved through the measures under the NDC Action Plan. This report shall be published annually to raise public awareness and promote public participation. Additionally, the report shall be disseminated through the department's website, social media channels, and a mobile application developed to communicate national GHG mitigation efforts. This ensures that the public can easily access relevant information through multiple platforms. The processes for reporting, monitoring, and evaluating sectoral implementation under the NDC Action Plan on Mitigation are illustrated in **Figure 8-1**.

3. The Department of Climate Change and Environment shall report the assessment results of GHG reductions achieved through the measures under the NDC Action Plan in the Biennial Transparency Reports (BTRs), in accordance with the transparency requirements for climate action under the Paris Agreement. These reports shall be submitted every two years, with the first BTR required to be submitted by all countries by December 2024.

4. The Sector Focal Points for each sector shall conduct an annual performance evaluation of the NDC Action Plan's implementation to track progress, identify sector-specific gaps and constraints, and assess the need for additional support if necessary. The findings from this evaluation will be used to revise the annual implementation plan at the work plan, project, and measure levels. Additionally, an annual summary report on the monitoring and evaluation of the NDC Action Plan shall be prepared.

5. The implementation of the NDC Action Plan is a long-term process, during which both domestic and international circumstances may change, potentially impacting its execution either positively or negatively. Therefore, the Sector Focal Points for each sector mandate that the NDC Action Plan be reviewed and revised every five years. Revisions will be made if Thailand's NDC target is adjusted or if a new NDC is submitted. This ensures that the NDC Action Plan remains appropriate and aligned with current circumstances, as well as with global and national policies and plans.

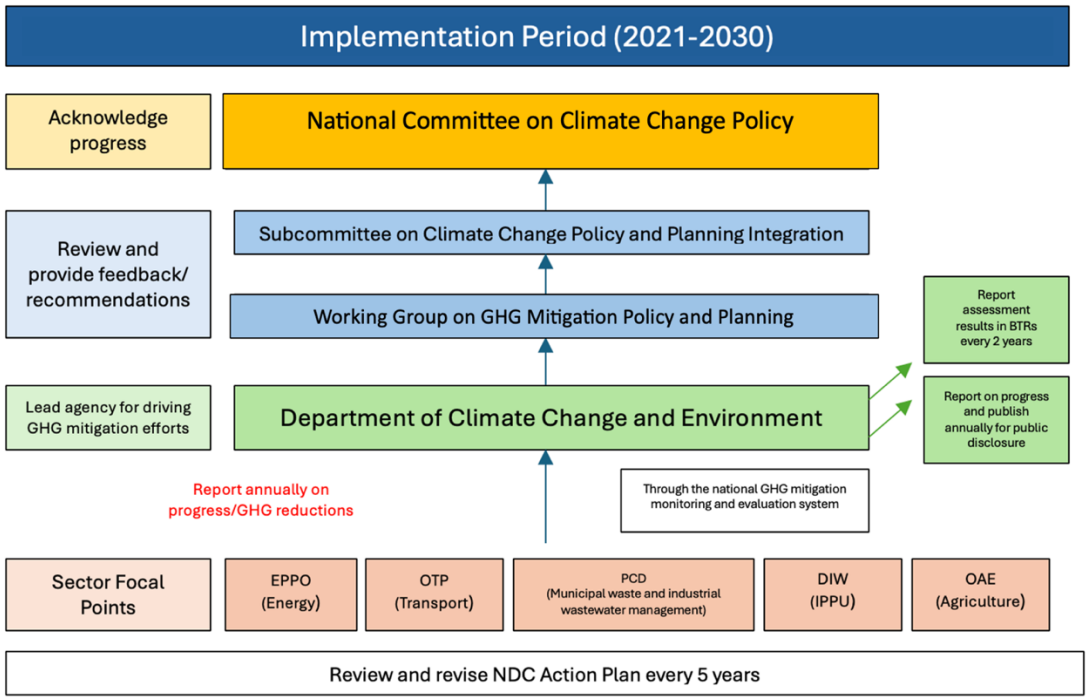


Figure 8-1 Process for monitoring and evaluating the implementation of Thailand's NDC Action Plan on Mitigation 2021-2030

Annex

Annex A. Mitigation Measures and Annual GHG Reduction Targets

A-1 Annual GHG Reduction Measures and Targets – Energy Sector

Measures	Targets (MtCO2e)									
	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Energy sector										
1. Energy conservation and efficiency enhancement in electricity generation										
1.1 Enforcement of energy conservation standards for factories and regulated buildings	**0.7000**	**2.310**	**2.628**	**2.958**	**4.080**	**5.260**	**5.410**	**5.560**	**5.710**	**5.860**
1.2 Enforcement of energy conservation standards for newly constructed buildings	-	-	-	-	-	**0.3400**	**0.4200**	**0.4900**	**0.5700**	**0.6600**
1.3 Establishments of standards and labeling for equipment, machinery, and materials for energy conservation	**0.8500**	**1.9680**	**2.2620**	**2.8740**	**4.3920**	**6.3200**	**6.9700**	**7.7100**	**8.4700**	**9.6300**
1.4 Enforcement of Energy Efficiency Resource Standards (EERS) for energy producers and distributors	-	-	-	-	-	**0.1550**	**0.1680**	**0.1850**	**0.1890**	**0.2010**
1.5 Provision of support and subsidies for energy conservation initiatives	-	-	-	-	-	**6.8900**	**7.1800**	**8.0400**	**8.5900**	**9.0500**
1.6 Electricity generation efficiency improvement	**4.1400**	**3.5000**	**4.0000**	**4.5000**	**6.0000**	**6.5000**	**7.0000**	**7.5000**	**7.5000**	**8.0000**
2. Renewable Energy										
2.1 Development of wind energy	**1.8600**	**0.4100**	**0.4600**	**0.5300**	**0.5900**	**0.6700**	**0.7600**	**0.8600**	**0.9800**	**1.1100**
2.2 Development of solar energy	**2.6690**	**2.3500**	**2.5800**	**2.8000**	**3.0400**	**3.4000**	**3.7900**	**4.1700**	**4.5400**	**4.9300**
2.3 Development of hydropower energy	**2.2500**	**3.0500**	**3.0700**	**3.0900**	**3.1000**	**3.1100**	**3.1200**	**3.1300**	**3.1500**	**3.1900**
2.4 Development of biomass energy	**24.7190**	**25.0920**	**26.6580**	**28.2720**	**39.9120**	**52.7500**	**55.6700**	**58.6800**	**61.7700**	**64.9400**
2.5 Development of biogas energy	**3.1200**	**2.8600**	**3.0500**	**3.3500**	**3.5700**	**3.6000**	**3.6600**	**3.7000**	**3.7500**	**3.7900**
2.6 Development of energy from waste	**1.8200**	**1.3900**	**1.4200**	**1.4500**	**1.4800**	**1.5100**	**1.5400**	**1.5700**	**1.5700**	**1.6300**
2.7 Development of ethanol fuel	**2.9500**	**2.2800**	**2.4200**	**2.5500**	**2.7300**	**2.8500**	**3.0400**	**3.2600**	**3.5000**	**3.7400**
2.8 Development of biodiesel fuel	**4.5120**	**3.8100**	**3.9800**	**4.2300**	**4.4700**	**4.6100**	**4.6400**	**4.6800**	**4.7400**	**4.7900**
2.9 Development of new clean energy	-	-	-	-	-	**0.8250**	**1.0670**	**1.3700**	**1.7020**	**2.0760**
3. Carbon capture and storage technologies										
3.1 The Arthit Carbon Capture & Storage Pilot Project or Arthit CCS	-	-	-	-	-	-	**0.2500**	**1.0000**	**1.0000**	**1.0000**
Total	**49.5900**	**49.0200**	**52.5280**	**56.6040**	**73.3640**	**98.7000**	**104.6850**	**111.9050**	**117.7310**	**124.5970**

A-2 Annual GHG Reduction Measures and Targets – Transport Sector

Measures	Targets (MtCO2e)									
	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Transport sector										
1. Electrification of transport	-	-	-	-	-	**13.3800**	**16.4800**	**19.8900**	**23.5900**	**28.2900**
1.1 Promotion of electric locomotive usage	-	-	-	-	-	-	-	-	-	-
1.2 Promotion of electric vehicle (EV) adoption and usage	-	-	-	-	-	**13.3800**	**16.4800**	**19.8900**	**23.5900**	**28.2900**
1.3 Promotion of electric boat usage	-	-	-	-	-	-	-	-	-	-
1.4 Development of infrastructure to support electric vehicle adoption	Infrastructure Support Projects									
2. Vehicle energy efficiency improvement	-	-	-	-	-	**8.1000**	**9.3700**	**10.7200**	**12.1500**	**13.9400**
2.1 Establishment of standards and dissemination of information on energy efficiency and GHG emissions	-	-	-	-	-	-	-	-	-	-
2.2 Reform of tax systems to promote the use of energy-efficient vehicles	-	-	-	-	-	**8.1000**	**9.3700**	**10.7200**	**12.1500**	**13.9400**
3. Development of urban mobility systems	**0.1394**	**0.5900**	**0.6200**	**0.7000**	**0.9100**	**1.0500**	**1.2100**	**1.3700**	**1.5500**	**1.7800**
3.1 Development of urban public transport infrastructure	**0.1394**	**0.5900**	**0.6200**	**0.7000**	**0.9100**	**1.0500**	**1.2100**	**1.3700**	**1.5500**	**1.7800**
3.2 Promotion of shared mobility and multimodal transport	-	-	-	-	-	-	-	-	-	-
3.3 Implementation of urban traffic management system	-	-	-	-	-	-	-	-	-	-
4. Advancement of inter-urban transport and green logistics	**0.1637**	**0.5200**	**0.5500**	**0.6300**	**0.8100**	**0.9420**	**1.0820**	**1.2320**	**1.3900**	**1.6000**
4.1 Development of railway transport infrastructure	**0.1637**	**0.5200**	**0.5500**	**0.6300**	**0.8100**	**0.9400**	**1.0800**	**1.2300**	**1.3800**	**1.5900**
4.2 Enhancement of efficiency in waterborne freight transport	-	-	-	-	-	**0.0020**	**0.0020**	**0.0020**	**0.0100**	**0.0100**
4.3 Promotion of freight transport logistics management system	-	-	-	-	-	-	-	-	-	-
5. Promotion of future energy for transport	In the process of developing a monitoring method									
5.1 Promotion of hydrogen fuel adoption in the transport sector	The promotion of hydrogen fuel adoption in the transport sector is a measure planned for implementation after 2030									
5.2 Promotion of sustainable aviation fuel (SAF) adoption in the aviation sector	The promotion of biofuel use falls under the responsibility of the Ministry of Energy, while the promotion of sustainable aviation fuel (SAF) targets the aviation sector.									
6. Enhancement of transport infrastructure and support	Infrastructure support projects aimed at improving transportation efficiency are supporting measures and cannot be used to quantify GHG emission reductions.									
6.1 Development of environmentally friendly transport infrastructure										
6.2 Development of infrastructure to enhance transport efficiency										
Total	**0.3031**	**1.1100**	**1.1700**	**1.3300**	**1.7200**	**23.4720**	**28.1420**	**33.2120**	**38.6800**	**45.6100**

Note: - means that the implementation of the measures has not yet resulted in a reduction of GHG emissions in that particular year.

A-3 Annual GHG Reduction Measures and Targets – Municipal Waste and Industrial Wastewater Management Sector

Measures	Targets (MtCO2e)									
	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Municipal waste and industrial wastewater management sector										
1. Municipal waste management										
1.1 Utilization of landfill gas through flaring or for beneficial purposes, such as electricity generation	**0.5797**	**0.8600**	**1.1200**	**1.3100**	**1.4600**	**1.5800**	**1.6700**	**1.7400**	**1.8100**	**1.8600**
1.2 Incineration of municipal solid waste for electricity generation (waste-to-energy)	**0.8090**	**0.8000**	**0.8000**	**0.8000**	**1.2500**	**1.5100**	**1.7600**	**1.8800**	**2.0100**	**2.1300**
1.3 Disposal of municipal solid waste using semi-aerobic landfills (tCO2e)*	74	74	74	74	74	74	74	90	95	100
1.4 Processing of organic waste into compost and liquid bio-fertilizer	**0.3498**	**0.3400**	**0.3400**	**0.3400**	**0.3600**	**0.3800**	**0.3900**	**0.4100**	**0.4300**	**0.4400**
1.5 Anaerobic digestion of organic waste with an emphasis on the beneficial utilization of the generated gas	**0.0147**	**0.0100**	**0.0100**	**0.0100**	**0.0100**	**0.0100**	**0.0100**	**0.0100**	**0.0100**	**0.0100**
1.6 Utilization of mechanical-biological treatment for processing organic waste	**0.6594**	**0.6400**	**0.6400**	**0.6400**	**0.6500**	**0.6500**	**0.6500**	**0.6600**	**0.6600**	**0.6700**
2. Municipal wastewater management										
2.1 Expansion of wastewater collection and centralized treatment systems in local communities	-	-	-	**0.0050**	**0.0050**	**0.0050**	**0.0050**	**0.0050**	**0.0050**	**0.0050**
3. Industrial wastewater management										
3.1 Increasing biogas production from industrial wastewater through methane recovery and utilization	**3.6800**	**3.7000**	**3.7000**	**3.8000**	**3.8000**	**3.8000**	**3.9000**	**3.9000**	**3.9000**	**4.0000**
Total	**6.0925**	**6.3500**	**6.6100**	**6.9050**	**7.5350**	**7.9350**	**8.3850**	**8.6050**	**8.8250**	**9.1151**

Note: - means that the implementation of the measures has not yet resulted in a reduction of GHG emissions in that particular year.

***** The GHG reduction results for Measure 1.3 are presented in units of tCO2e, where 1 tCO2e is equal to 0.000001 MtCO2e.

A-4 Annual GHG Reduction Measures and Targets – Industrial Processes and Product Use (IPPU) Sector

Measures	Targets (MtCO2e)									
	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Industrial processes and product use sector										
1. Clinker substitution										
1.1 Use of alternative materials to replace clinker in hydraulic cement production	**0.3300**	**0.3500**	**0.4000**	**0.4500**	**0.5000**	**0.5000**	**0.6000**	**0.7000**	**0.7500**	**0.9000**
1.2 Use of alternative materials to replace cement in ready-mix concrete	**0.0700**	**0.0700**	**0.0700**	**0.0700**	**0.0700**	**0.0700**	**0.0800**	**0.0900**	**0.1000**	**0.1000**
2. Refrigerant replacement										
2.1 Refrigerant replacement under the RAC NAMA Project	-	**0.0300**	**0.0400**	**0.0500**	**0.0800**	**0.1000**	**0.1500**	**0.2000**	**0.2500**	**0.3000**
2.2 Proper disposal of waste and degraded refrigerants	-	-	-	-	-	**0.1000**	**0.1000**	**0.1000**	**0.1000**	**0.1000**
Total	**0.4000**	**0.4500**	**0.5100**	**0.5700**	**0.6500**	**0.7700**	**0.9300**	**1.0900**	**1.2000**	**1.4000**

Note: - means that the implementation of the measures has not yet resulted in a reduction of GHG emissions in that particular year.

A-5 Annual GHG Reduction Measures and Targets – Agriculture Sector

Measures	Targets (MtCO2e)									
	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Agriculture sector										
1. Manure management	**3.9500**	**3.0000**	**3.0000**	**3.0000**	**3.0000**	**3.0000**	**3.0000**	**3.0000**	**3.0000**	**3.0000**
2. Reduction in the use of chemical fertilizers	-	-	-	-	-	**0.0500**	**0.0500**	**0.1000**	**0.1000**	**0.1000**
3. Adoption of the alternate wetting and drying method for rice cultivation	-	**0.5000**	**0.5000**	**0.5000**	**0.7500**	**0.7500**	**0.7500**	**1.0000**	**1.0000**	**1.0000**
Total	**3.9500**	**3.5000**	**3.5000**	**3.5000**	**3.7500**	**3.8000**	**3.8000**	**4.1000**	**4.1000**	**4.1000**

Note: - means that the implementation of the measures has not yet resulted in a reduction of GHG emissions in that particular year.

Annex B. Flagship Projects that should be Implemented and Promoted at the Policy Level

Project	Project Details	Outputs/Outcomes	Implementation Period (Start - End)	Budget (Million Baht)	Responsible Agencies
1. Pilot Project for the Development and Application of Carbon Capture and Storage (CCS) Technology in the Gulf of Thailand	**Principle and Rationale** Climate change has long been recognized as a major global challenge and remains a key barrier to sustainable development. The increasing severity of climate-related impacts, driven by rising global temperatures, has led to heightened international cooperation aimed at mitigating these effects. Current projections indicate that climate change is accelerating at a faster and more intense rate than previously anticipated, prompting many nations to adopt more ambitious GHG reduction targets. Thailand has strengthened its climate commitments in alignment with the global community and is dedicated to achieving carbon neutrality by 2050 and net-zero GHG emissions by 2065. With adequate and equitable support in financing, technology, and capacity building, facilitated through international cooperation and mechanisms under the UNFCCC, Thailand aims to enhance its NDC target to a 40% reduction, reinforcing its pathway toward carbon neutrality by 2050. While expanding renewable energy and reducing fossil fuel consumption are fundamental strategies for Thailand's transition to a low-carbon economy, carbon capture and storage (CCS) technology has been recognized as a critical solution for mitigating emissions during this transition. At the global level, CCS is regarded as an essential tool for achieving substantial GHG reductions, particularly in hard-to-abate sectors. The Pilot Project for Carbon Capture and Storage (CCS) in the Arthit Gas Field within the Gulf of Thailand aims to enhance Thailand's readiness for CO_2 emissions reduction in petroleum production by deploying CCS technology and securely storing CO_2 in geologically suitable rock formations within designated petroleum concession areas. Additionally, this project will lay the groundwork for further studies on the carbon storage potential of other geological formations in the Gulf of Thailand. Beyond its technical implementation, the project will develop regulatory frameworks, governance mechanisms, and industry standards to support both private sector stakeholders and government agencies in the deployment of CCS technology. Ultimately, this initiative will serve as a cornerstone for large-scale CCS implementation in Thailand, providing the necessary infrastructure to manage CO_2	**Outputs** By 2030, Thailand achieves a reduction of 1 $MtCO_2$ in GHG emissions through the application of CCS technology. This initiative is a voluntary project undertaken in collaboration with the private sector. **Outcomes** 1. Greater private sector investment in environmentally friendly businesses, leading to the expansion of Public-Private Partnerships (PPP) and strengthened collaboration between the government and private sector. 2. Improved technical readiness in Thailand, enabling further studies on the carbon storage potential of geological formations in other areas of the Gulf of Thailand. Additionally, the project lays the groundwork for developing incentive mechanisms and regulatory frameworks to support future CCS deployment.	2024 – 2030 (Investment decision in 2024)	15,000	**Lead Agencies** - PTT Exploration and Production Public Company Limited (PTTEP) - Department of Mineral Fuels (DMF) - Department of Climate Change and Environment (DCCE) **Supporting Agencies** - Revenue Department - Excise Department - Fiscal Policy Office (FPO) - Board of Investment (BOI) - Thailand Greenhouse Gas Management Organization (Public Organization) (TGO)

Project	Project Details	Outputs/Outcomes	Implementation Period (Start - End)	Budget (Million Baht)	Responsible Agencies
	emissions from various industrial sectors. By facilitating industrial decarbonization, this project will strengthen Thailand's global competitiveness, particularly in industrial and export markets, while reinforcing its long-term climate commitments. **Objectives** (1) Reduce GHG emissions from petroleum production processes in the Arthit Field, Gulf of Thailand, through the application of Carbon Capture and Storage (CCS) technology. (2) Enhance Thailand's preparedness for long-term CO_2 emissions reduction using CCS technology. (3) Establish a foundation for further studies on the carbon storage potential of geological formations in other areas of the Gulf of Thailand. This includes strengthening technical readiness, regulatory frameworks, and governance mechanisms for both industry operators and government agencies, enabling the development of large-scale CCS projects to support future emission reduction needs across various industrial sectors in Thailand. **Activities** (1) Conduct a study and develop a pilot CCS project with technically feasible solutions, implemented in three phases: Phase 1: Assess feasibility and develop an optimal project development plan to support investment decisions. Phase 2: Initiate project development following the investment decision. Phase 3: Carry out CO_2 storage operations according to the project plan. (2) Clarify the legal framework under the Petroleum Act specifically for the pilot project, establishing clear operational guidelines and standards aligned with existing regulations. Additionally, assess the effectiveness of the pilot project to inform potential legal amendments that will facilitate future large-scale CCS implementation. (3) Evaluate incentive mechanisms to promote the pilot project through government-backed financial support, such as				

Project	Project Details	Outputs/Outcomes	Implementation Period (Start - End)	Budget (Million Baht)	Responsible Agencies
	double tax deductions on petroleum income tax or tax credits. This includes formulating well-defined investment promotion strategies to support decision-making and developing concrete financial support measures for future CCS projects.				

Project	Project Details	Outputs/Outcomes	Implementation Period (Start - End)	Budget (Million Baht)	Responsible Agencies
2. Tax Measures to Promote the Manufacturing and Use of High-Efficiency Equipment	**Principle and Rationale** Improving and developing machinery, equipment, and materials for higher efficiency comes with high production costs, affecting product prices. Therefore, tax measures serve as a mechanism to encourage the production and use of high-efficiency equipment. **Objectives** (1) Create incentives and encourage manufacturers, suppliers, and the public to adopt more efficient energy use. (2) Reduce financial burdens for businesses and individuals when purchasing high-efficiency products. (3) Enhance overall energy efficiency. (4) Lower GHG emissions through improved energy efficiency. **Activities** (1) Establish criteria, conditions, methods, and mechanisms for tax incentives, and collaborate with relevant agencies. (2) Develop a reference guide listing high-efficiency machinery, materials, and equipment eligible for tax incentives. (3) Create a database and monitoring system to track and evaluate the effectiveness of tax incentive programs in promoting the production and use of high-efficiency equipment.	**Outputs** (1) Increased production and adoption of high-efficiency machinery, equipment, and materials. (2) Reduced financial burden on businesses and individuals when purchasing high-efficiency products. **Outcomes** (1) Improved energy efficiency, resulting in reduced fuel imports for electricity generation. (2) Lower GHG emissions through enhanced energy efficiency.	2023 – 2028	-	**Lead Agencies** - Department of Alternative Energy Development and Efficiency (DEDE) - Electricity Generating Authority of Thailand (EGAT) - Revenue Department

Project	Project Details	Outputs/Outcomes	Implementation Period (Start - End)	Budget (Million Baht)	Responsible Agencies
3. Tax Incentives to Promote Solar Rooftop Adoption in Residential Households	**Principle and Rationale** Promote household solar rooftop installation for self-generated electricity by allowing individuals to deduct installation costs from personal income tax. **Objectives** (1) Encourage the installation of solar rooftop systems through financial incentives. (2) Alleviate the financial burden of solar rooftop installation through tax deductions. (3) Lower household energy consumption and electricity costs, ensuring cost-effectiveness and a shorter payback period. (4) Reduce GHG emissions by promoting electricity generation from solar energy. **Activity** Develop criteria and frameworks for tax incentives in collaboration with relevant agencies and submit them to the Cabinet for approval.	**Outputs** (1) Increased adoption of solar rooftops for self-sufficient electricity generation in households. (2) Reduced financial burden on households for installing solar rooftop systems. **Outcomes** (1) Encourage investment in businesses related to solar rooftop systems. (2) Reduce GHG emissions through the generation and use of solar energy.	2025 - 2027	-	**Lead Agencies** - Department of Alternative Energy Development and Efficiency (DEDE) - Revenue Department - Fiscal Policy Office (FPO) **Supporting Agencies** - Metropolitan Electricity Authority (MEA) - Provincial Electricity Authority (PEA)

Project	Project Details	Outputs/Outcomes	Implementation Period (Start - End)	Budget (Million Baht)	Responsible Agencies
4. Measures to Promote Solar Rooftop Power System Installation for Government Agencies	**Principle and Rationale** On March 22, 2022, the Cabinet approved a resolution requiring government agencies to reduce energy consumption by 20%, including both electricity and fuel. Additionally, it endorsed long-term measures to implement the Energy Service Company (ESCO) model in public sector operations as part of the national energy reform plan. **Objectives** (1) Alleviate the investment burden on government agencies for installing solar rooftop systems by implementing a service provider model. Under this model, entities such as state utilities or private providers finance the installation and sell the generated electricity to government agencies at a discounted rate compared to standard electricity tariffs. (2) Reduce energy consumption and electricity costs for government agencies. (3) Lower GHG emissions by promoting the use of solar power generation systems. **Activities** (1) Propose measures to the Cabinet for approval on promoting the installation of solar rooftop power systems in government agencies. (2) Disseminate official guidelines to government agencies for awareness and implementation.	**Outputs** (1) Increased adoption of solar rooftop systems in government agencies. (2) Reduced investment and maintenance costs for government agencies installing solar rooftop systems. (3) Lower electricity expenses for government agencies. **Outcomes** (1) Promote investment in businesses related to solar rooftop systems. (2) Reduce GHG emissions through the implementation of solar power generation. (3) Contribute to overall national budget savings.	2023 - 2024	-	**Lead Agency** - Department of Alternative Energy Development and Efficiency (DEDE) **Supporting Agencies** - Comptroller General's Department (CGD) - Office of the Attorney General - The Budget Bureau (BB) - The Treasury Department (TRD)

Project	Project Details	Outputs/Outcomes	Implementation Period (Start - End)	Budget (Million Baht)	Responsible Agencies
5. Energy Service Company (ESCO) Measures for Government Agencies	**Principle and Rationale** On March 22, 2022, the Cabinet approved a resolution requiring government agencies to reduce energy consumption by 20%, including electricity and fuel. It also endorsed the long-term adoption of the Energy Service Company (ESCO) model for government agencies under the national energy reform plan. This initiative aims to lower utility costs in the public sector by promoting structured and efficient energy management. To achieve this, the Ministry of Energy and relevant agencies are tasked with formulating clear regulations and guidelines to serve as standardized frameworks for implementation. These measures will enable government agencies to effectively integrate the ESCO model, ensuring cost efficiency, budget optimization, and practical applicability across all funding sources. Ultimately, this initiative supports sustainable energy management in the public sector. **Objectives** (1) Promote the adoption of the ESCO model in government agencies by establishing standardized budgeting frameworks, procurement procedures, and contract agreements. (2) Reduce energy consumption and electricity costs in government agencies. (3) Decrease GHG emissions by reducing overall energy use. **Activities** (1) Develop guidelines for unit-cost budgeting to serve as a framework for budget assessment. (2) Draft a standardized ESCO contract, including agreements for the procurement and servicing of energy-efficient equipment with guaranteed energy savings, to facilitate the adoption of the ESCO model in government agencies.	**Outputs** (1) Development of standardized budgeting frameworks, procurement procedures, and ESCO contracts for government agencies. (2) Reduced financial burden on the government for investing in energy-efficient equipment upgrades and energy-saving projects. (3) Lower electricity costs for government agencies. **Outcomes** (1) Reduced GHG emissions through lower energy consumption. (2) Growth and promotion of the domestic Energy Service Company (ESCO) industry.	2023 - 2024	-	**Lead Agency** - Department of Alternative Energy Development and Efficiency (DEDE) **Supporting Agencies** - The Budget Bureau (BB) - Comptroller General's Department (CGD) - Office of the Attorney General (OAG) - Office of the National Economic and Social Development Council (NESDC)

Project	Project Details	Outputs/Outcomes	Implementation Period (Start - End)	Budget (Million Baht)	Responsible Agencies
6. Development of a Low-Carbon Intercity Bus System with Climate-Resilient Infrastructure in Thailand	**Principle and Rationale** Climate change has become a pressing global concern, with increasing recognition of its widespread impacts. Countries worldwide are committed to reducing GHG emissions and enhancing climate resilience as the severity of climate-related issues continues to escalate. In Thailand, the transport sector is a significant contributor to GHG emissions. In 2016, the sector emitted 76.92 $MtCO_2e$, accounting for 29.50% of the country's total emissions. Road transport alone was responsible for 96% of emissions within the sector, primarily due to the incomplete combustion of fossil fuels in internal combustion engine (ICE) vehicles—including private cars, pickup trucks, taxis, trucks, and buses. Specifically, intercity buses contributed 1.01 $MtCO_2e$ per year, making up 1.31% of total emissions from the transport sector. Additionally, Thailand is highly vulnerable to climate change, facing increasing risks from natural disasters such as droughts, floods, rising rainfall levels, and sea-level rise. Among these, flooding presents a critical challenge to public transportation, particularly intercity bus services. Data from 2015–2019 indicates that the Central and Northeastern regions are most at risk, with peak flooding occurring between September and November each year. To effectively address these challenges and support Thailand's Nationally Determined Contribution (NDC) commitments, this project proposes the Development of a Low-Carbon Intercity Bus System with Climate-Resilient Infrastructure in Thailand. The initiative aims to establish a sustainable transport system by transitioning intercity buses from ICE vehicles to electric vehicles (EVs) to significantly reduce GHG emissions, encourage a shift from private vehicle use to public transport to minimize carbon footprints, promote non-motorized transport options such as walking and cycling as part of an integrated transport network, and enhance climate-resilient infrastructure to ensure intercity bus services can withstand climate change-related disruptions. By implementing this initiative, Thailand can move toward a sustainable, low-	**Outputs** (1) Transition of intercity buses from internal combustion engine (ICE) vehicles to electric buses (EVs), reducing GHG emissions and promoting sustainable transportation. (2) Development of environmentally friendly intercity bus terminals that are resilient to the impacts of climate change and capable of operating efficiently under changing environmental conditions. (3) Improved accessibility to intercity bus terminals and better integration with public transport systems in surrounding areas, enhancing connectivity and reducing reliance on private vehicles. (4) Implementation of an efficient and sustainable battery management system for used electric bus batteries to minimize environmental impact. (5) Capacity building and skill development for personnel involved in electric bus operations, maintenance, and	5 years (following approval from the Green Climate Fund – GCF).	18,570* (USD 501 million, comprising: - USD 195 million supported by the GCF - USD 306 million from co-financing)	**Lead Agencies** - The Transport Company Limited (TCL) - Department of Land Transport (DLT) - Department of Climate Change and Environment (DCCE) **Supporting Agencies** - Office of Transport and Traffic Policy and Planning (OTP) - Thailand Greenhouse Gas Management Organization (Public Organization) (TGO) - Energy Policy and Planning Office (EPPO) - Department of Alternative Energy Development and Efficiency (DEDE) - Pollution Control Department (PCD) - Ministry of Industry (MOI) - Local Administrative Organizations (LAOs) - Private Sector Transport Operators - Department of Skill Development (DSD) - Automotive Human Resource

Project	Project Details	Outputs/Outcomes	Implementation Period (Start - End)	Budget (Million Baht)	Responsible Agencies
	carbon transport system while increasing resilience against the growing impacts of climate change. **Objectives** (1) Transition intercity buses from internal combustion engine (ICE) vehicles to electric buses to reduce carbon emissions and promote sustainable transportation. (2) Develop environmentally friendly bus terminals that are resilient to climate change impacts and capable of operating efficiently under changing environmental conditions. **Activities** (1) Transition to Electric Intercity Buses – Replace internal combustion engine (ICE) buses with electric buses (EVs), including up to 381 intercity buses (60 minibuses and 321 full-sized buses) and 2,099 vans operating across 219 intercity routes. Establish 350 charging stations to ensure sufficient coverage and operational efficiency. Additionally, provide financial support for EV bus and battery manufacturers, complementing existing government incentives. (2) Development of Climate-Resilient and Eco-Friendly Bus Terminals – Design and upgrade bus terminals to be environmentally friendly and resilient to climate change. Improvements include enhancing energy efficiency in passenger buildings (e.g., lighting, cooling systems, and building facades), integrating solar power generation, and making structural modifications to withstand flooding. (3) Enhancing Accessibility and Integration with Public Transport – Improve access to bus terminals and ensure seamless connections with local public transportation networks. Infrastructure enhancements will facilitate multimodal transport, reduce reliance on private vehicles, and promote sustainable, low-carbon public transit options. (4) Battery Management and Recycling – Establish an efficient and environmentally responsible system for managing used batteries from electric buses, ensuring proper disposal and minimizing environmental impact. (5) Capacity Building and Awareness Programs – Strengthen the skills and expertise of personnel at all levels, including operators, technicians, and stakeholders, through training, knowledge transfer, and skill development in EV maintenance, infrastructure management, emergency response,	related infrastructure to ensure effective project implementation. **Outcomes** (1) Reduction of GHG emissions by 267,317.50 tons per year through the transition from internal combustion engine (ICE) buses to electric buses (EVs), supporting Thailand's NDC targets. (2) Mitigation of environmental impacts from intercity bus terminals, ensuring their ability to operate efficiently under all conditions while continuing to provide reliable public services. (3) Increased public adoption of public transport, encouraging greater use of sustainable, low-carbon mobility options. (4) Reduced environmental impact and hazardous waste from used batteries through effective management and disposal strategies. (5) Enhanced knowledge and capacity among personnel at all levels, ensuring comprehensive expertise in service			Development Academy (AHRDA)

Project	Project Details	Outputs/Outcomes	Implementation Period (Start - End)	Budget (Million Baht)	Responsible Agencies
	and public awareness campaigns on the benefits of electric buses. **Note:** - The Low-Carbon Intercity Bus System with Climate-Resilient Infrastructure in Thailand is part of the broader initiative under the project "Building Project Pipeline Capacities: Development of the GCF Concept Note in the Transport and Health Sector in Thailand." This initiative has been jointly implemented by the Department of Climate Change and Environment (DCCE), Office of Transport and Traffic Policy and Planning (OTP), and the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), with financial support from the GCF Readiness Facility. The project was conducted from 2022 to 2023, and the draft concept note was officially submitted to DCCE and the GCF Readiness Facility in 2024. - Exchange rate as of April 29, 2024: 37.07 THB per 1 USD.	provision while raising public awareness of climate change impacts.			

Project	Project Details	Outputs/Outcomes	Implementation Period (Start - End)	Budget (Million Baht)	Responsible Agencies
7. Project on Enhancing Rice Cultivation Efficiency through Alternate Wetting and Drying (AWD) Water Management Techniques	**Principle and Rationale** Thailand has been an agricultural country from past to present, with a significant portion of its farmland dedicated to rice cultivation. Rice farming is prevalent in the northern, central, northeastern, and southern regions, and as one of the world's leading rice exporters, the industry plays a crucial role in the country's economy and the livelihoods of its people. However, climate change poses growing challenges to the sector, with increasing incidents of floods, droughts, and pest and disease outbreaks affecting agricultural productivity. These impacts extend beyond farming, influencing social, cultural, and economic aspects of life. According to Thailand's GHG emissions data, certain agricultural activities contribute significantly to global warming, with rice cultivation being a major emitter. Rice farming accounts for approximately 50% of the sector's total GHG emissions, primarily due to methane released from continuously flooded paddy fields. Methane is a potent greenhouse gas with a global warming potential 28 times greater than carbon dioxide. To address this issue, improving rice cultivation efficiency through the alternate wetting and drying (AWD) technique offers a promising solution for reducing GHG emissions. This method is a key strategy in advancing Thailand's efforts to meet its NDC target of a 30–40% emission reduction by 2030. In addition to being cost-effective, AWD provides long-term benefits, not only by mitigating climate change but also by enhancing adaptation to its impacts. The technique supports climate resilience while offering co-benefits in both adaptation—strengthening the agricultural sector's ability to cope with climate-related challenges—and mitigation—reducing emissions from rice farming. **Objectives** (1) Generate co-benefits for farmers by promoting rice cultivation practices that reduce GHG emissions while ensuring compliance with sustainable rice production standards. (2) Raise awareness and enhance farmers' understanding of the benefits of adopting the alternate wetting and drying (AWD) technique, while also increasing incentives to support a system-wide transition in rice production. (3) Improve the efficiency of integrated and sustainable water management.	**Outputs** By 2030, Thailand will have reduced GHG emissions by 1 $MtCO_2$ through the implementation of the alternate wetting and drying (AWD) water management technique in rice cultivation. **Outcomes** Farmers receive co-benefits from adopting low-emission rice farming practices, including GHG reduction and compliance with sustainable rice production standards.	2025 – 2030	300	**Lead Agencies** - Rice Department (RD) - Royal Irrigation Department (RID) - Office of Agricultural Economics (OAE) **Supporting Agencies** - Department of Agricultural Extension (DOAE) - Thailand Greenhouse Gas Management Organization (TGO) (Public Organization) - Department of Climate Change and Environment (DCCE)

Project	Project Details	Outputs/Outcomes	Implementation Period (Start - End)	Budget (Million Baht)	Responsible Agencies
	Activities (1) Conduct research and collect relevant data, including general information, geographical characteristics, rice cultivation areas, rice farming methods, water management practices, and details of existing and planned projects. (2) Review and analyze models for promoting, developing, and incentivizing farmers to adopt low-emission rice farming practices that align with sustainable production standards. (3) Conduct surveys to gather farmers' opinions, identifying operational gaps, challenges, and areas where support is needed to inform the design of activities for pilot implementation. (4) Select suitable pilot project sites that do not overlap with existing initiatives. Promote and publicize the project, while organizing training sessions and providing knowledge to farmers in the pilot areas before implementation. (5) Collaborate with relevant stakeholders in the pilot areas to develop an integrated water management plan, maximizing overall benefits and minimizing the risk of future water resource conflicts. (6) Implement project activities and conduct regular monitoring and evaluation to identify challenges and obstacles. Continuously refine and improve the project to enhance its overall effectiveness.				

Project	Project Details	Outputs/Outcomes	Implementation Period (Start - End)	Budget (Million Baht)	Responsible Agencies
8. Capacity Enhancement for Community Forest Management to Strengthen Climate Resilience and Integrate into Forest Sector GHG Reduction Mechanisms	**Principle and Rationale** The global challenge of climate change has led the international community to collaborate on solutions through the United Nations Framework Convention on Climate Change (UNFCCC), the Paris Agreement, and the Sustainable Development Goals (SDGs). These frameworks have shaped national policies to support GHG reduction efforts. Thailand has actively participated in these initiatives by submitting its Nationally Determined Contribution (NDC) and implementing climate change mitigation actions. At COP27, Thailand submitted its updated Long-Term Strategy (LTS), aligning with its goals of achieving carbon neutrality by 2050 and net-zero GHG emissions by 2065. Additionally, Thailand has raised its NDC target to a 40% reduction in emissions, contingent on international support, and aims to increase total green space to 55% of the country's land area by 2037 to enhance carbon sequestration. According to Thailand's 2019 GHG emissions data, the country's total emissions—excluding the LULUCF sector—amounted to 372,716.86 $GgCO_2eq$, while net emissions (including LULUCF) stood at 280,728.34 $GgCO_2eq$. The energy sector remains the largest emitter, contributing 260,772.69 $GgCO_2eq$ (69.96% of total emissions), followed by the agriculture sector (56,766.32 $GgCO_2eq$, 15.23%), the IPPU sector (38,301.21 $GgCO_2eq$, 10.28%), and the waste sector (16,876.64 $GgCO_2eq$, 4.53%). A community forest is a forested area near a local community, where the government allows community participation in forest management and resource utilization. This approach promotes collaborative forest governance, aligning with local livelihoods, traditions, and cultural practices. Community forests help reduce household expenses by providing access to edible plants and food resources, with surplus products generating additional household income. Moreover, by engaging in forest conservation and restoration, communities enhance biodiversity, foster environmental education, and support eco-tourism, further boosting local economies. Community forests play a vital role in carbon sequestration and GHG reduction. The Royal Forest Department has made community forest management a core mission, fostering multi-sector participation in forest conservation, protection, restoration, and sustainable	**Outputs** Baseline GHG sequestration values for community forests in target areas. **Outcomes** Community groups in target areas are strengthened, improving their readiness and capacity to adapt to climate change impacts. Community forests are successfully registered for their reduced or sequestered GHG emissions under Thailand's voluntary carbon market. Additionally, initiatives to expand green spaces and conserve biodiversity are promoted to support climate change adaptation and resilience.	2026 – 2030	75	**Lead Agency** - Royal Forest Department (RFD) **Supporting Agency** - Department of Climate Change and Environment (DCCE)

Project	Project Details	Outputs/Outcomes	Implementation Period (Start - End)	Budget (Million Baht)	Responsible Agencies
	management. This approach not only strengthens sustainable forest management but also mitigates climate change by reducing emissions from deforestation and land-use changes while enhancing carbon storage capacity. Studies on carbon sequestration in community forests indicate that they can absorb approximately 6.3 tons of carbon per rai (39.4 tons per hectare). As of March 2024, Thailand has established 12,433 community forests under the Community Forest Act, B.E. 2562, covering 6.85 million rai (1.1 million hectares). These forests store an estimated 43 million tons of carbon, with the potential to sequester approximately 158 $MtCO_2eq$. Given their significant carbon storage capacity, community forests serve as crucial natural assets for climate change adaptation and mitigation, playing a key role in reducing global warming and strengthening climate resilience. **Objectives** (1) Establish a baseline database on carbon sequestration in community forests to support the registration of reduced or sequestered GHG emissions under Thailand's voluntary carbon market. (2) Enhance the capacity of community forest management to strengthen preparedness for climate change adaptation and mitigation. (3) Build community resilience by raising awareness and fostering a sense of responsibility toward the impacts of climate change. **Activities** (1) Develop a baseline database on carbon sequestration in community forests to support the registration of reduced or sequestered greenhouse gas emissions under Thailand's voluntary carbon market. (2) Conduct capacity-building activities to strengthen community forest management, including wildfire prevention, reforestation, firebreak construction, and the development of check dams to enhance forest moisture and improve carbon sequestration efficiency. (3) Organize awareness campaigns and public outreach initiatives to highlight the progress and successes of pilot projects, promoting their expansion and long-term sustainability.				

Project	Project Details	Outputs/Outcomes	Implementation Period (Start - End)	Budget (Million Baht)	Responsible Agencies
9. Project on Enhancing the Efficiency of Carbon Sequestration Assessment in the Forestry and Land Use Sector (LULUCF) Using Remote Sensing Technology and Artificial Intelligence	**Principle and Rationale** Thailand has developed its Long-Term Low Greenhouse Gas Emission Development Strategy (LT-LEDS) as a framework for long-term GHG reduction efforts, aiming to achieve carbon neutrality by 2050 and net-zero GHG emissions by 2065. Under its Nationally Determined Contribution (NDC), Thailand has committed to reducing GHG emissions by 40% by 2030, contingent on international support. However, this target does not yet account for mitigation efforts in the forestry and land use sector. The Project on Enhancing the Efficiency of Carbon Sequestration Assessment in the Forestry and Land Use Sector (LULUCF) Using Remote Sensing Technology and Artificial Intelligence aims to improve the effectiveness of Thailand's GHG reduction initiatives by establishing standardized, nationwide carbon sequestration assessments. This will ensure consistent and annual evaluations across the country, enhancing the accuracy and efficiency of carbon stock assessments. **Objectives** (1) Establish a baseline carbon sequestration database for Thailand's forestry and land use sector using remote sensing and artificial intelligence (AI) technologies certified by the Greenhouse Gas Management Organization (TGO). (2) Validate the data obtained from remote sensing and AI-based assessments through on-site field surveys. **Activities** (1) Review and analyze relevant data, such as national GHG removal figures, forest area statistics, and forest classifications. (2) Develop a baseline carbon sequestration database using remote sensing and artificial intelligence (AI) technologies certified by the Greenhouse Gas Management Organization (TGO). (3) Conduct field surveys to validate the accuracy of remote sensing and AI-based assessments from Activity (2).	**Outputs** (1) Baseline carbon sequestration database for 1 million rai of dry dipterocarp and mixed deciduous forests in northern Thailand. (2) Comparative accuracy report assessing remote sensing and AI-based evaluations against data from 500 field survey plots. **Outcomes** Thailand establishes a nationwide standardized assessment for carbon sequestration in the forestry and land-use sector, allowing for regular annual evaluations of carbon stock increases or decreases.	2029	680	**Lead Agencies** - Royal Forest Department (RFD) - Department of National Parks, Wildlife and Plant Conservation (DNP) **Supporting Agencies** - Department of Marine and Coastal Resources (DMCR) - Forest Industry Organization (FIO) - Department of Climate Change and Environment (DCCE) - Thailand Greenhouse Gas Management Organization (Public Organization) (TGO) - Office of Natural Resources and Environmental Policy and Planning (ONEP)

Annex C

Agency Abbreviations

A	
ALRO	Agricultural Land Reform Office
AOT	Airports of Thailand Public Company Limited
B	
BB	Budget Bureau
BMA	Bangkok Metropolitan Administration
BMTA	Bangkok Mass Transit Authority
BOI	Board of Investment
C	
CAAT	Civil Aviation Authority of Thailand
CGD	Comptroller General's Department
D	
DBD	Department of Business Development
DCCE	Department of Climate Change and Environment
DEDE	Department of Alternative Energy Development and Efficiency
DIT	Department of Internal Trade
DIW	Department of Industrial Works
DLA	Department of Local Administration
DLD	Department of Livestock Development
DLD	Department of Land Development
DLT	Department of Land Transport
DMCR	Department of Marine and Coastal Resources
DMF	Department of Mineral Fuels
DNP	Department of National Parks, Wildlife and Plant Conservation
DOA	Department of Agriculture
DOA	Department of Airports
DOAE	Department of Agricultural Extension
DOEB	Department of Energy Business
DOH	Department of Highways
DOL	Department of Lands
DPT	Department of Public Works and Town & Country Planning
DRT	Department of Rail Transport
DSD	Department of Skill Development
DSDW	Department of Social Development and Welfare
E	
EGAT	Electricity Generating Authority of Thailand
EPPO	Energy Policy and Planning Office
ERC	Energy Regulatory Commission
EXAT	Expressway Authority of Thailand
F	
FIO	Forest Industry Organization
FPO	Fiscal Policy Office

I

IEAT	Industrial Estate Authority of Thailand
IPST	Institute for the Promotion of Teaching Science and Technology

J

JSCCIB	Joint Standing Committee on Commerce, Industry, and Banking

L

LAO	Local Administrative Organization

M

MD	Marine Department
MDES	Ministry of Digital Economy and Society
MEA	Metropolitan Electricity Authority
MNRE	Ministry of Natural Resources and Environment
MOAC	Ministry of Agriculture and Cooperatives
MOC	Ministry of Commerce
MOC	Ministry of Culture
MOE	Ministry of Energy
MOE	Ministry of Education
MOF	Ministry of Finance
MOT	Ministry of Transport
MRTA	Mass Rapid Transit Authority of Thailand

N

NESDC	Office of the National Economic and Social Development Council
NHA	National Housing Authority
NRCT	National Research Council of Thailand
NSTDA	National Science and Technology Development Agency
NXPO	Office of the National Higher Education Science Research and Innovation Policy Council

O

OAE	Office of Agricultural Economics
OIE	Office of Industrial Economics
ONEP	Office of Natural Resources and Environmental Policy and Planning
OPS-MNRE	Office of the Permanent Secretary, Ministry of Natural Resources and Environment
OTP	Office of Transport and Traffic Policy and Planning

P

PAT	Port Authority of Thailand
PCD	Pollution Control Department
PDMO	Public Debt Management Office
PEA	Provincial Electricity Authority
PONRE	Provincial Office of Natural Resources and Environment
PRD	Public Relations Department
PTT	PTT Public Company Limited
PTTEP	PTT Exploration and Production Public Company Limited

R

RD	Rice Department
RD	Revenue Department
RFD	Royal Forest Department

RID	Royal Irrigation Department
RTP	Royal Thai Police

S

SRT	State Railway of Thailand

T

TCL	The Transport Company Limited
TD	The Treasury Department
TGO	Thailand Greenhouse Gas Management Organization (Public Organization)
ThaiHealth	Thai Health Promotion Foundation
TISI	Thai Industrial Standards Institute
TISTR	Thailand Institute of Scientific and Technological Research
TPSO	Trade Policy and Strategy Office
TSRI	Thailand Science Research and Innovation

W

WMA	Wastewater Management Authority