THAILAND
THIRD BIENNIAL UPDATE REPORT

THAILAND THIRD BIENNIAL UPDATE REPORT

Empowered lives.
Resilient nations.

THE KINGDOM OF THAILAND

MINISTRY OF NATURAL RESOURCES AND ENVIRONMENT
- POLICY FORMULATION AND NATIONAL FOCAL POINT
OFFICE OF NATURAL RESOURCES AND ENVIRONMENTAL POLICY AND PLANNING
CLIMATE CHANGE MANAGEMENT AND COORDINATION DIVISION

HONORARY ADVISOR

Dr. Raweewan Bhuridej
Secretary-General, Office of Natural Resources and Environmental Policy and Planning
Dr. Phirun Saiyasitpanich
Deputy Secretary-General, Office of Natural Resources and Environmental Policy and Planning
Dr. Natthanich Asvapoositkul
Director of Climate Change Management and Coordination Division

DEVELOPMENT TEAM

Dr. Bundit Limmeechokchai
Dr. Kraichat Tantrakarnapa
Dr. Patthra Pengthamkeerati
Dr. Chalor Jarusutthirak
Dr. Sapit Diloksumpun
Mrs. Katunchalee Thammakul
Dr. Kollawat Sakhakara
Dr. Kittisak Prukkanone
Mr. Sivach Kaewcharoen
Mr. Teerapong Laopongpith
Ms. Chompunut Songkhao
Mr. Worapon Mathurosmatanee
Ms. Chanutsakul Supirak
Ms. Krittaya Chunhaviriyakul
Dr. Anuporn Wanwisade
Ms. Seetala Chantes
Mr. Suphat Phengphan
Ms. Tippawan Photiwut
Ms. Karnpanich Tunskul
Ms. Sasiwimon Wichadee
Ms. Chanitsa Warachit
Ms. Kamonporn Phukpanasun
Ms. Apirugee Buadok
Mr. Boonrod Yaowapruek
Ms. Yung-Hsin Lin
Ms. Kornkanok Laoprasertsuk

CONTRIBUTORS

The Prime Minister's Office
Ministry of Agriculture and Cooperatives
Ministry of Education
Ministry of Energy
Ministry of Finance
Ministry of Foreign Affairs
Ministry of Higher Education, Science, Research and Innovation
Ministry of Industry
Ministry of Interior
Ministry of Natural Resources and Environment
Ministry of Public Health
Ministry of Tourism and Sports
Ministry of Transport
Bangkok Metropolitan Administration

FOREWORD

Climate change continues to be a defining challenge to the global community, with intensified and devastating consequences on human survival and the environment. Greenhouse gases emissions continue to rise and accumulate in the atmosphere and the ocean, causing the increase in the global average temperature of more than 1.1 °C warmer than in pre-industrial level. The consequences of this warming are enormous and irreversible such as extreme weather events, rising sea levels, and biodiversity loss. Despite its universal adverse impacts, the most vulnerable groups with the least adaptive capacity are suffering the most.

Thailand is among the most vulnerable countries to the adverse impact of climate change, as it has constantly faced with climate variability and change and extreme weather events such as flood and drought, causing severe impacts on its economy and ecosystem. Despite these challenges, Thailand attaches high priority to take collectively responsible for addressing climate change. As a Party to the UNFCCC, Thailand has been implementing its mitigation actions under the Nationally Appropriate Mitigation Action (NAMA) with the primary focus on energy and transport sectors. The recent tracking record provides a promising result that Thailand is on a strong track to meet this pre-2020 target. As a Party to the Paris Agreement, Thailand has submitted its Nationally Determined Contribution (NDC), aiming to reduce its greenhouse gas emissions by 20 to 25 percent from the projected BAU by 2030, which enhances ambition from its NAMA. Domestically, various policies, plans, and actions plans have been developed to provide concrete implementations towards a low greenhouse gas emission and climate-resilient development and in line with the sustainable development goals.

Thailand's third Biennial Update Report (BUR) has been prepared in accordance with UNFCCC guideline. The main purposes are to present updated information on the national circumstances, institutional arrangements, national greenhouse gas (GHG) inventory, and achievement of GHG emissions reduction under NAMA; together with constraints, gaps, and supports needed and received to implement its adaptation and mitigation actions as well as fulfilling its transparency requirement under the Paris Agreement.

I would like to express my appreciation to representatives of Ministries, sub-national government agencies, academic institutions, private sectors, civil societies, non-governmental organizations and international agencies, for their contributions in preparing this report. I would also like to take this opportunity to thank the Global Environment Facility (GEF) and the United Nations Development Programme (UNDP) for their funding and technical support, respectively.

Lastly, despite the global outbreak of COVID-19, Thailand reaffirms its commitment to taking collective actions under UNFCCC to address the global challenges of climate change and staying on the path of building back better and more sustainable future.

Dr. Raweewan Bhuridej
Secretary - General
Office of Natural Resources and Environmental Policy and Planning

CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ACRONYMS, ABBREVIATIONS AND UNITS

3Rs	Reduce, Reuse and Recycle
AEDP	Alternative Energy Development Plan
AFOLU	Agriculture, Forest and Other Land Use
AI	Artificial Intelligence
BAU	Business-As-Usual
BUR	Biennial Update Report
COP	Conference of the Parties
EEC	Eastern Economic Corridor
EEP	Energy Efficiency Plan
EF	Emission Factor
EI	Energy Intensity
FNC	Fourth National Communication
F-Gases	Fluorinated Gases
GCF	Green Climate Fund
GDP	Gross Domestic Product
GEF	Global Environment Facility
GHG	Greenhouse Gas
GWP	Global Warming Potential
IKI	International Climate Initiative
INDC	Intended Nationally Determined Contribution
IPPU	Industrial Processes and Product Use
JCM	Joint Crediting Mechanism
KCA	Key Category Analysis
LULUCF	Land Use, Land-Use Change and Forestry
MRV	Measurement, Reporting and Verification
MSW	Municipal Solid Waste
NA	Not Applicable

NAMA	Nationally Appropriate Mitigation Action
NAP	National Adaptation Plan
NBSAPs	National Biodiversity Strategies and Action Plans
NC	National Communication
NCCC	National Committee on Climate Change Policy
NDC	Nationally Determined Contribution
NE	Not Estimated
NO	Not Occurring
PM	Particulate Matter
PMR	Partnership for Market Readiness
PPP	Polluter Pays Principle
QA	Quality Assurance
QC	Quality Control
RAC	Refrigeration and Air Conditioning
REDD+	Reducing Emissions from Deforestation and Forest Degradation in Developing Countries (REDD); and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in Developing countries (+)
SBUR	Second Biennial Update Report
SDGs	Sustainable Development Goals
SMEs	Small and Medium-sized Enterprises
TBUR	Third Biennial Update Report
TGCP	Thai-German Climate Programme
TGEIS	Thailand Greenhouse Gas Emission Inventory System
T-PLAT	Thailand Climate Change Adaptation Information Platform
WEEE	Waste Electrical and Electronic Equipment

GASES

CH_4	Methane
CO	Carbon Monoxide
CO_2	Carbon Dioxide
HFCs	Hydrofluorocarbons
N_2O	Nitrous Oxide
NMVOCs	Non-Methane Volatile Organic Compounds
NO_X	Nitrogen Oxides
O_3	Ozone
PFCs	Perfluorocarbons
SF_6	Sulphur Hexafluoride
SO_2	Sulphur Dioxide

UNITS

$	United States Dollar (USD)
¥	Japanese Yen
€	Euro (EUR)
°C	Degree Celsius
A$	Australian Dollar
Gg	Giga (represents a factor of 10^9)
kg	Kilogram (represents a factor of 10^3)
km	Kilometer (represents a factor of 10^3)
km^2	Square kilometer
ktoe	Kilo ton of oil equivalent
M	Million (represents a factor of 10^6)
m^3	Cubic meter
mm	Millimeter (represents a factor of 10^{-3})
tCO_2eq	Ton of Carbon Dioxide Equivalent
THB	Thai Baht

ORGANIZATIONS

ADB	Asian Development Bank
ALRO	Agricultural Land Reform Office
BB	Bureau of the Budget
BMA	Bangkok Metropolitan Administration
BMU	Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety
CAAT	The Civil Aviation Authority of Thailand
DDPM	Department of Disaster Prevention and Mitigation
DEDE	Department of Alternative Energy Development and Efficiency
DEQP	Department of Environmental Quality Promotion
DIO	Department of International Organizations
DIW	Department of Industrial Works
DLA	Department of Local Administration
DLD	Department of Livestock 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
DOAE	Department of Agricultural Extension
DOC	Department of Customs
DOEB	Department of Energy Business
DOF	Department of Fisheries
DOH	Department of Health
DOPA	Department of Provincial Administration
DOT	Department of Tourism
DPIM	Department of Primary Industries and Mines

ED	The Excise Department
EEI	Electrical and Electronics Institute
EGAT	Electricity Generating Authority of Thailand
EPPO	Energy Policy and Planning Office
ERC	Energy Regulatory Commission
EU	European Union
FAO	Food and Agriculture Organization
FIO	Forest Industry Organization
FPO	Fiscal Policy Office
FTI	The Federation of Thai Industries
GISTDA	Geo-Informatics and Space Technology Development Agency
GIZ	The Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH (German development agency)
IEAT	Industrial Estate Authority of Thailand
IPCC	Intergovernmental Panel on Climate Change
ISIT	Iron and Steel Institute of Thailand
JICA	Japan International Cooperation Agency
LAOs	Local Administrative Organizations
LDD	Land Development Department
MD	Marine Department
MEA	Metropolitan Electricity Authority
MOE	Ministry of Education
MOI	Ministry of Interior
MONRE	Ministry of Natural Resources and Environment
NESDC	Office of the National Economic and Social Development Council
NFI	National Food Institute
NRCT	National Research Council of Thailand
NSO	National Statistical Office

OAE	Office of Agricultural Economics
OCSB	Office of the Cane and Sugar Board
OIE	The Office of Industrial Economics
ONEP	Office of Natural Resources and Environmental Policy and Planning
ONWR	Office of the National Water Resources
OTP	The Office of Transport and Traffic Policy and Planning
PAT	Port Authority of Thailand
PCD	Pollution Control Department
PEA	Provincial Electricity Authority
PONRE	Provincial Offices of Natural Resources and Environment
PTIT	Petroleum Institute of Thailand
RAOT	Rubber Authority of Thailand
RD	Rice Department
REO	Regional Environment Office
RFD	Royal Forest Department
RID	Royal Irrigation Department
SRT	State Railway of Thailand
TAI	Thailand Automotive Institute
TCMA	Thai Cement Manufacturers Association
TGO	Thailand Greenhouse Gas Management Organization
TMD	Thai Meteorological Department
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNIDO	United Nations Industrial Development Organization
WMA	Wastewater Management Authority

EXECUTIVE SUMMARY

As a developing country highly vulnerable to the impacts of climate change, Thailand attaches great importance to the global efforts to address this common and pressing challenge. Climate change is currently addressed at the highest policy level in Thailand under the National Strategy 2018-2037 to ensure a long-term continuity of the issue alongside other economic and social considerations, including poverty eradication. The Climate Change Master Plan 2015-2050 was developed to reflect Thailand's strategy on climate change mitigation, adaptation, capacity building and cross-cutting issues. Climate change adaptation and mitigation are becoming more deeply embedded in governmental structures in line with the increasing profile of climate actions in national agendas.

Thailand as a Non-Annex I Party to the United Nations Framework Convention on Climate Change (UNFCCC), is obligated to submit National Communications (NCs) every 4 years and Biennial Update Reports (BURs) every 2 years. Thailand submitted its first BUR on 29 December 2015 and its second BUR on 29 December 2017. Thailand has actively implemented climate actions and shared the results to UNFCCC and the global community. Thailand has established the inter-ministerial committees to oversee climate policy development and implementation and comprehensive national systems to monitor, evaluate and report on progress. Thailand will continue to work relentlessly with the global community in order to address the challenges of climate change. The global outbreak of novel coronavirus (COVID-19) has dramatically threatened the way people conduct their daily life. The so-called "New Normal" that emerges after the pandemic will reshape many economic and social activities. As Thailand plans its recovery from this pandemic, Thailand aims to use this opportunity to build back better an ecosystem and economy that promotes climate-resilient and sustainable development, including through the implementation of NDC.

This report, the third BUR (TBUR), has demonstrated the country's intention to work with the global community to tackle climate change. According to Conference of the Parties (COP) guidelines, the TBUR has been updated and strengthened to provide information regarding national circumstances, national greenhouse gas (GHG) inventories, progress made on climate actions, as well as national gaps, international support received, and international support needs in terms of finance, technology development and transfer, and capacity building in order to overcome the existing constraints on tackling climate change. This BUR consists of 4 chapters as follows:

NATIONAL CIRCUMSTANCES

Thailand is a developing country highly vulnerable to the impacts of climate change and is ranked, by Global Climate Risk Index (CRI), as the 8th most affected countries in the period 1999-2018. This shows that Thailand is increasingly at risk of either frequent events or rare, but extraordinary catastrophes and is vulnerable to future climate change impacts over the next thirty years.

The Kingdom of Thailand is located in Southeast Asia and covers an area of 513,115 km^2 with total coastline of about 2,815 km. Under the climate change crisis, Thailand's coastal zone is one of the most vulnerable areas and it is at greater risk of intensive flooding resulting from sea-level rising and coastal erosion in several provinces, including the capital and its perimeter provinces. The total population of Thailand as of 2018 was 66,413,979; making it the 20th most populated country in the world. The national population trend is predicted to move Thailand towards an aging society by around 2025, with the urban population comprising three quarters of the total, leaving only a quarter of the total population living in rural areas by 2040. Although Thailand is a small country, there are considerable variations in the topography and climate patterns of each region. Thailand's climate is under the influence of two main monsoon winds, which produce three seasons: hot, cool and wet. Temperature fluctuations and changes in Thailand in recent years have produced above average temperatures and this trend is likely to continue. While the number of rainy days has decreased, total annual rainfall trends have shown an increase. Precipitation has frequently fluctuated over time.

The majority of land use in Thailand is for agriculture for about 47% and almost half of agricultural land is attributed to paddy use. In terms of water resources, Thailand has had periodic issues with household water shortages in villages, in addition to experiencing periodic droughts and flooding. In order to facilitate more effective management of national water resources, Thailand has formulated a Water Resource Management Strategy (2015-2026) as well as a 20-Year National Water Resources Management Plan (2018-2037). Thailand has furthermore developed similar strategies to address other aspects of the environment, including the 20-Year Master Plan on Air Quality Management (2018-2037), the 20-Year National Plan for Water Quality Management (2018-2037), the 20-Year Master Plan on Prevention and Mitigation of Solid Waste Problems and the 20-Year Pollution Management Strategy (2018-2037). Regarding Thailand's environmental quality, levels of both air and water quality in 2018 were relatively stable. The main air pollutants that have continued to exceed guidelines are $PM_{2.5}$, PM_{10} and ozone. Overall water quality has improved and remained within 'fair' or 'good' quality ranges. The amount of waste generated in 2018 from both municipal solid waste (27.93 million tons) and municipal hazardous waste (638,000 tons) has increased, although waste management practices have shown signs of improvement. Meanwhile, the amount of infectious waste in 2018 decreased alongside the amount of industrial waste that was pulled into the managing system (which decreased by 33% compared to 2017).

In 2018, the majority of final energy consumption came from petroleum products, which totaled 49.29% of total consumption, followed by electricity, natural gas and coal. Within the economic sector, transportation was responsible for the largest consumption of energy at 39.41%, followed by the industrial sector (36.26%), residential sector (13.10%), commercial (7.80%), and finally the

agricultural sector (3.43%). Total energy production was 72,609 ktoe, with natural gas in commercial energy contributing the largest source of energy, comprising 42.86% of the total, followed by renewable energy (23.63%) and traditional renewable energy (9.66%). Thailand's alternative energy consumption was 12,996 ktoe; a figure that has increased steadily from 2013-2018. Alternative energy consumption in terms of electricity, heat, and biofuel (ethanol and biodiesel) shared 15.5% of the total final energy consumption.

Thailand's economy has operated under the 12th National Economic and Social Development Plan (2017-2021) and constitutes a mix of agriculture, industry, tourism, service and natural resources. The Thai economy in 2018 grew by 4.1%, up from 4.0% in 2017; the highest expansion rate in 6 years. Export value grew by 7.7%, while private consumption and total investment grew by 4.6 and 3.8% respectively. While the agricultural sector typically accounts for over 30% of employment, it only contributes around 8% of Thailand's GDP – although this contribution remained relatively constant between 2016-2018. Conversely, the tourism industry generated around 15% of GDP during this same time period, while providing only 10.9% of total employment. As the agriculture and tourism are key sectors in socio-economy aspect of the country, actions must be taken to build resilient for climate crisis.

Thailand established the National Committee on Climate Change Policy (NCCC) in 2007 in order to fulfill Thailand's commitments under the UNFCCC and to define national climate policies. Currently, the NCCC is composed of 5 subcommittees: 1) Subcommittee on Climate Change Policy and Planning Integration, 2) Subcommittee on Climate Change Knowledge and Database, 3) Subcommittee on Climate Change Negotiation and International Cooperation, 4) Subcommittee on Public Relations and Actions for Climate Empowerment, and 5) Subcommittee on Climate Law (added in 2019). Furthermore, Thailand has updated its National Greenhouse Gas Inventory in accordance with the 2006 Intergovernmental Panel on Climate Change (IPCC) Guidelines, including by applying Thailand Greenhouse Gas Emission Inventory System (TGEIS). Adjustments have also been made to the sub-sectoral working groups responsible for data collection in estimating GHG emissions for 5 sectors in the GHG inventory.

NATIONAL GREENHOUSE GAS INVENTORY

The estimation of greenhouse gas (GHG) emissions in this report comprises of both direct emission (CO_2, CH_4, N_2O) and indirect emission (NO_X, CO, NMVOCs and SO_2). In 2016, Thailand's total direct emissions (excluding those from the Land Use and the Land-Use Change and Forestry – LULUCF – sector) were 354,357.61 $GgCO_2eq$, while the net removal of CO_2 was 91,134.15 $GgCO_2eq$. Net GHG emissions were therefore 263,223.46 $GgCO_2eq$ and resulted from 1) Energy (253,895.61 $GgCO_2eq$), 2) Industrial Processes and Product Use (IPPU) (31,531.41 $GgCO_2eq$), 3) Agriculture (52,158.70 $GgCO_2eq$) and 4) Waste (16,771.89 $GgCO_2eq$). The proportion of GHG emissions in the energy sector accounted for 71.65% of total emission sources in 2016, followed by the agriculture, IPPU and waste sectors. Overall, Thailand's GHG emissions represent less 1% of global emissions and lower than world average.

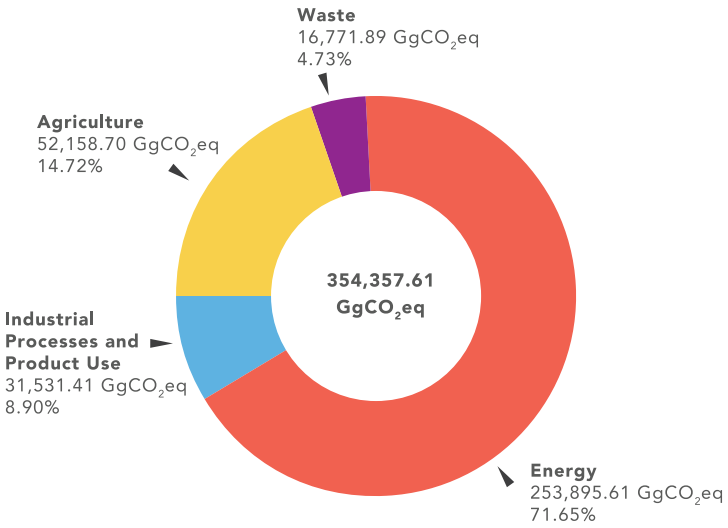


Figure: Total GHG emissions by sector (excluding LULUCF), 2016

INFORMATION ON MITIGATION ACTIONS

Thailand have incorporated climate change into its national economic and social development plans since 2007. Climate change is currently addressed at the highest policy level under the National Strategy (2018-2037) to ensure a long-term continuity of the issue alongside other economic and social considerations. The Climate Change Master Plan 2015-2050 reflects on climate change mitigation, adaptation, capacity building and enabling environment issues.

Thailand submitted its Nationally Appropriate Mitigation Action (NAMA) pledging to reduce its GHG emissions in the energy and transportation sectors by 7-20% from business-as-usual (BAU) levels by 2020. To date, Thailand has made substantive progress in implementing its mitigation measures under NAMA and has successfully achieved a GHG emissions reduction of 57.84 $MtCO_2eq$ in 2018, which is approximately a 15.76% lower its BAU level.

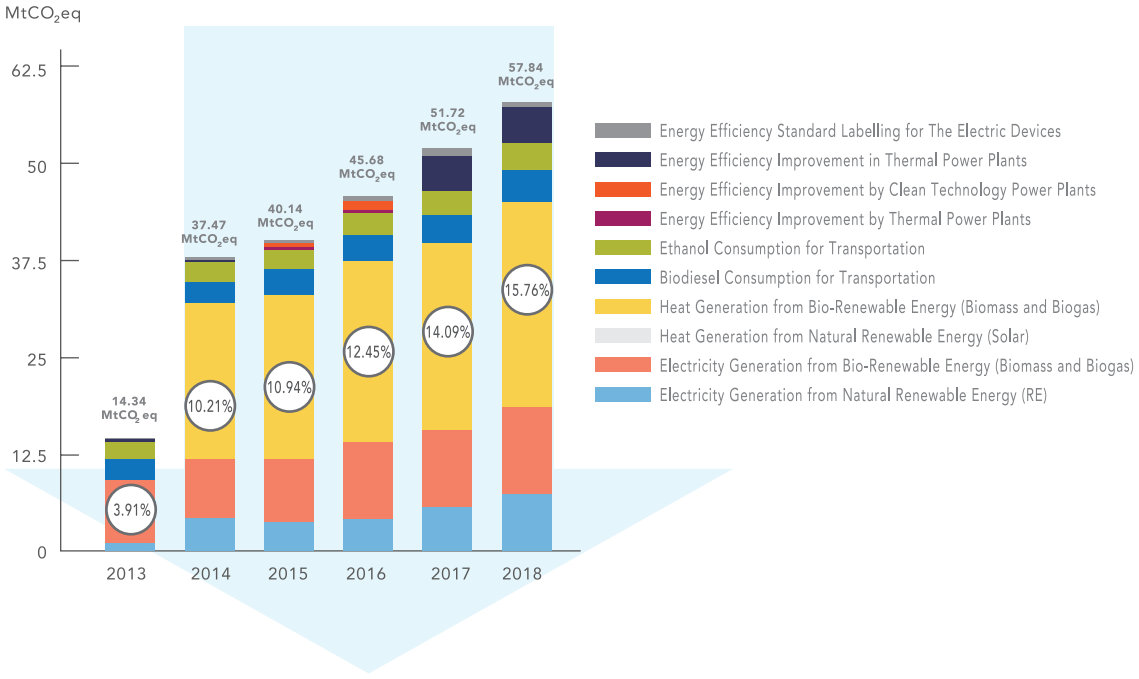


Figure: GHG emission reductions toward NAMA 2013-2018

Additionally, in 2015 Thailand submitted its Nationally Determined Contribution (NDC), which intends to reduce GHG emissions by 20% from the projected BAU level by 2030. This level of contribution could increase up to 25%, subject to adequate and enhanced access to technology development and transfer, financial resources and capacity building. Thailand's NDC Roadmap on Mitigation (2021-2030) was further established to facilitate the achievement of its NDC targets, covering mitigation actions in the energy, transportation, IPPU and waste management sectors. To ensure the achievement of the NDC from 2021 onwards, Thailand already developed its post-2020 efforts addressed in the updated NDC consistent with the country's relevant policies in 2020. Moreover, Thailand is formulating its Long-term Low Greenhouse Gas Emission Development Strategy (LT-LEDS) which will guide Thailand towards a climate-resilient and low greenhouse gas emissions development and serve as a basis for enhancing its subsequent NDC.

CONSTRAINTS, GAPS, NEEDS AND SUPPORT RECEIVED

Key constraints and gaps were identified which include capacities and resources of governmental agencies, private sectors, and public for preparing and implementing climate actions. The provision of support and cooperation are important to achieving mitigation and adaptation objectives and increasing ambition. To enhance Thailand's effective implementation of mitigation, adaptation and climate resilient actions towards the ultimate objective of the UNFCCC and the goal of Paris Agreement, adequate and predictable means of implementation in terms of finance, technology development and transfer, and capacity building are needed.

Several of the proposed measures and actions in climate mitigation and adaptation plans require extremely high investment, strong institutional structure, innovative technology as well as human capacity. Main support needed were identified which include an increase in capacities and resources of governmental agencies, private sectors, and public to take climate actions. At present, the responsible public agencies still have limited capacity to develop information services for facilitating climate-smart decision. Therefore, Thailand needs international supports to build proper enabling environment and take climate actions in both mitigation and adaptation. To enhance Thailand's effective implementation of mitigation, adaptation, and climate resilient actions towards the goal of Paris Agreement, the support needed by Thailand and the support provided by international partners shall be aligned.

CHAPTER 1

NATIONAL CIRCUMSTANCES

CHAPTER 1: NATIONAL CIRCUMSTANCES

Thailand is a developing country highly vulnerable to the impacts of climate change and is ranked, by Global Climate Risk Index (CRI), as the 8th most affected countries in the period 1999-2018.

Thailand has established the inter-ministerial committees to oversee climate policy development and implementation and comprehensive national systems to monitor, evaluate and report on progress. Thailand will continue to work relentlessly with the global community in order to address the challenges of climate change.

1.1 Physical Context

1.1.1 Geography

Thailand, officially the Kingdom of Thailand, is situated in Southeast Asia between latitudes 5° 37′ N and 20° 27′ N and longitudes 97° 22′ E and 105° 37′ E, covering a total area of 513,115 km2. To the north, it borders with Myanmar and Laos, and to the east with Laos and Cambodia. To the south lies Malaysia and the Gulf of Thailand, while westwards sits Myanmar and the Andaman Sea. The dominant topography of the country is littoral area with the coastal zone including the Gulf of Thailand coast and the Andaman sea coast. The total coastal length is about 2,815 km including Andaman Sea coast 937 km and Gulf of Thailand coast 1,878 km Thailand's coastal zone is one of the most vulnerable area from climate change. In the recent years, Thailand coastal areas around 155 locations with approximately 600 km (23% of Thailand coastline) has been encountered a coastal erosion crisis with an erosion rate from 1 - 5 meters per year which refer to the land loss at 2 km^2 per year or the value of economic damage up to 6,000 million Baht. They are economic important areas where 23 provinces are located with approximately 12 million of population living in the areas. The area is not only an economic area for tourism and fishery industry but also is home to coastal fishery communities which those coastal communities are hardly inevitably affected by climate crisis. On top of that, Bangkok and its perimeter provinces surrounded by the coast and rivers are ranked as one of the top cities in the world at the highest risk of intensive flooding resulting from precipitation change, sea-level rising and coastal erosion under climate change.

Source: 1) Department of Marine and Coastal Resources 2) Thailand's Second Assessment Report on Climate Change 2016, Thailand Research Fund

Source: Department of Field Support Cartographic Section, United Nations

Figure 1-1 Map of the Kingdom of Thailand

1.1.2 Administrative Area

Region: Thailand is comprised of the north high mountains, the central plains, the northeast plateau and the south coastal plain and it was officially geographically divided into the 6 regions system in 1977. This continues to be the most well-known and commonly used division for local administration. The 6 official regions are 1) North, 2) West, 3) East, 4) North East, 5) South, and 6) Central.

Source: Office of the Royal Society

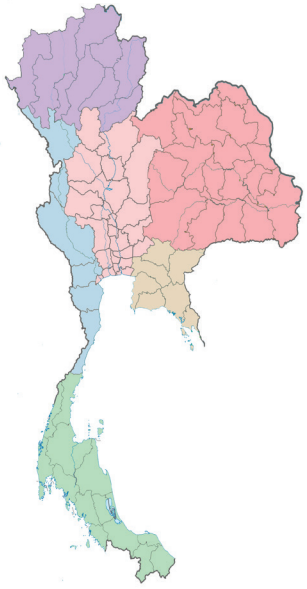


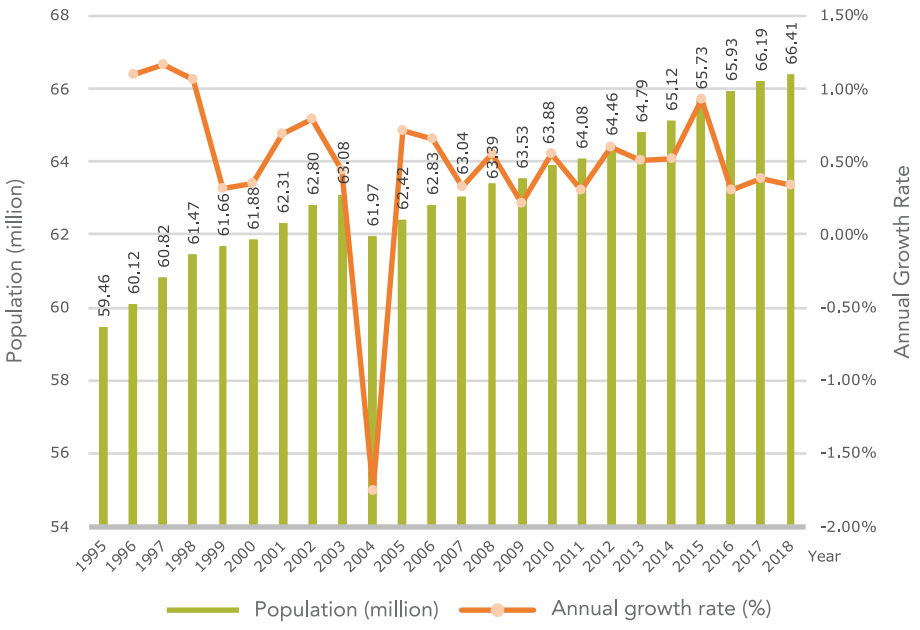
Figure 1-2: Thailand's six regions division

Province: Thailand is further divided into 76 provinces; not including Bangkok, the capital. Thailand's public administration is divided into 3 tiers of central, provincial, and local administration. The central administration is comprised of the ministries, bureaus, and departments which the positions at the field units are from each central department that are responsible of implementing the government policies. The provincial government consists of provinces and each province is divided into districts. The provincial administration follows the concept of deconcentration which authorized through the central administration. The Local administration consists of Provincial Administrative Organization, Municipality, Sub-district Administrative Organization. Its roles and functions are as stated in the Decentralization Act. There are also 2 special territories under local administration: Bangkok and Pattaya. While Pattaya is still part of Chonburi Province (and therefore also subject to provincial organization), Bangkok operates at the provincial level itself. Unlike the other 76 provinces, Bangkok is a special administrative area, locally governed by the Bangkok Metropolitan Administration (BMA).

Source: Department of Provincial Administration

1.1.3 Population

Population density: According to registration records, the total population of Thailand in 2018 was 66,413,979, making it the 20th most populated country in the world. The average annual population growth rate over the past decade is estimated to be around 0.4%.



Remark: In 2004, The Department of Provincial Administration reviewed and made necessary corrections to remedy issues of double counting in Thailand's total population figures. This chart accordingly reflects the accurate, corrected figure of the country's total population.

Source: 1) National Statistical Office 2) Department of Provincial Administration

Figure 1-3: Population and annual growth rate 1995-2018

Population projections: The population is projected to gradually increase until around 2030, from which point it will start to decline. The forecast populations for 2025, 2030 and 2040 are 67.09, 67.14 and 65.37 million, respectively. A decline in birth rate with a concurrent increase in life expectancy has contributed towards shaping Thailand's population structure into an 'aging society'. Figure 1-4 shows that the projected aging index – the percentage of people aged 60 and over divided by people aged younger than 15 – will increase steadily. The aging index will exceed 120 slightly before 2025, at which point Thailand will be officially categorized as an 'aged society'. Thailand's population is projected to become a 'super aged society' by 2035, when the aging index is estimated to exceed 200. By 2040, the aging population will be more than double that of the youthful population. This demographic transition translates into challenges related to the care and support of aging members of society. Pension spending, health care, and long-term care systems for the elderly will create large financial burdens. The anticipated shrinking labor force could also potentially harm Thailand's economy and as such, an improvement in labor productivity is required.

Table 1-1: Thailand's population projections from 2020-2040

Population Projections	2020	2025	2030	2035	2040
1. Population					
0-14 years	11,225,072	10,637,212	9,916,612	9,149,160	8,363,327
15-59 years	43,269,391	41,917,127	40,105,230	38,334,858	36,498,965
60 and over	12,040,221	14,534,657	17,118,697	19,102,768	20,510,045
Total	**66,534,684**	**67,088,996**	**67,140,539**	**66,586,786**	**65,372,337**
2. Fertility Rates	1.53	1.47	1.41	1.36	1.30
3. Life Expectancy at Birth (years)					
Men	73.23	74.33	75.27	76.07	76.75
Women	80.35	81.28	82.04	82.66	83.15

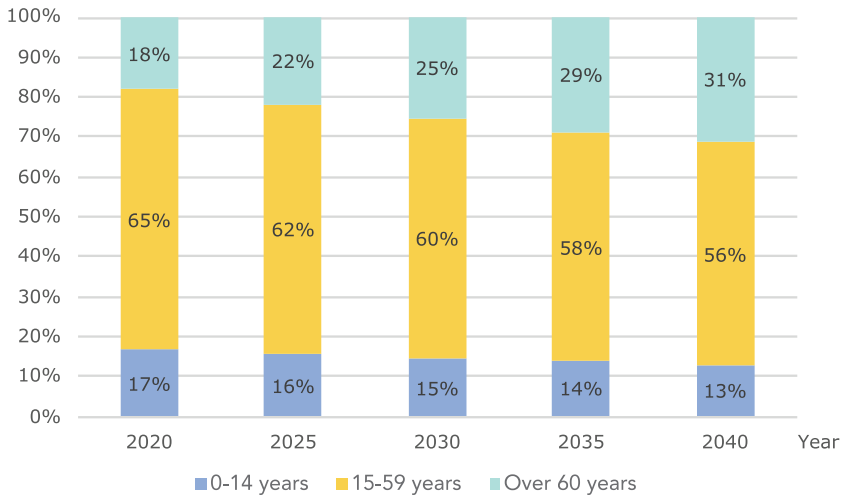
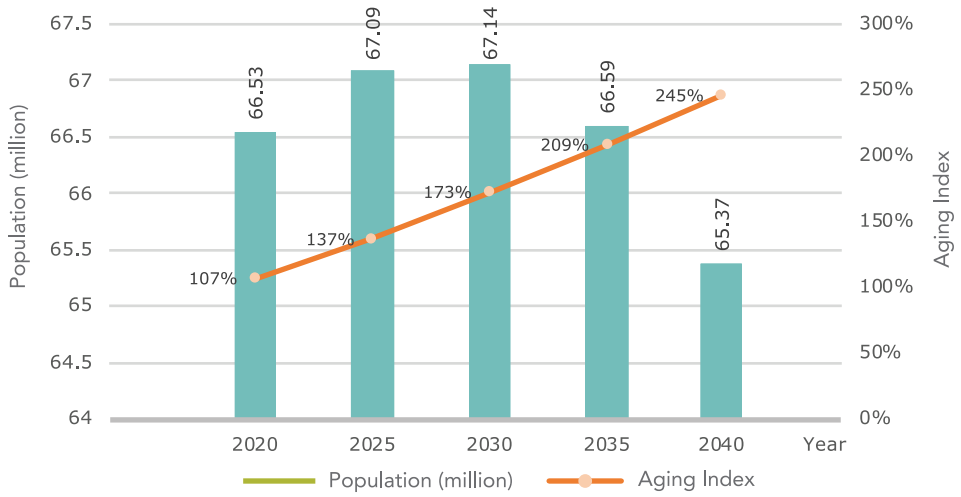


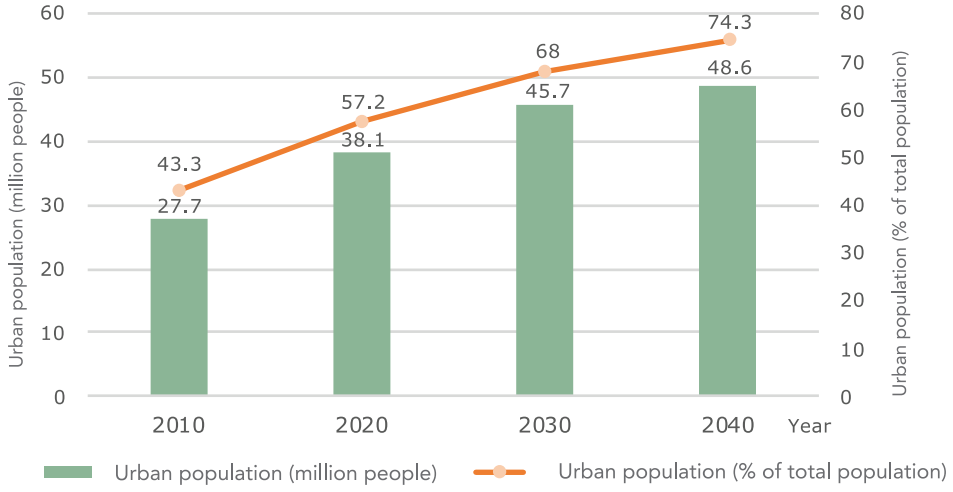
Figure 1-4: Age structure of Thailand 2020-2040



Source: 1) Office of the National Economic and Social Development Council 2) Department of Provincial Administration

Figure 1-5: Aging index and total projected population 2020-2040

Urbanization rate: Thailand is in the midst of transforming itself from a predominantly rural country to an increasingly urban one. Population projections for 2010 to 2040 indicate that the urban population (those living in cities or municipalities) will increase from 43.3% in 2010, rising to 57.2% in 2020, 68% in 2030 and 74.3% by 2040. In other words, only a quarter of the total population will live in rural areas by 2040.



Source: Office of the National Economic and Social Development Council

Figure 1-6: Urbanization rate 2010-2040

Thailand has targeted and made progress with Sustainable Development Goal 3 (SDG3) – Ensure healthy lives and promote well-being for all at all ages – with the following improvements:

- A reduction in maternal, infant and adult mortality rates.
- The Ministry of Interior, the Ministry of Public Health, the National Health Security Office and the Thai Health Promotion Foundation have signed a memorandum of understanding (MOU) to promote the implementation of relevant policies and the participation of all stakeholders in enhancing Thai people's health and well-being, as well as establishing the District Health Board (DHB).

Source: 1) Thailand's Voluntary National Review on the Implementation of the 2030 Agenda for Sustainable Development 2018, Ministry of Foreign Affairs 2) United Nations Global SDG Indicators Database

1.2 Climate

1.2.1 Season and Temperature

Although Thailand is a small country, there is considerable variation in the topography and climate patterns within each region. Thailand's climate is influenced by two main seasonal monsoon winds: The southwest monsoon and the northeast monsoon. The southwest monsoon starts in May and brings a stream of warm, moist air from the Indian Ocean towards Thailand, causing abundant rain over the country, especially on the windward side of the mountains. The northeast monsoon starts in October and brings cold, dry air from the anticyclone in the Chinese mainland over major parts of Thailand, particularly focused on the north and northeast regions. The climate of Thailand can be broadly divided into 3 seasons; 1) Rainy, or the southwest monsoon season, from mid-May to mid-October 2) Winter, or the northeast monsoon season, from mid-October to mid-February and 3) Summer, or the pre-monsoon season, from mid-February to mid-May.

Data on temperature fluctuations in Thailand over the eight-year period of 2012-2019 shown the highest temperature period on record; these high temperatures are likely to continue to rise. Additionally, in April 2016, Thailand recorded its highest temperature since 1951 of 44.6 °C in Mae Hong Son province. When considering the trend in the average temperature of Thailand, it was found that between 1981-1990, temperatures increased by 0.33 °C, while the periods of 1991-2000 and 2001-2010, recorded temperature increases of 0.16 °C and 0.145 °C per decade, respectively. The average temperature in Thailand from 2011-2019 increased by an average of 0.09 °C per year.

Source: Thai Meteorological Department

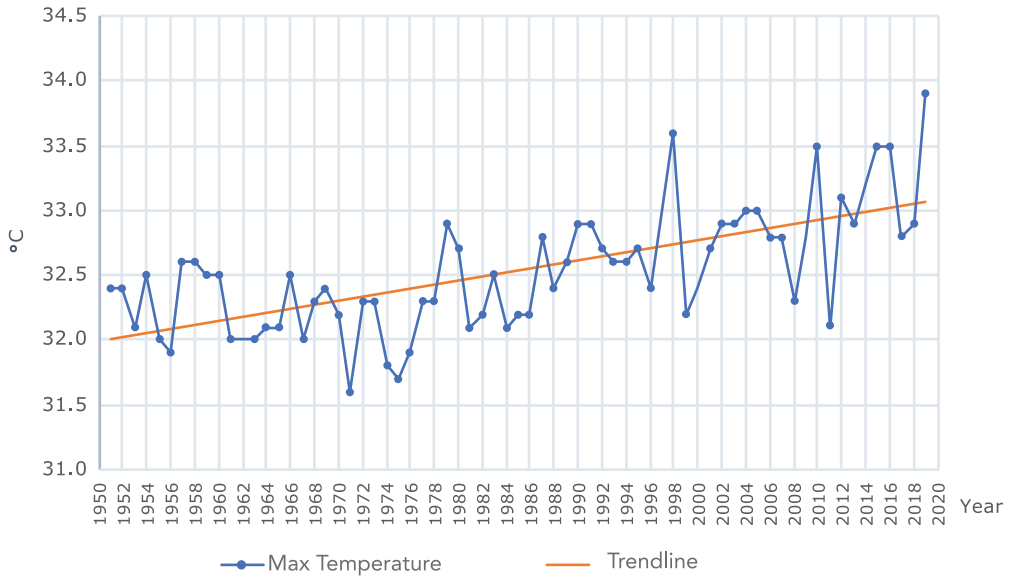


Figure 1-7: Annual mean maximum temperature in Thailand (°C) 1951-2019

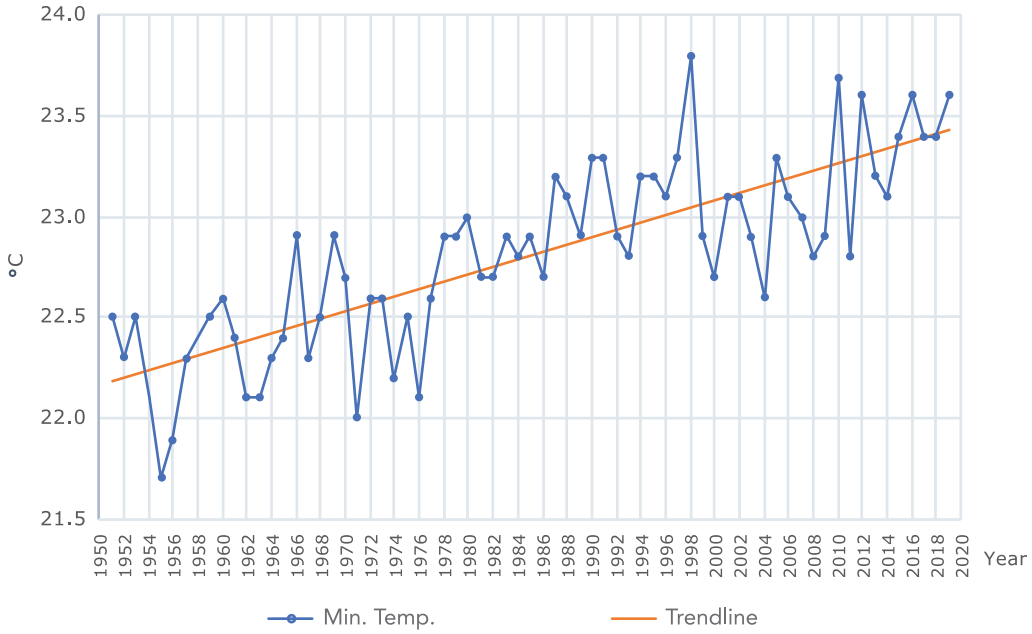


Figure 1-8: Annual mean maximum temperature in Thailand (°C) 1951-2019

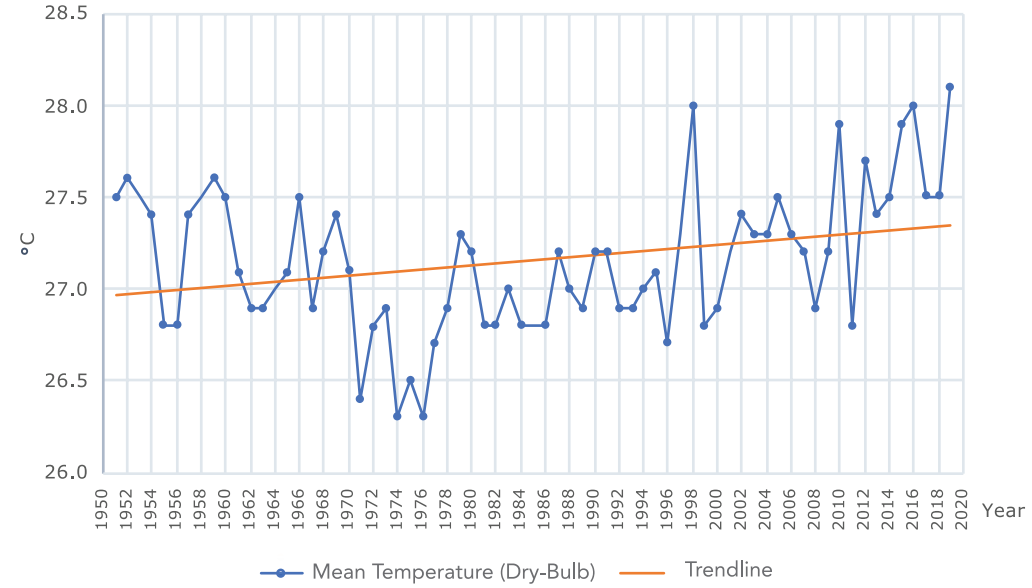
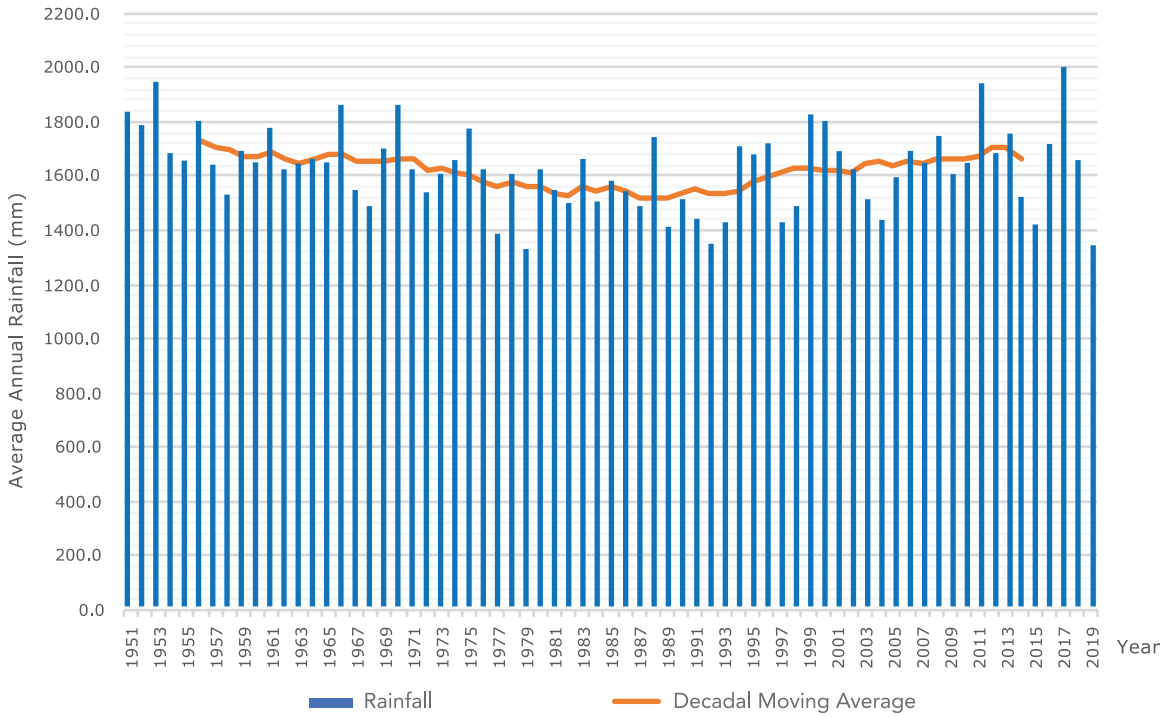


Figure 1-9: Annual mean temperature (dry-bulb) in Thailand (°C) 1951-2019

1.2.2 Precipitation

Based on Thai Meteorological Department's climate changes report 2019, it was found that the variation of precipitation has been oscillated over time as well as the number of rainy days. Considering the last 5 years (2015-2019) in the following figure, the rainfall variation has been the most flatulated with the lowest rainfall in 40 years in 2019 (1,343 mm) since 1979 (1,332 mm). The highest annual rainfall in Thailand has been recorded in 2017 (2,017 mm) since record began in 1951.



Source: Thai Meteorological Department

Figure 1-10: Annual mean rainfall in Thailand (mm) 1951-2019

The trends from statistical data of both temperature and precipitation shown above are consistent with the forecasting of Thailand's climate based on the global climate model. It was projected that average daily temperature, maximum temperature and minimum temperature across the country would increase significantly in all models and scenarios. While, average rainfall would possibly remain in an undefined pattern of change. The annual climatic effect of the monsoon on Thailand and other regions in Southeast Asia is also projected to increase in duration, resulting in increased and more variable precipitation patterns.

Source: Thailand's Second Assessment Report on Climate Change 2016, Thailand Research Fund

In order to maintain the ability to cope with climate change, Thailand has continued to engage in climate action to improve climate resilience relating to SDG 13 – Take Urgent Action to Combat Climate Change and its Impacts. This includes the following measures:

- Thailand has been increasing its efforts on the localization of SDG 13 and has succeeded in enabling various communities to translate the National Climate Change Master Plan (2015–2050) into area-specific local work plans.
- In terms of the prevention and mitigation of adverse effects of climate-related disasters, various capacity building programmes have been conducted for personnel of district centers, provincial offices and other local agencies, to enhance their knowledge and capacities regarding the formulation of local disaster prevention and mitigation plans and the alignment of such plans with the National Disaster Prevention and Mitigation Plan 2015.

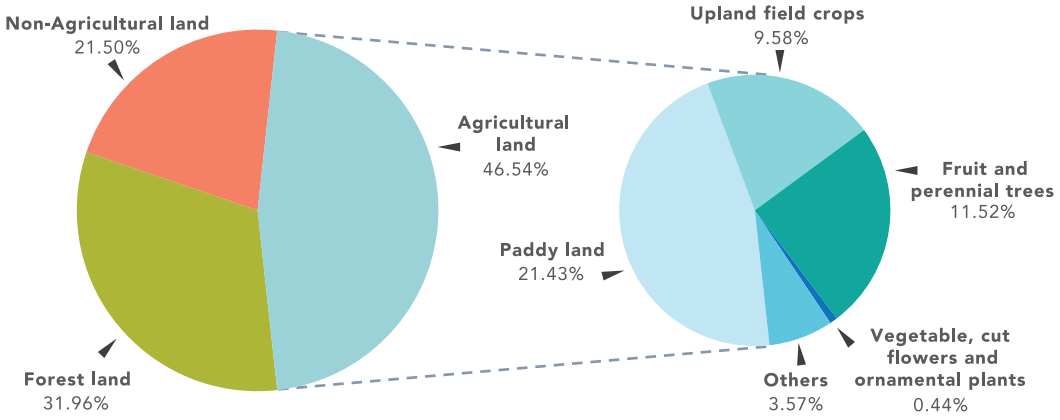
- Thailand has also managed to reduce the number of deaths and missing persons attributed to disasters per 100,000 population from 0.19 in 2015 to 0.13 in 2018. The number of people whose dwellings were damaged by disasters has also been significantly reduced from 114,600 in 2015 to 88,452 in 2018.
- From the perspective of local governance, the proportion of local governments that have adopted and implemented local disaster risk reduction strategies in line with national disaster risk reduction strategies increased from 31.8% in 2016 to 35.4% in 2018.

Source: 1) Thailand's Voluntary National Review on the Implementation of the 2030 Agenda for Sustainable Development 2018, Ministry of Foreign Affairs 2) United Nations Global SDG Indicators Database

1.3 Natural Resources

1.3.1 Land Resources and Forestry

Thailand has a total land area of approximately 513,115 km^2. As of 2018, 46.54% of the nation's total land area (or 238,791 km^2) was categorized as agricultural land. Forest land and non-agricultural land accounted for 31.96% and 21.50%, respectively. For nearly half of agricultural land is attributed to paddy land, equal to 109,949 km^2 or 21.43% of Thailand's total land area.



Source: Agricultural Statistics of Thailand 2018, Office of Agricultural Economics

Figure 1-11: Share of land use in Thailand in 2018

The current estimate of forest area by the Royal Forest Department as of 2018 is almost 164,000 km^2, which is equivalent to 16.40 million hectares. The forest area in Thailand has been recorded as being stable since 2014, accounting for 31.62% in 2014, 31.60% in 2015, 31.58% in 2016, 31.58% in 2017, and 31.68% in 2018. There are a number of laws in place in Thailand related to the management and maintenance the national forest estate, the most important of which include: The 20-Year Forestry Strategy (2017-2036), the Forest Act (1941), National Park Act (1961), National Reserved Forest Act (1964), Wild Animal Reservation and Protection Act (1992), Commercial Forest Plantation Act (1992), Chain Saws Act (2002), and the Community Forest Act (2019). In addition to these legislative measures, a range of projects have also been implemented to solve issues surrounding forest loss, such as activities related to Reducing Emissions from Deforestation and Forest Degradation (REDD+).

Source: 1) Department of National Parks, Wildlife, and Plant Conservation 2) Royal Forest Department

1.3.2 Water Resources

Thailand has 25 major river basins and 254 sub-basins and has an average annual rainfall of approximately 1,455 mm. Although natural surface flow from rainfall is roughly 285 billion m^3, with groundwater from 27 basins contributing around 1,130 billion m^3, of this only roughly 45 billion m^3 per year has the potential to be extracted for utilization. Furthermore, the average amount of natural flow in Thailand is 3,449 m^3 per person per year, lower than averages in other countries in Southeast Asia. Whereas the total water demand in 2015 was 147 billion m^3, the accessible amount was only 102 billion m^3, leaving a shortfall of water to meet agricultural and consumer needs of roughly 45 billion m^3.

Over the last 40 years, Thailand has experienced water shortage problems, which have been compounded by a number of droughts, hugely impacting farmers' incomes and the country's economic output. Severe droughts that occurred in the years 1979, 1994 and 1999 affected almost every part of the country and there have been an increasing number of recurring droughts over the course of the last 10 years, which have affected a total area of around 42,280 km^2. For household water shortage problems, it was found that as of 2017, around 75,000 villages in Thailand had no centrally controlled plumbing system.

In addition to droughts, over the past 30 years Thailand has experienced flooding in almost all provinces of the country, causing damage to life, property and the economy. In 2011, Thailand faced major flooding, which impacted over 13 million people, with resultant economic damage costing more than 1.44 trillion THB.

Therefore, in order to effectively manage the country's water resources, Thailand has formulated the National Water Resources Management Strategies (2015-2026) and the 20-Year Master Plan on Water Resources Management (2018-2037), both of which are in line with the plans of the 20-Year National Strategy (2018-2037). The 20-Year Master Plan on Water Resources Management has been defined according to 6 aspects, outlined in Table 1-2.

Table 1-2: Development aspects of the 20-Year Master Plan on Water Resources Management

Aspect	Target
Management of water use	• Tap water for villages • Tap water for urban/economic zones • Improve drinking water standards and affordability • Water saving in all sectors
Security of water production	• Better management • Increase water efficiency • Water allocation in rainfed areas • New water storage capacity • Develop water distribution systems • Increase water productivity • Increase water through artificial rainfall
Inundation control	• Increase drainage efficiency • Urban flood protection • Flood area/retention pond management • Area-based flood management
Water quality conservation	• Wastewater reduction at source of origin • Increase treatment efficiency • Preserve ecological balance • Recover national water resources
Afforestation in watershed areas and soil erosion protection	• Conserve upstream forest • Soil erosion protection in upstream areas
Managerial approach	• Strengthen water laws and institutional management • Develop a water management plan • Improve monitoring and evaluation • Develop a decision support system database • R&D • Improve communication and citizen participation

Source: The 20-Year Master plan on Water Resources Management 2018-2037, Office of National Water Resources

1.3.3 Biodiversity

One of the most biodiverse countries in Southeast Asia, Thailand is located in two Bio-geographies: the Indo-Chinese Region in the north and the Sundaic Region in the south. Based on the plant biodiversity studied and surveyed under the Flora of Thailand Project, Thailand was found to be home to 11,000 plant species, equating to approximately 3% of the world's total plant species. Additionally, there were 4,731 species of vertebrate recorded in 2016, an increase of 123 species from 2005.

Thailand's unique biodiversity is supported by seven diverse ecosystems, **1) Forest:** forest areas in Thailand comprised roughly 31.6% of the total land area in 2017. Whilst this has decreased from 43.2% in 1973, the rates of decline have stabilized as of 2014 due to government policies on forest plantation; **2) Mountain:** total mountainous areas comprise 29.3% of the country; **3) Agricultural:** due to government policies, the total area devoted to agriculture increased between 2008 and 2016, with notable increases

in the three main cash crops of Pará rubber, oil palm and eucalyptus. An increase in agricultural lands, however, often comes at the expense of forested areas. **4) Marine and coastal:** these ecosystems are in the east and south of the country and consist of: mangrove forests, which decreased from 3,679 km^2 in 1961 to 2,455 km^2 in 2014, beach forests, some of which have been destroyed in order to be converted to tourism sites, seagrass which covers a total area of 256 km^2 (new areas of seagrass spanning 0.69 km^2 were found in 2016), and finally, coral reefs, which cover a total area of 238 km^2; **5) Island:** there are 936 islands distributed along the Gulf of Thailand and Andaman Coast with a total length of 3,724.32 km and total area of 2,720 km^2; **6) Inland water:** this includes swamps and seasonal flooded forests along the floodplain, comprising a total area of 17,432 km^2 and **7) Dry and semi-humid:** these ecosystems are found in the northeast of Thailand due to necessary climate and soil conditions, and constitute an area of 104,000 km^2 or 62% of the entire northeast region.

As reported in Thailand's Sixth National Report on the Implementation of the Convention on Biological Diversity, in order to protect the country's rich biodiversity, Thailand has revised the National Biodiversity Strategies and Action Plans (NBSAPs) since its first adoption in 2008. The latest revision, the 4th Master Plan for Integrated Biodiversity Management (2015-2021), consists of 2 phases of operation with 4 strategies:

1) Integrate biodiversity values and management with participation at all levels
2) Conserve and restore biodiversity
3) Protect the country's rights and enable management to enhance and share benefits from biodiversity in line with a green economy
4) Develop biodiversity knowledge and database systems to be consistent with internationally recognized standards

Its second phase (2017-2021) comprises action plans for meeting 25 targets, as indicated in Figure 1-12:

Source: Thailand's Sixth National Report on the Implementation of the Convention on Biological Diversity, Office of Natural Resources and Environmental Policy and Planning (ONEP)

Figure 1-12: National biodiversity targets for 2017-2021

So far, Thailand has been working in a comprehensive manner to support the implementation of the NBSAPs through the implementation of protected area systems, with moderately satisfying results.

Moreover, in terms of indicators relating to SDG 15 – Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification and halt and reverse land degradation and halt biodiversity loss, the average proportion of Territorial Key Biodiversity Areas covered by protected areas in Thailand has increased from nearly 67% in 2000 to over 70.7% in 2019. Forest area controlled under an independently verified forest management certification scheme has also significantly expanded, from 76,400 km^2 in 2010 to 757,800 km^2 in 2019.

Source: 1) Thailand's Voluntary National Review on the Implementation of the 2030 Agenda for Sustainable Development 2018, Ministry of Foreign Affairs 2) United Nations Global SDG Indicators Database

1.4 State of the Environment

1.4.1 Air Quality

The five major air pollutants in Thailand are sulphur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), ozone (O_3), and particulate matter (this includes particulate matter <10 microns: PM_{10}, and <2.5 microns: $PM_{2.5}$). Although air quality in 2018 was relatively stable, $PM_{2.5}$, PM_{10} and ozone continued to exceed standard levels. While $PM_{2.5}$ saw a decrease in 2015, it increased again in 2018. PM_{10} values have greatly exceeded maximum guidelines in Saraburi province, which is a major area for cement production. Ozone values also remain in excess, though 2018 levels have held steady from the previous year. One of the recurrent issues of air pollution in Thailand related to haze in

the northern regions caused by open crop burning and forest fires. These conditions have, however, improved since 2016.

Air pollution in Thailand can be attributed to two main sources, 1) Meteorological factors during the dry season, which result in air stagnation and high air pressure, combining to exacerbate pollution accumulation and 2) Point source pollution, for example, high levels of $PM_{2.5}$ have been found in large cities with heavy traffic, open burning of agricultural materials and industrial areas. PM_{10} has been generated by building and road construction, and SO_2 mainly results from industrial activities, while Volatile Organic Compounds (VOCs) are attributed to gas stations and the use of chemicals and solvents, etc.

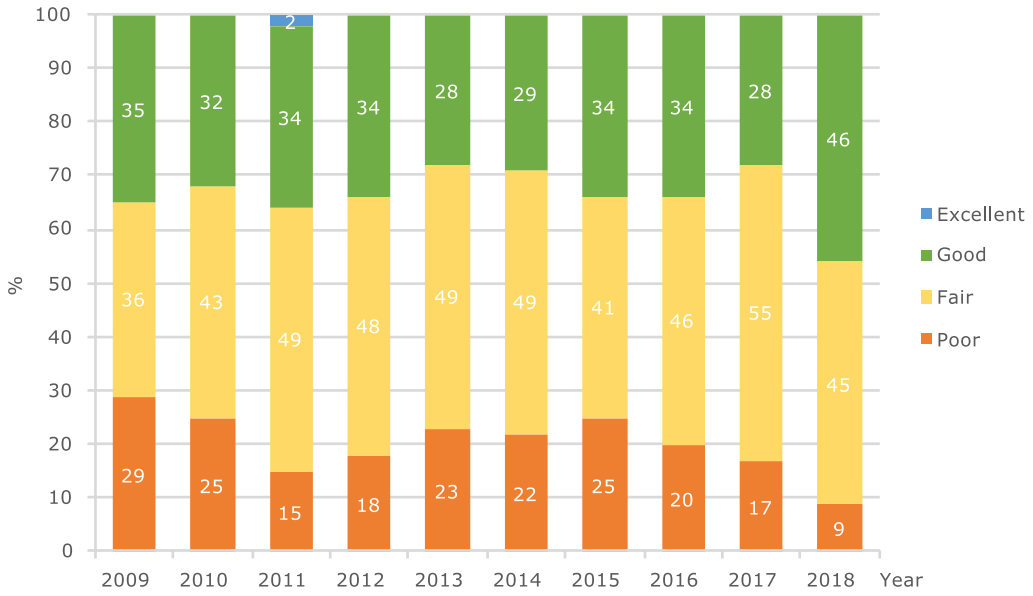
The government has taken a number of actions in order to improve air quality, for example, establishing the 20-Year Master Plan on Air Quality Management (2018-2037), setting up standards for atmospheric air quality and emissions from specific sources of origin, developing a national air quality reporting system for communicating information to Thai citizens and all relevant parties, as well as adopting an air pollution warning system with up-to-date information in order to safeguard public health.

Source: Thailand State of Pollution Report 2018, Pollution Control Department

1.4.2 Water Quality

Although Thailand has abundant groundwater and coastal water resources, surface water sources (such as lakes, rivers, creeks, swamps and canals) are the most well-known and commonly utilized water sources in the country. Water quality indicators generally include color, odor, taste, temperature, potential of Hydrogen (pH), and Biochemical Oxygen Demand (BOD). The status of these three sources of water in Thailand can be summarized as follows:

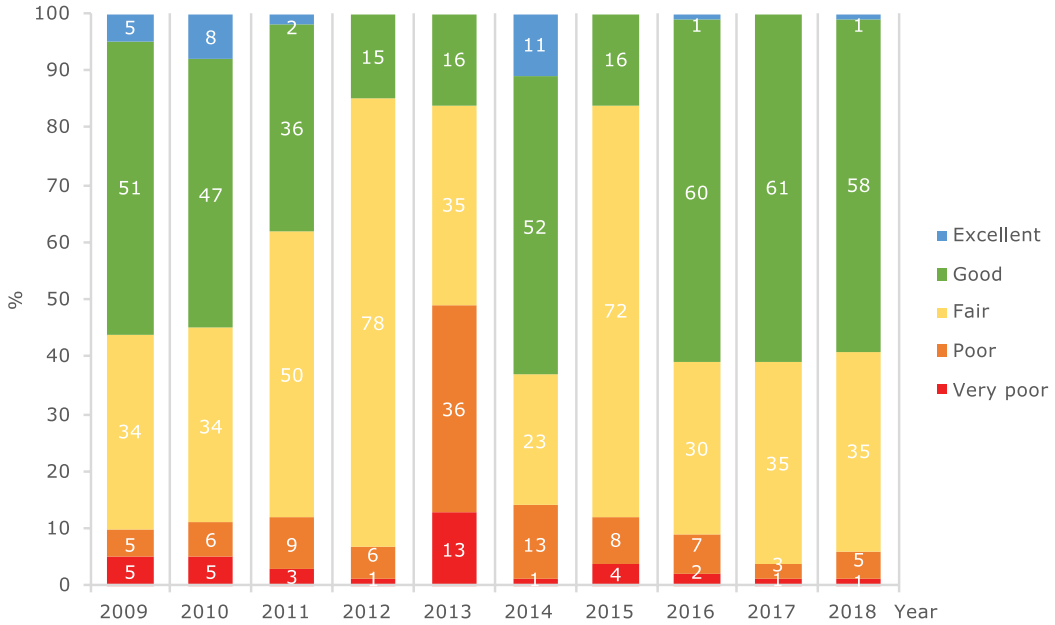
Surface water: Overall surface water quality improved in 2018, remaining within 'fair' and 'good' quality ranges. Some water resource quality decreased, mostly in estuaries in Central Thailand, where municipal, industrial and agricultural waste are focused. The outcome of water quality testing of the country's 59 major rivers and 6 standing water sources showed results of 'good', 'fair' and 'poor' water quality indices in the proportion of 46%, 45% and 9%, respectively. Water quality monitoring in 64 provinces revealed 27 provinces (42%) with good quality, 29 provinces (45%) with fair quality, and 8 provinces (13%) with poor quality. Figure 1-13 shows that within the past 10 years (2009-2018), most water sources have tested at a fair water quality standard. With the exception of 2011 (where 2% of water sources measured 'excellent'), no water source has been measured as either excellent or very poor since 2009.



Source: Thailand State of Pollution Report 2018, Pollution Control Department

Figure 1-13: State of surface water quality 2009-2018

Coastal water: Most of the coastal water quality is either 'good' or 'fair' and the tourist attractive beaches typically have excellent coastal water quality. However, water quality in some coastal areas is defined as poor, especially in the Inner Gulf of Thailand. Coastal water quality in 2018 was measured at 1% excellent, 58% good, 35% fair, 5% poor and 1% very poor. Overall, in the past three years (2016-2018), coastal water quality remained steady at around 60% and has remained within the parameters of either good or excellent quality.



Source: Thailand State of Pollution Report 2018, Pollution Control Department

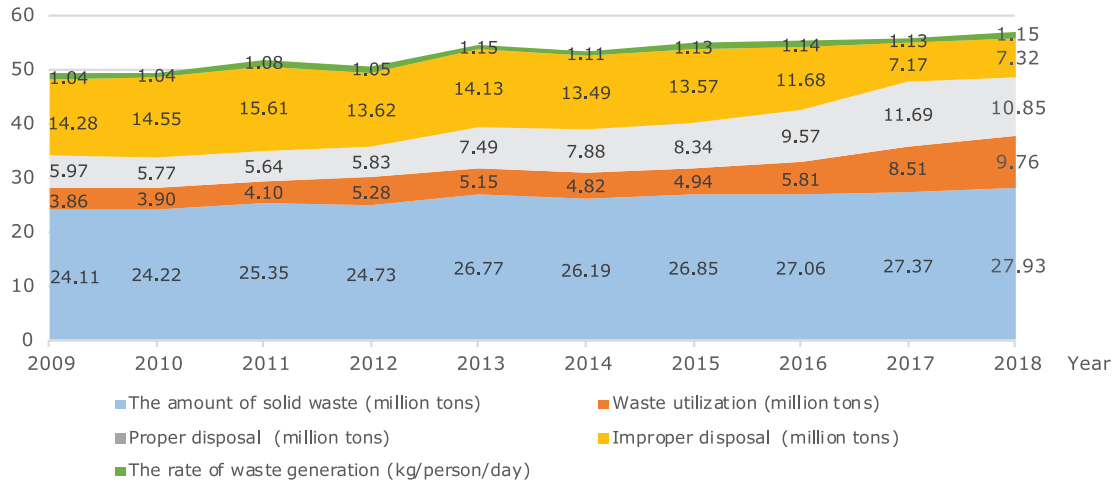
Figure 1-14: State of coastal water quality 2009-2018

Groundwater: There are a total of 27 groundwater basins in the country. The monitoring data of observing changes in groundwater levels and quality from 1,587 sites showed that groundwater quality in Thailand is acceptable for consumption.

The major obstacles to an improvement in water quality are population growth combined with wastewater discharge from pollution sources such as community businesses, industrial factories and agricultural activities. These activities discharge wastewater into national water resources, thereby causing them to fall below required standards. In order to overcome this issue, Thailand has formulated a 20-Year National Water Quality Management Plan (2018-2037), which prioritizes controlling wastewater discharge from these sources.

1.4.3 Waste

The amount of **municipal solid waste** (MSW) generated in 2018 was 27.93 million tons; this is a 2% increase from 2017, and mainly a result of expanding urban communities and the shift from an agricultural to an urban society. Population growth, the increase in tourism, and higher consumption are also compounding factors causing an increase in amounts of solid waste in various areas. Although the amount of solid waste was higher than previous year, solid waste management in 2018 showed improvement. More MSW (9.76 million tons or 35%) was separated at source and re-utilized, marking a 15% increase from 2017. Most of this re-utilization was for recycling and natural fertilizer production. For the remainder of the municipal solid waste, 10.85 million tons (39%) was disposed appropriately, while improper disposal remained an issue, accounting for 7.32 million tons (26%) of waste.



Source: Thailand State of Pollution Report 2018, Pollution Control Department

Figure 1-15: The proportion of solid waste generated, re-utilized, disposed appropriately and disposed inappropriately 2009-2018

The volume of **municipal hazardous waste** generated in 2018 was 638,000 tones – a 3.2% increase from 2017. 65% of this hazardous waste (414,600 tons) was Waste Electrical and Electronic Equipment (WEEE), with the remaining 35% (223,400 tons) consisting of other municipal hazardous waste, such as batteries, dry cell batteries, chemical containers and spray bottles. A municipal hazardous waste management system has been installed, with local administrative organizations and relevant agencies collecting hazardous waste from villages or communities, and then transferring this waste to provincial hazardous waste collection centers. This system allows hazardous waste to be managed and treated properly, and has resulted in a 13% improvement (equal to about 83,600 tons). However, this result is still deficient as there are no regulations to separate hazardous waste from general solid waste. Further regulations are needed to enforce responsibility on the part of the private sector for WEEE management. A draft of the Waste Electrical and Electronic Equipment Management Act was approved by the Council of Ministers on 25 December 2018. In addition to this, the government has created the 20-Year Master Plan on the Prevention and Management of Pollution Caused by Solid and Hazardous Waste (2018-2037). This plan includes a focus on the '3Rs' (reduce, reuse, recycle), circular economy, the Polluter Pays Principle (PPP) and further aims to encourage private sector participation in joint investment (through Public Private Partnership) on waste management.

The amount of **industrial waste** managed by an appropriated treatment in 2018 was 22.02 million tons, which decreased 33% from 2017. From that total amount, the 20.82 million tons is non-hazardous industrial waste, of which 7.2 million tons were used as fuel to generate electric power, and 1.2 million tons were hazardous industrial waste. There are industrial waste treatment and disposal facilities in each region of the country. The highest treatment and disposal capacity are in the East, followed by the Central region, West, Northeast, South and North.

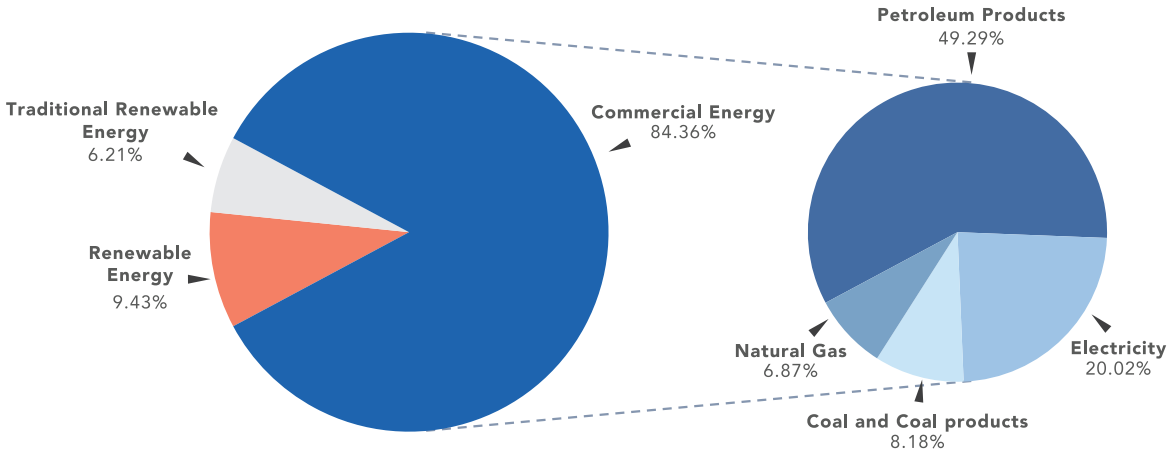
The amount of **infectious waste** in 2018 decreased 4.2% from 57,954 tons in 2017 to 55,497 tons. Most of the infectious waste was generated from public hospitals, private hospitals, private clinics, veterinary clinics and hazardous pathogen laboratories, constituting more than 38,235 locations. 50% of the infectious waste was from public hospitals operated under the Ministry of Public Health and 24% came from private hospitals and clinics. The amount of infectious waste that was treated properly was 49,897.86 tons (89.91%), which most of this waste were eliminated by infectious waste incinerators and autoclaving at the infirmaries themselves. For small clinics, infectious waste is collected and transferred to host hospitals, which acts as disposal centers or hubs for the network.

Source: Thailand State of Pollution Report 2018, Pollution Control Department

1.5 Energy

1.5.1 Energy Consumption

In 2018, the majority of energy consumption was for commercial use, amounting to 70,822 ktoe (84.36% of total). Among the energy sources, petroleum products accounted for the largest proportion of consumption (49.29%), followed by electricity (20.02%), natural gas (6.87%), and coal and coal products (8.18%).



Source: Energy Balance of Thailand 2018, Department of Alternative Energy Development and Efficiency

Figure 1-16: Final energy consumption by fuel type 2018

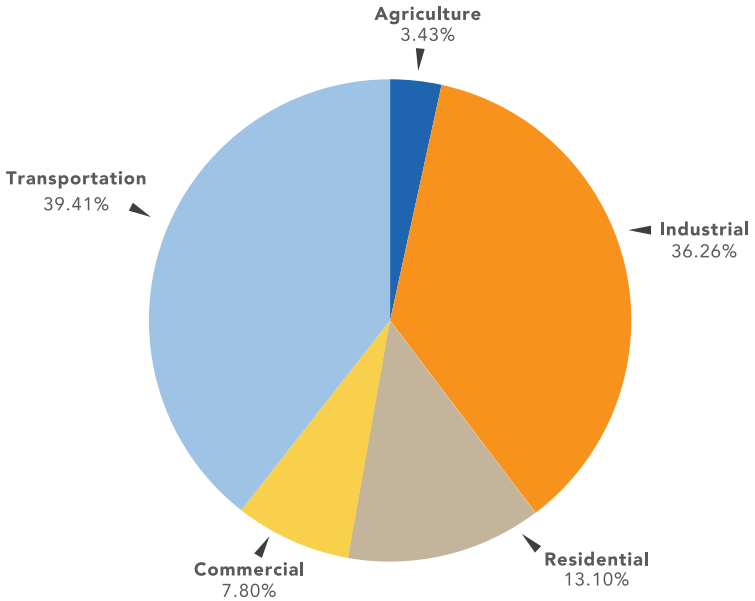
Table 1-3 shows trends for Thailand's final energy consumption by fuel type. In 2018, Thailand's final energy consumption was 83,952 ktoe (a roughly 4% increase from 2017). Commercial renewable energy consumption (from solar, fuel wood, paddy husk, bagasse, agricultural waste, MSW, and biogas) increased in 2018, while traditional renewable energy consumption (from fuel wood, charcoal, paddy husk, and agricultural waste) decreased 2% from the previous year. The largest growth in consumption was from coal and coal products, which increased by 29% in 2018.

Table 1-3: Final energy consumption by fuel type 2016-2018

Final energy consumption by fuel type	Quantity (ktoe)			Growth (%)	
	2016	2017	2018	2017	2018
Final Energy Consumption	79,929	80,752	83,952	1.03	3.96
Commercial Energy	67,296	68,114	70,822	1.22	3.98
• Petroleum Products	39,714	40,501	41,383	1.98	2.18
• Electricity	16,233	16,519	16,805	1.76	1.73
• Coal and Coal Products	5,313	5,327	6,865	0.26	28.87
• Natural Gas	6,036	5,767	5,769	-4.46	0.03
Renewable Energy	7,182	7,322	7,919	1.95	8.15
Traditional Renewable Energy	5,451	5,316	5,211	-2.48	-1.98

Source: Energy Balance of Thailand 2018, Department of Alternative Energy Development and Efficiency

Commercial energy consumption in 2018 was distributed between the following economic sectors: the transportation sector consumed the largest share of energy at 33,086 ktoe, followed by the industrial sector (including manufacturing, mining and construction) at 30,440 ktoe, the residential sector with 11,001 ktoe, the commercial sector with 6,549 ktoe and finally the agricultural sector with 2,876 ktoe.



Source: Energy Balance of Thailand 2018, Department of Alternative Energy Development and Efficiency

Figure 1-17: Share of final energy consumption by economic sectors 2018

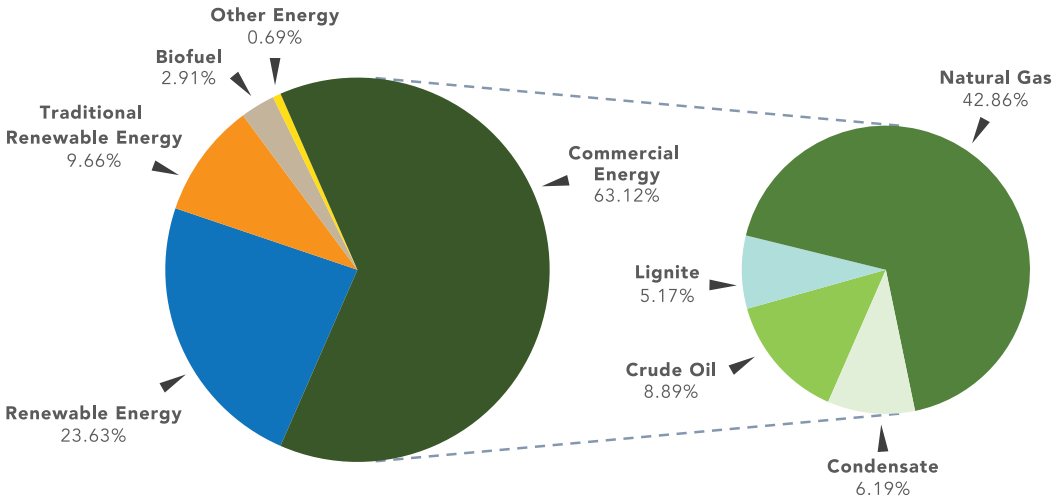
1.5.2 Energy Production

Energy production in 2018 measured 72,609 ktoe, a 2.13% decrease from the previous year (Table 1-4). Commercial energy contributed the largest share of energy production at 45,828 ktoe (63.12% of the total), followed by renewable energy at 17,156 ktoe (23.63%), traditional renewable energy at 7,012 ktoe (9.66%), biofuel at 2,113 ktoe (2.91%), and finally other energy sources (namely black liquor and residual gas) produced 500 ktoe (0.69%) (Figure 1-18). While the production of renewable energy, biofuel and as those in the 'Other Energy' category increased in 2018, production from most commercial energies and traditional renewable energy decreased, contributing to the overall decrease in energy production between 2017 and 2018.

Table 1-4: Energy production by fuel type 2016-2018

Energy Production	Quantity (ktoe)			Growth (%)	
	2016	2017	2018	2017	2018
Total Energy Production	80,298	74,191	72,609	-7.61	-2.13
Commercial Energy	50,144	47,673	45,828	-4.93	-3.87
• Crude Oil	8,124	7,155	6,453	-11.93	-9.81
• Lignite	4,306	4,105	3,756	-4.67	-8.50
• Natural Gas	33,408	31,962	31,122	-4.33	-2.63
• Condensates	4,306	4,491	4,497	4.30	0.13
Renewable Energy*	17,391	15,423	17,156	-11.32	11.24
Traditional Renewable Energy**	10,861	8,646	7,012	-20.39	-18.90
Biofuel	1,682	1,976	2,113	17.48	6.93
Other Energy***	220	473	500	115.00	5.71

** solar, wind, hydro geothermal, fuel wood, paddy husk, bagasse, agricultural waste, MSW and biogas*
*** fuel wood, charcoal, paddy husk and agricultural waste*
**** black liquor and residual gas*



Source: Energy Balance of Thailand 2018, Department of Alternative Energy Development and Efficiency

Figure 1-18: Share of final energy production by fuel type 2018

In 2018, the total amount of energy imported was 83,066 ktoe, with crude oil comprising the largest share at 57.14%. The amount of energy exported was 12,623 ktoe; approximately 86% of which consisted of petroleum products. Over 99% of energy imports and exports occured within the commercial sector, as can be seen in Figure 1-19 and Figure 1-20.

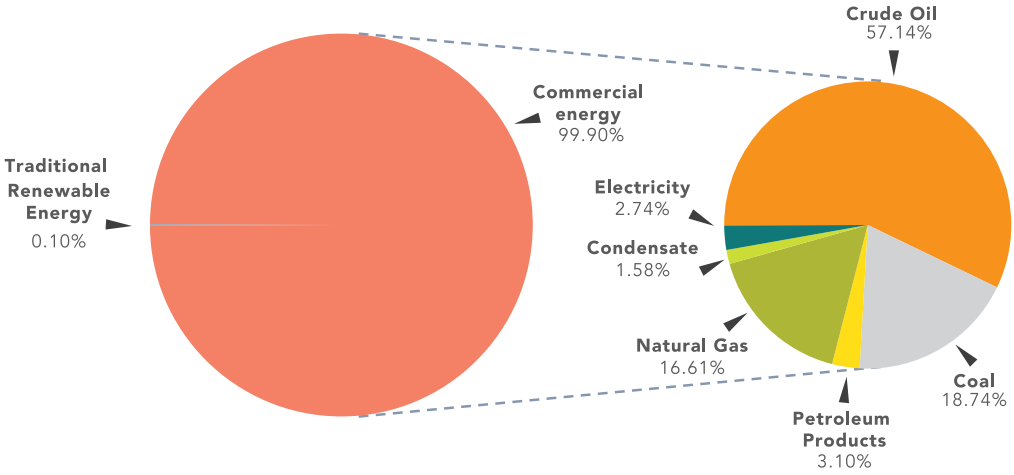
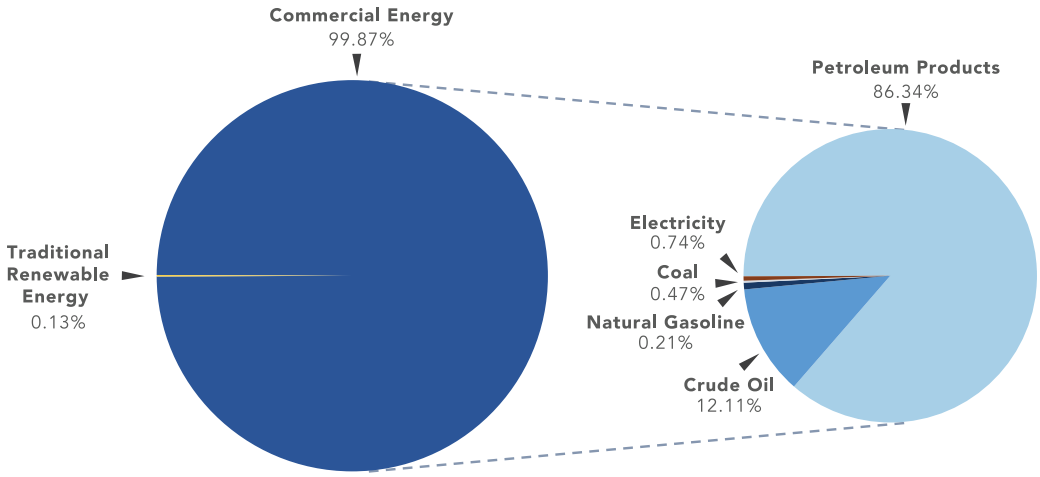


Figure 1-19: Share of imported energy 2018



Source: Energy Balance of Thailand 2018, Department of Alternative Energy Development and Efficiency

Figure 1-20: Share of exported energy 2018

1.5.3 Alternative Energy

Thailand's alternative energy consumption continued to increase between 2013 and 2018. By 2018, Thailand's alternative energy consumption was 12,996 ktoe, an increase of 10.78% from the previous year. Alternative energy consumption from electricity, heat, and biofuel (ethanol and biodiesel) shared 15.5% of the total final energy consumption.

Meanwhile, the total electricity consumption from electrical alternative energy sources (including solar, wind, hydroelectricity, biomass, MSW and biogas) in 2018 was 2,960 ktoe, while heat sources (such as solar, biomass, MSW and biogas) contributed it was 7,919 ktoe. Biofuel consumption constituted 781 ktoe from ethanol and 1,336 ktoe from biodiesel (Table 1-5).

Thailand has formulated The Alternative Energy Development Plan (AEDP) 2015 and an AEDP action plan aiming to promote alternative energy and reduce dependency on energy imports such as oil and natural gas. The overall goal of this plan is to increase the share of renewable energy consumption to 30% by 2036.

Table 1-5: Alternative energy consumption 2016-2018

Alternative Energy Consumption	Quantity (ktoe)			Growth (%)
	2016	2017	2018	2018
1. Electricity* (solar, wind, hydroelectricity, biomass, MSW and biogas)	2,122	2,473	2,960	19.69
2. Heat (solar, biomass, MSW and biogas)**	7,182	7,322	7,919	8.15
3. Biofuel				
• Ethanol	684**	733	781	6.55
• Biodiesel	1,063	1,203	1,336	11.06
Total	11,051	11,731	12,996	10.78

** including electricity generated for own use (off grid)*
*** the net calorific value calculation has been changed from gasoline to ethanol*
Source: Energy Balance of Thailand 2018, Department of Alternative Energy Development and Efficiency

Overall, the key achievements on energy development targeting indicators for SDG 7 – ensure access to affordable, reliable, sustainable, and modern energy for all, focused on three areas:

- *Access to energy:* Thailand has made significant progress in access to electricity from 82.1% in 2000 to 99.77% in 2017. The Thai Government's ultimate goal is to ensure that 99.99% of the population will have access to electricity.

- *Uptake in renewable energies:* Thailand aims to increase the percentage of renewable energy in gross final consumption to 24.08 % by 2030. In December 2017, renewable energy constituted 14.49% of gross final consumption.
- *Improve energy efficiency:* Thailand's Government aims to reduce Energy Intensity (EI) by 30% by 2036 compared to levels from 2010. In 2017, EI was 7.77 ktoe[3] per billion THB.

Source: Thailand's Voluntary National Review on the Implementation of the 2030 Agenda for Sustainable Development 2018, Ministry of Foreign Affairs

1.6 Current State of the National Economy

1.6.1 Economic Profile

Thailand's economy has been developed under the 12th National Economic and Social Development Plan (2017-2021), which adhered to the 20-Year National Strategy Framework (2017-2036), a commitment to the SDGs, a philosophy of Sufficiency Economy, the Thailand 4.0 Policy, and other reform agendas. In order to set out development directions and strategies to achieve the objectives of "Security, Prosperity, and Sustainability", the Thailand 4.0 Policy lays out a long-term vision to shift the country's economy from a heavy manufacturing to be a high-value-added and innovation-driven economy. Thailand 4.0 will develop a knowledge-based economy by encouraging creativity, innovation, science, technology and research and development, aiming to increase the added value in the technology sector and other targeted industries. One of the strategies to support the Thailand 4.0 roadmap is the Eastern Economic Corridor (EEC), launched in 2017. The EEC is expected to enhance Thailand's competitiveness as it is located in the potential area suitable for being a regional economic center.

Thailand is regarded as a mix-typed economy, constituting agriculture, industry, tourism, service and natural resources. The Thai economy expanded by 4.1% in 2018, up from 4.0% the year prior, which was the highest expansion rate in the past 6 years. Export value grew by 7.7% while private consumption and total investment grew by 4.6% and 3.8%, respectively. Headline inflation averaged at 1.1% and the Current Account to Gross Domestic Product (GDP) recorded a surplus of 7.4%.

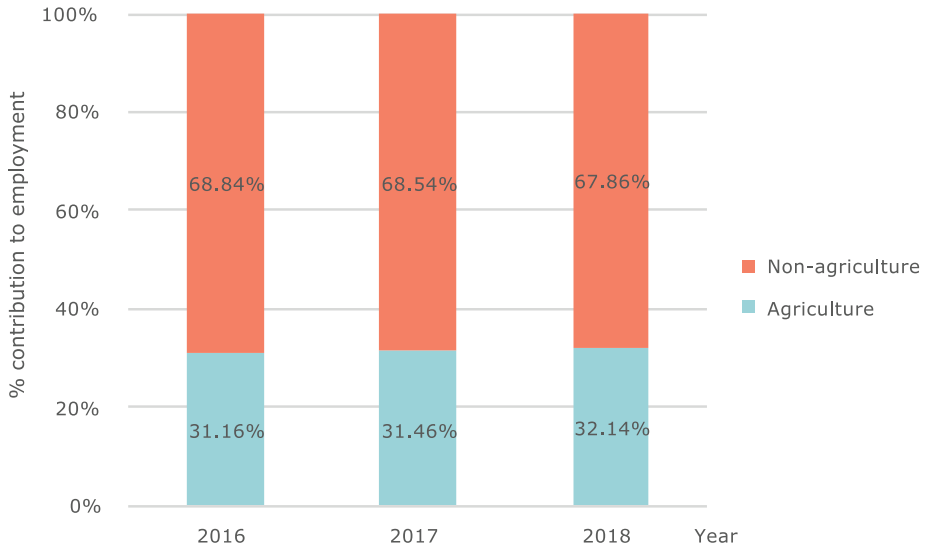
Table 1-6: Thailand's economic indicators

Indicators	2016	2017	2018
Growth in Real GDP	3.3	4.0	4.1
Investment	2.8	1.8	3.8
• Private	0.5	2.9	3.9
• Public	9.5	-1.2	3.3
Private Consumption	3.0	3.0	4.6
Government Consumption	2.2	0.1	1.8
Export of Goods	0.1	9.8	7.7
• Volume	0.5	6.0	4.2
Import of Goods	-5.1	13.2	14.3
• Volume	-2.5	7.2	8.2
Current Account to GDP (%)	11.7	11.0	7.4
Inflation (%)	0.2	0.7	1.1

Source: NESDC Economic Report and National Income of Thailand 2018, Office of the National Economic and Social Development Council

1.6.2 Agriculture

In 2018, overall agricultural production expanded by 5.5%, accelerating from 4.7% in 2017. This was propelled by annual crops, perennial crops, livestock, and agricultural services with a growth of 6.7%, 5.3%, 2.5%, and 2.9%, respectively, together with a rise of 2.4% and 5.3% expansion of forestry and fishing production. Prices of agricultural products in 2018 decreased by 3.1%, in contrast to a 0.4% increase the previous year. The contribution of agriculture to Thailand's GDP remained relatively constant between 2016-2018 (8.5%, 8.4% and 8.1%, respectively). Although the agricultural sector only contributes around 8% of the country GDP, it accounts for over 30% of total employment in Thailand. The agriculture and food security are essential to support an increasing of population growth and has high impact on the quality of life of Thai citizen. Sustainable farming that strengthens ecological immunity and approaches to reducing GHG emissions will help to ensure the stability of livelihoods that rely on agricultural management amid the climate change crisis, especially in commercial scale agriculture which would benefits the national economy.



Source: 1) Office of the National Economic and Social Development Council 2) World Bank

Figure 1-21: Agriculture and Non-agriculture contribution to employment

1.6.3 Tourism

According to the 2018 Tourism Satellite Account (TSA), the tourism industry has continued to play an important role in Thailand 's economy, generating around 15% of GDP and providing 10.9% of total employment (equating to 4,154,947 jobs). Average annual expenditure of domestic and overseas tourists over the past 10 years was approximately 2.116 trillion Baht. In regard to tourism management, Thailand has integrated the concept of sustainable tourism into its local socio-cultural context namely traditions, cultures, beliefs as well as communities' livelihood and needs that could contribute economic benefits equally to both public and private sectors.

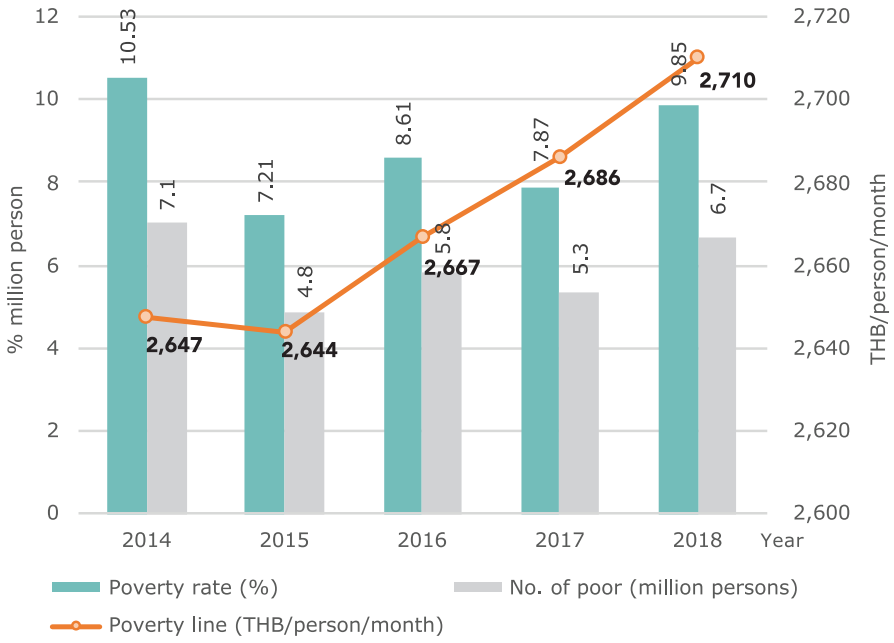
Table 1-7: Economy impact generated by tourism

Economy impac	2017	2018
Tourism Expenditure (trillion THB)	2.855	2.984
Tourism GDP (trillion THB)	2.780	2.907
Tourism GDP/ Total GDP (%)	17.95	17.76
Tourism Direct GDP/ Total GDP (%)	7.32	7.25
Tourism Indirect GDP/ Total GDP (%)	10.63	10.51
Total Employment in Tourism Sector (person)	4,318,297	4,393,294
Tourism Employment/Total Employment (%)	11.53	11.60

Source: Ministry of Tourism and Sports

1.6.4 Poverty and Inequality

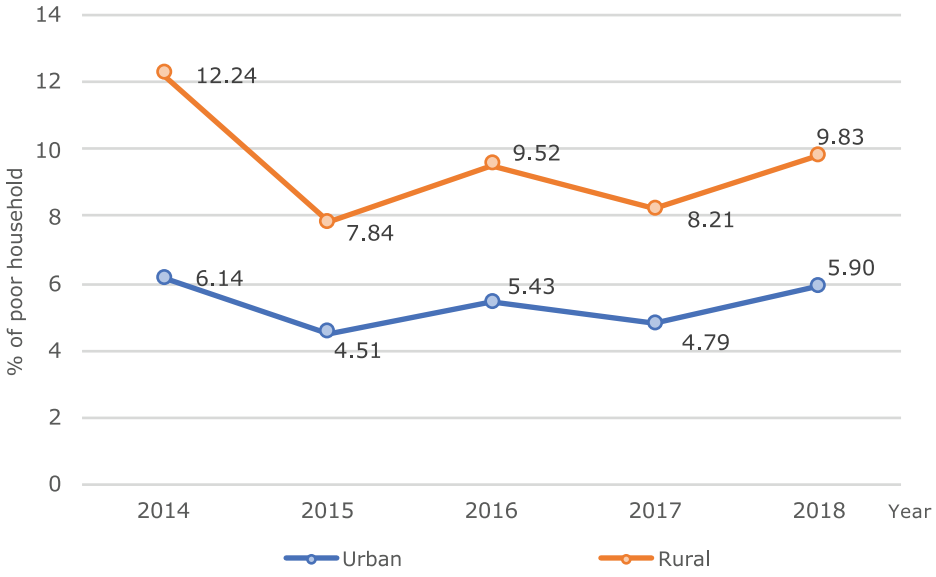
Between 2015 and 2018, Thailand's poverty line increased from 2,644 to 2,710 THB per person per month. The poverty rate, or the percentage of people living under the poverty line, has fluctuated from 2016 onwards. The number of poor people in 2018 increased by almost 1.5 million, or 2.1% of the total population, compared with rates from 2017.



Source: Office of the National Economic and Social Development Council

Figure 1-22: Poverty line, poverty rate and number of poor 2014-2018

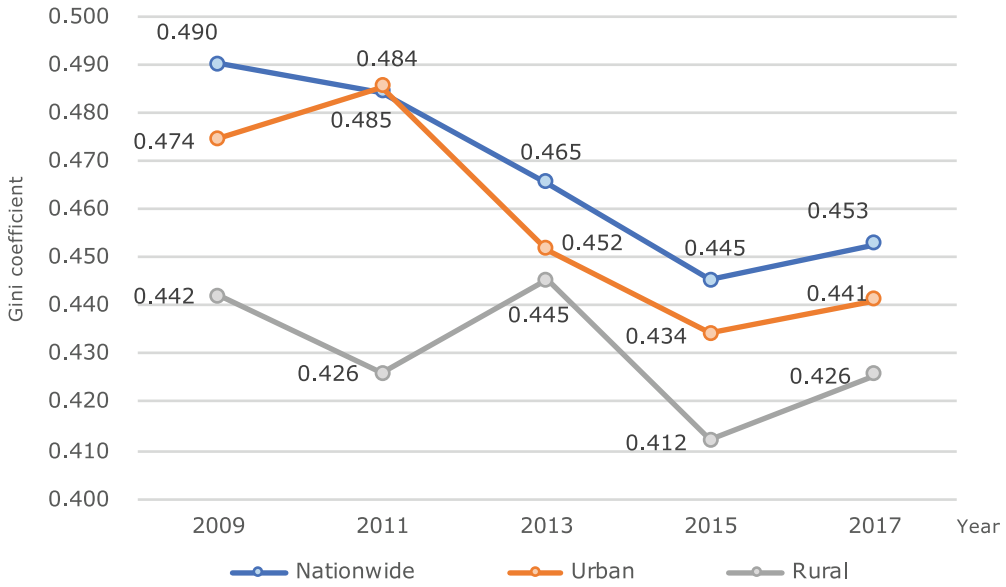
As Figure 1-23 shows, poverty is more concentrated in rural, as opposed to urban areas according to the higher percentage of poor households living in rural. Although the gap between the proportion of households in poverty in rural and urban areas has overall decreased, as of 2018 there remained a difference of over 3% between these groups.



Source: Office of the National Economic and Social Development Council

Figure 1-23: Inequality of poor household between urban and rural areas 2014-2018

As the Gini coefficient has fallen from 0.490 in 2009 to 0.445 in 2015, income inequality is considered to be moderate and improving, although this figure did increase slightly in 2017. Inequality in urban areas was found to be typically higher than that of rural areas but was not significantly different to levels from 2013. In 2017, the Gini coefficient was 0.441 in urban areas and 0.426 in rural areas.



Remark: The Gini coefficient is a tool for measuring inequality, where the value is between 0 and 1. The closer the value is to 1, the greater the income inequality.

Source: Office of the National Economic and Social Development Council

Figure 1-24: Biennial Gini coefficient in Thailand, showing urban, rural and national levels 2009-2017

In terms of the national economic status in relation to economic growth and inequality, the progress made towards SDGs are as follows:

- SDG 8 – Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all: Thailand has been able to keep an extremely low unemployment rate at less than 1% for the population for both sexes aged above 15. Fatal occupational injuries among employees have been reduced from 11.3 per 100,000 employees in 2000 to 6.84 per 100,000 employees in 2014. Likewise, nonfatal occupational injuries have decreased significantly from 925.1 per 100,000 employees in 2000 to 321.13 per 100,000 employees in 2014.
- SDG 10 – Reduce Inequality within and among countries: Thailand has been able to reduce the proportion of people living below 50% of median income from 15% in 2006 to 11% in 2016. The country has also either partially or fully met migration policies in the domains outlined by the United Nations in order to facilitate the orderly, safe, regular, and responsible migration and mobility of people.

Source: 1) Thailand's Voluntary National Review on the Implementation of the 2030 Agenda for Sustainable Development 2018, Ministry of Foreign Affairs 2) United Nations Global SDG Indicators Database

1.7 Institutional Arrangements

1.7.1 National Committee on Climate Change Policy (NCCC)

Thailand established the National Committee on Climate Change Policy (NCCC). The NCCC is chaired by the Prime Minister and has members from both the public and private sectors, including experts from relevant agencies. The NCCC has a mandate to define national climate policies and establish guidelines and mechanisms for international collaboration regarding conventions and protocols on climate change, including support and evaluate domestic relevant agencies to be in accordance with the national established policies and plans.

The NCCC is composed of 5 subcommittees, 1) Subcommittee on Climate Change Policy and Planning Integration, 2) Subcommittee on Climate Change Knowledge and Database, 3) Subcommittee on Climate Change Negotiation and International Cooperation, 4) Subcommittee on Public Relations and Actions for Climate Empowerment and 5) Subcommittee on Climate Law (recently added in 2019). Figure 1-25 shows the institutional arrangements of Thailand's NCCC.

National Committee on Climate Change Policy (NCCC)	
Chairperson	Prime Minister
1st Vice-Chairperson	Minister of Natural Resources and Environment
2nd Vice-Chairperson	Minister of Foreign Affairs
Committee members: *Permanent Secretary of;* 1. Prime Minister's Office 2. Ministry of Finance 3. Ministry of Foreign Affairs 4. Ministry of Tourism and Sports 5. Ministry of Transport 6. Ministry of Digital Economy and Society 7. Ministry of Energy 8. Ministry of Commerce 9. Ministry of Interior 10. Ministry of Labor 11. Ministry of Education	12. Ministry of Public Health 13. Ministry of Industry 14. Ministry of Agriculture and Cooperatives 15. Ministry of Higher Education, Science, Research and Innovation 16. Bangkok Metropolitan Administration 17. Secretary-General, Office of the National Economic and Social Development Council 18. Secretary-General, Office of the National Water Resources 19. Director, Bureau of Budget 20. 5-9 Experts on law, economics, environment, science and technology, energy or climate change 21. 1 expert from private sector
Secretariat: Permanent Secretary, MONRE	Assistant secretary: Secretary-General of ONEP Assistant secretary: Director of Thailand Greenhouse Gas Management Organization (TGO)
Subcommittee on Climate Change Policy and Planning Integration	**Subcommittee on Climate Change Knowledge and Database**
Subcommittee on Climate Change Negotiation and International Cooperation	**Subcommittee on Action for Climate Empowerments and Public Relations**
Subcommittee on Climate Law	

Source: Office of Natural Resources and Environmental Policy and Planning (ONEP)

Figure 1-25: Structure of the National Committee on Climate Change Policy

The Subcommittee on Climate Change Policy and Planning Integration is responsible to provide input on policy integration, strategy and planning linked with climate mitigation and adaptation; provide suggestions on mechanisms and measures, such legal regulations and financial measures; and push forward an integrated budget allocation system on climate change.

The Subcommittee on Climate Change Knowledge and Database is responsible to provide comments on the country report under the agreement of UNFCCC; support the development of the GHG inventory; provide suggestions on the development of databases and climate change knowledge in the areas of mitigation, adaptation and Measurement, Reporting and Verification (MRV) systems.

The Subcommittee on Climate Change Negotiation and International Cooperation is responsible to provide recommendations on Thailand's positions for negotiations on climate change under multilateral agreements and other international frameworks; prepare and develop knowledge and data in relation to international negotiations on climate change; provide guidance in international aspects of climate change implementation and the composition of Thailand's delegation for international negotiation on climate change.

The Subcommittee on Action for Climate Empowerments and Public Relations is responsible to publicize news and knowledge on the causes, impacts, and solutions related to climate change under the Paris Agreement, Thailand's NDC targets and the SDGs. This committee also works to promote and support activities related to climate change by conducting training, raising awareness and implementing capacity building across all sectors.

The Subcommittee on Climate Law is responsible to provide comments on policies for the development, improvement, cancellation or amendment of laws related to climate change according to the NCCC; to arrange and propose draft laws, rules, regulations, or notifications; provide legal opinions on tackling issues related to climate change; and finally to provide advice on the enforcement of laws related to national climate change.

1.7.2 Institutional Arrangements of National Greenhouse Gas Inventory

Calculations of the national GHG inventory for the purposes of reporting in the Third Biennial Update Report (TBUR) have been made in accordance with 2006 IPCC Guidelines for National Greenhouse Gas Inventories. The key components in estimating GHG emissions are activity data and emission factors. Activity data is sourced from a collaboration between the Office of Natural Resources and Environmental Policy and Planning (ONEP) and lead agencies of the following 5 sectors.

1) Energy: led by the Energy Policy and Planning Office (EPPO) and the Office of Transport and Traffic Policy and Planning (OTP)
2) IPPU: led by the Department of Industrial Works (DIW)
3) Agriculture: led by the Office of Agricultural Economics (OAE)
4) LULUCF: led by Department of National Parks, Wildlife and Plant Conservation (DNP)
5) Waste: led by the Pollution Control Department (PCD).

After these lead agencies have collected activity data according to ONEP's required template from relevant agencies responsible for data collection (e.g., agencies under their supervisors, local government, and the private sector), ONEP will verify the data to be used for the GHG inventory by using the Thailand Greenhouse Gas Emission Inventory System (TGEIS). Results will then be interpreted into graphs and tables according to reporting format laid out by UNFCCC. Results from TGEIS will then be submitted to 5 working groups, comprising appointed representatives of the 5 sectors outlined above. Each working group then reviews the methodology of the GHG emission estimation as part of quality control (QC) to ensure that GHG emission estimates for their sectors are valid, accurate, and complete. Following this, the GHG inventories of the 5 sectors are submitted to the Climate Change Knowledge and Database Subcommittee for verification.

Finally, as Secretariat of the NCCC, ONEP will submit the final GHG inventories as part of the BUR to the NCCC for approval before submission to UNFCCC. For a complete list of the sub-sectoral support agencies under each leading sector, please see Figure 1-27.

The lead agencies and their responsibility in reporting data activity are as follows:

Energy: EPPO and OTP are the 2 lead agencies, responsible for gathering the data from relevant agencies within the Ministry of Energy, the Ministry of Transport and others. the activity data used for GHG emissions calculations are derived from fossil fuel/ electricity consumption used in different activities.

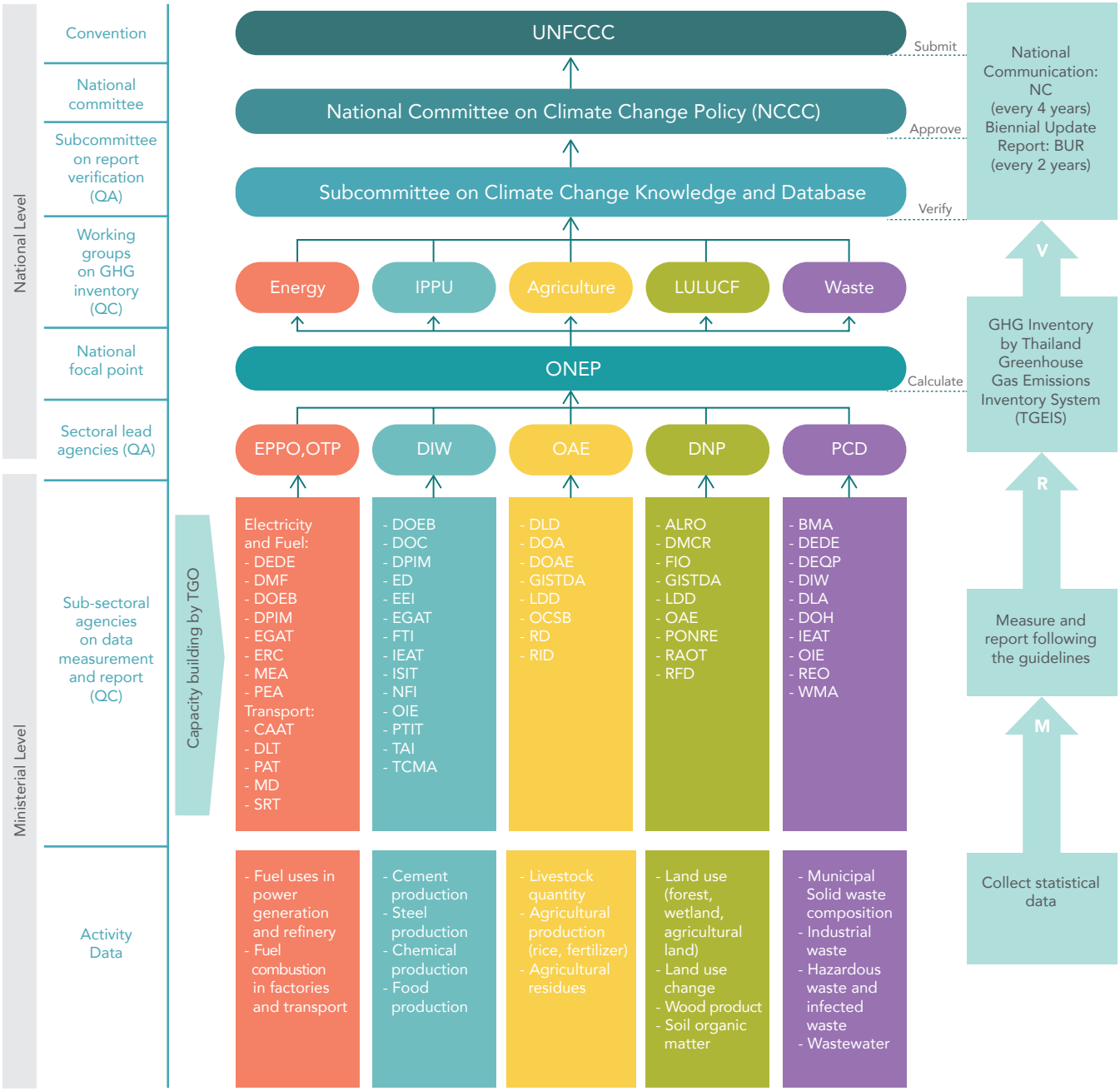
Industrial Processes and Product Use (IPPU): DIW is the lead agency, responsible for gathering the data from relevant agencies within Ministry of Industry and others. The activity data used for GHG emissions calculations are production volume, import volume and export volume in each industry group.

Agriculture: OAE is the lead agency, responsible for gathering the data from relevant agencies within the Ministry of Agriculture and Cooperatives and others. The activity data used for GHG emissions calculations are derived from livestock farming, rice cultivation, agricultural soils, field burning and open burning of agricultural residues.

Land Use, Land-Use Change and Forestry (LULUCF): DNP is the lead agency, responsible for gathering the data from relevant agencies within the Ministry of Natural Resources and Environment (MONRE) and others. The activity data used for GHG emissions calculations are derived from land use, land use change and wood product.

Waste: PCD is the lead agency, responsible for gathering the data from relevant agencies within the MONRE and others. the activity data used for GHG emissions calculations are derived from sources of waste, waste production rate, waste composition, wastewater volume, including Emission Factors.

Source: Office of Natural Resources and Environmental Policy and Planning (ONEP)



ALRO	= Agricultural Land Reform Office	GISTDA	= Geo-Informatics and Space Technology Development Agency
BMA	= Bangkok Metropolitan Administration	IEAT	= Industrial Estate Authority of Thailand
CAAT	= The Civil Aviation Authority of Thailand	ISIT	= Iron and Steel Institute of Thailand
DEDE	= Department of Alternative Energy Development and Efficiency	LDD	= Land Development Department
DEQP	= Department of Environmental Quality Promotion	MD	= Marine Department
DIW	= Department of Industrial Works	MEA	= Metropolitan Electricity Authority
DLD	= Department of Livestock Development	NFI	= National Food Institute
DLA	= Department of Local Administration	OAE	= Office of Agricultural Economics
DLT	= Department of Land Transport	OCSB	= Office of the Cane and Sugar Board
DMCR	= Department of Marine and Coastal Resources	OIE	= The Office of Industrial Economics
DMF	= Department of Mineral Fuels	OTP	= The Office of Transport and Traffic Policy and Planning
DNP	= Department of National Parks, Wildlife and Plant Conservation	PAT	= Port Authority of Thailand
DOA	= Department of Agriculture	PCD	= Pollution Control Department
DOC	= Department of Customs	PEA	= Provincial Electricity Authority
DOAE	= Department of Agricultural Extension	PONRE	= Provincial Offices of Natural Resources and Environment
DOEB	= Department of Energy Business	PTIT	= Petroleum Institute of Thailand
DOH	= Department of Health	RAOT	= Rubber Authority of Thailand
DPIM	= Department of Primary Industries and Mines	RD	= Rice Department
ED	= The Excise Department	REO	= Regional Environment Office
EEI	= Electrical and Electronics Institute	RID	= Royal Irrigation Department
EGAT	= Electricity Generating Authority of Thailand	RFD	= Royal Forest Department
EPPO	= Energy Policy and Planning Office	SRT	= State Railway of Thailand
ERC	= Energy Regulatory Commission	TAI	= Thailand Automotive Institute
FIO	= Forest Industry Organization	TCMA	= Thai Cement Manufacturers Association
FTI	= The Federation of Thai Industries	WMA	= Wastewater Management Authority

Source: Office of Natural Resources and Environmental Policy and Planning (ONEP)

Figure 1-26: Structure of Thailand's Greenhouse Gas Inventory processes

1.7.3 The Institutional Arrangements of Domestic MRV System

To monitor the implementation progress of the NAMA Roadmap, Thailand has developed a domestic MRV system, which operates according to the following structure:

National level:

- *The working groups on GHG inventory and mitigation measures* is responsible for 1) selecting appropriate measures/policies for monitoring and evaluation (M&E) of GHG emissions reduction, identifying Coefficient/Emission Factors, and implementing MRV processes for activity data, and 2) reviewing and providing feedback on the GHG emissions reduction report.

- *Subcommittee on Climate Change Knowledge and Database* is responsible for further approval on the pre-approved report submitted from sectoral level.

- *National Committee on Climate Change Policy (NCCC)* is responsible for the final approval on the GHG emissions reduction report which will later be included in national reports, the Biennial Update Report (BUR) and National Communication (NC).

Sectoral level:

- *The main agencies at the sectoral level* is responsible for the verification of the following key data and approaches after the finalization by the working groups on GHG inventory and mitigation measures as follows: 1) the appropriate measures/policies for M&E of GHG emissions reduction, 2) the methodology for calculation GHG emissions reduction, 3) MRV process for activity data, and 4) the final results and GHG emissions reduction report.

The structure of the domestic MRV system is shown in Figure 1-27.

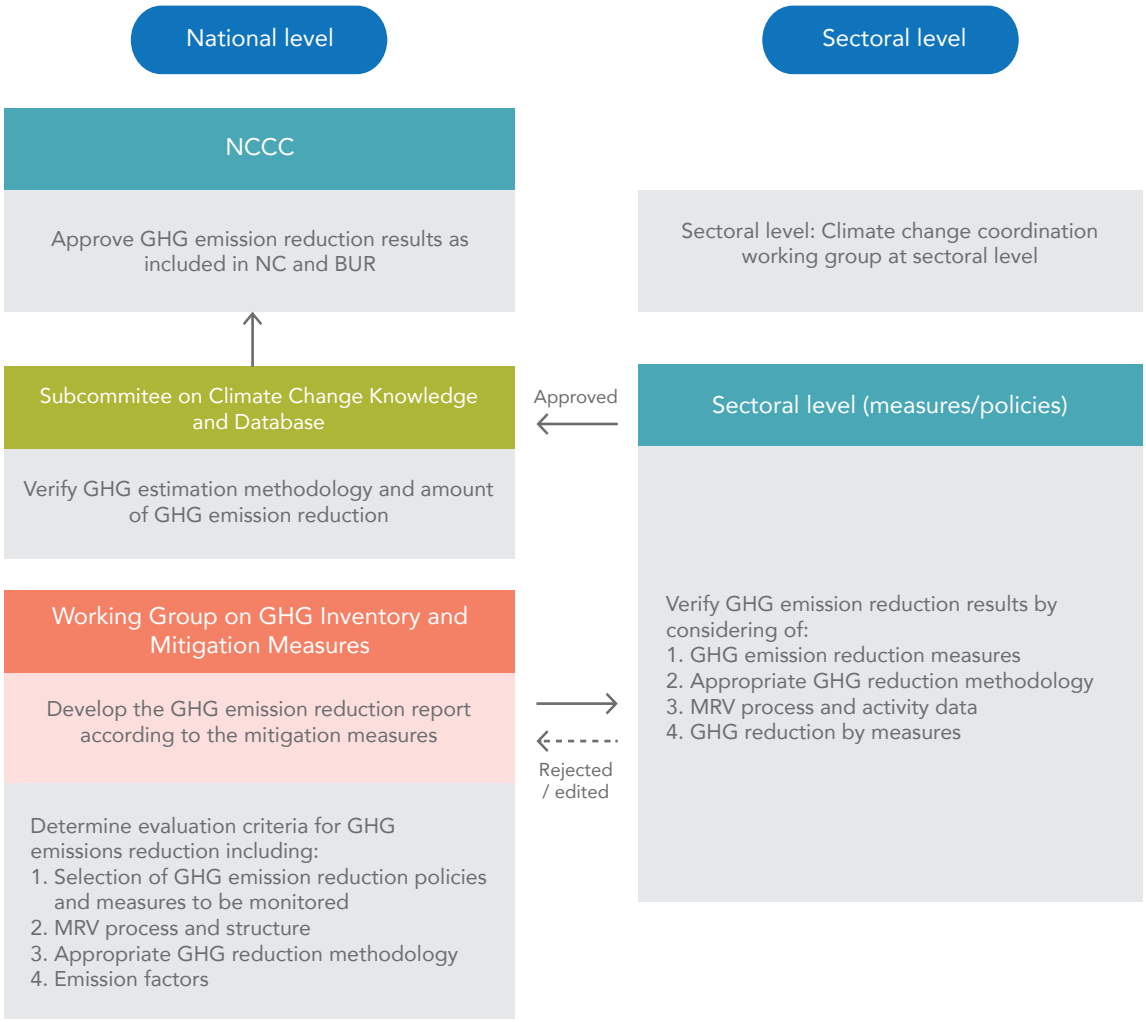


Figure 1-27: The structure of domestic MRV system

CHAPTER 2

NATIONAL GREENHOUSE GAS INVENTORY

CHAPTER 2: NATIONAL GREENHOUSE GAS INVENTORY

The national GHG inventory reported in this TBUR have been made in accordance with 2006 IPCC Guidelines for National Greenhouse Gas Inventories and the developed TGEIS, which TGIES is an information system designed to enhance the national GHG inventory.

In 2016, total GHG emissions (excluding those from LULUCF) were 354,357.61 $GgCO_2eq$ and Net GHG emissions were 263,223.46 $GgCO_2eq$. (including those from LULUCF).

The Energy sector has been the largest contributor to Thailand's GHG emission, accounting for 71.65% of total GHG emissions. While emissions from the Agriculture, IPPU and Waste sectors account for 14.72%, 8.90% and 4.73%, respectively. LULUCF sector contributed to a net removal of 91,134.15 $GgCO_2eq$, showing a trend of increased net removals as total removals exceeded total emissions.

Overall, Thailand's greenhouse gas (GHG) emissions represent less 1% of global emissions and lower than world average.

2.1 Inventory Process in Thailand

Thailand's GHG inventory was developed and submitted according to the UNFCCC Article 4.1(a) of the Convention in accord with Article 12: national inventories of anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol. The inventory report was prepared using the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (referred to as the 2006 IPCC Guidelines), and presented Thailand's national GHG emissions from 2000 to 2016 by sources, and removals by sinks. The GHG emissions estimated in this report include both direct emissions (carbon dioxide, methane, and nitrous oxide) and indirect emissions (nitrogen oxides, carbon monoxide, non-methane volatile organic compounds, and sulfur dioxide).

2.1.1 Transition to 2006 IPCC Guidelines and TGEIS

Previously, ONEP had coordinated and worked with sectoral lead agencies to compile GHG inventory data for five sectors according to the Revised 1996 Guidelines for National Greenhouse Gas Inventories (referred to as the 1996 IPCC Guidelines) without a proper supporting tool for GHG inventory development.

At present, TGEIS: Thailand Greenhouse Gas Emissions Inventory System, a tool to support robust and clear national inventory system governance and institutional arrangements, has been used in the process of calculating the national GHG inventory for Thailand.

TGEIS is designed to produce timely, high quality and transparent greenhouse gas emissions data by using primarily on 2006 IPCC Guidelines for National Greenhouse Gas Inventories (referred to as the 2006 IPCC Guidelines) and Thailand's own country context. Basically, ONEP remains the coordination and work with sectoral lead agencies, however, all activity data and supplementary information have been collected through the MRV system by sectoral lead agencies. Then, the data will be entered and transferred to TGEIS by ONEP, as TGEIS authorized user, for the assessment of national GHG emissions and also recalculated historical data of GHG emissions from 2000-2013 from the Second BUR (SBUR), to report in this Third Biennial Update Report.

2.1.2 Methodology for GHG Emissions and Removals Calculation

Overall, this GHG inventory report has improved on the previous submission. All of the methodologies and tools used for GHG inventory reporting followed 2006 IPCC Guidelines, LULUCF Good practice guidance for Land Use, Land-Use Change and Forestry (referred to as GPG 2003), as well as the IPCC's 2000 Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories (referred to as GPG 2000).

Either Tier 1 or Tier 2 methodologies were applied wherever activity data and country-specific emission factors were available. Tier 1 methodologies were employed for all activity data in the Energy sector, and almost all in Industrial Processes and Product Use (IPPU) sector. Tier 2 was adopted in most categories under the Agriculture, Forest and Other Land Use (AFOLU), and Waste sectors, in addition to some categories under the IPPU sector. GHG emissions from the Energy and IPPU sectors were calculated using default emission factors provided in 2006 IPCC Guidelines.

Country specific emission factors were used for some sub-sectors of the Waste and AFOLU sectors, when available. Global Warming Potential (GWP) was recommended for data on aggregated GHG emissions and removal, expressed in CO_2 equivalents (CO_2eq). The use of GWP was provided by the IPCC in its Fourth Assessment Report (2007 IPCC GWP Values) based on the effects of GHGs over a 100-year time horizon.

Table 2-1: Summary of methods and emission factors

GHG source and sink categories	CO_2		CH_4		N_2O		NO_x		CO		NMVOCs		SO_2		HFCs		PFCs		SF_6	
	Method applied	Emission factor	Method applied	Emission factor	Method applied	Emission factor	Method applied	Emission factor	Method applied	Emission factor	Method applied	Emission factor	Method applied	Emission factor	Method applied	Emission factor	Method applied	Emission factor	Method applied	Emission factor
1. Energy	T1	D	T1	D	T1	D	T1	D	T1	D	T1	D	T1	D						
1A Energy Combustion Activities	T1	D	T1	D	T1	D	T1	D	T1	D	T1	D	T1	D						
1A1 Energy Industries	T1	D	T1	D	T1	D	T1	D	T1	D	T1	D	T1	D						
1A2 Manufacturing Industries and Construction	T1	D	T1	D	T1	D	T1	D	T1	D	T1	D	T1	D						
1A3 Transport	T1	D	T1	D	T1	D	T1	D	T1	D	T1	D	T1	D						
1A4 Other Sectors	T1	D	T1	D	T1	D	T1	D	T1	D	T1	D	T1	D						
1B Fugitive Emissions from Fuel			T1	D																
1B1 Solid Fuels			T1	D																
1B2 Oil and Natural Gas			T1	D																
1C Carbon dioxide Transport and Storage																				
1C1 Transport of CO_2																				
1C2 Injection and Storage																				
1C3 Other																				
2. Industrial Processes and Product Use	T1, T2	D	T1	D	T1	D	T1	D	T1	D	T1	D	T1	D						
2A Mineral Industry	T1, T2	D	T1	D	T1	D	T1	D	T1	D	T1	D	T1	D						
2A1 Cement Production	T1, T2	D																		
2A2 Lime Production	T1	D																		
2A3 Glass Production	T1	D																		
2A4b Other Uses of Soda Ash	T1	D																		
2A4d Other	T1	D																		
2B Chemical Industry	T1	D	T1	D	T1	D														
2C Metal Production																				
2C1 Iron and Steel Production	T1	D																		
2D Non-Energy Products from Fuels and Solvent Use																				
2D1 Lubricant Use	T1	T1																		
2H Other							T1	D	T1	D	T1	D	T1	D						
2H1 Pulp and Paper Industry							T1	D	T1	D	T1	D	T1	D						
2H2 Food and Beverages Industry											T1	D								

Table 2-1: Summary of methods and emission factors (cont'd)

GHG source and sink categories	CO_2		CH_4		N_2O		NO_x		CO		NMVOCs		SO_2		HFCs		PFCs		SF_6	
	Method applied	Emission factor	Method applied	Emission factor	Method applied	Emission factor	Method applied	Emission factor	Method applied	Emission factor	Method applied	Emission factor	Method applied	Emission factor	Method applied	Emission factor	Method applied	Emission factor	Method applied	Emission factor
3. Agriculture	T1	D	T1, T2	CS, D	T1, T2	D	T1	D	T1	D										
3A Enteric Fermentation			T1, T2	CS, D																
3B Manure Management			T1, T2	CS, D	T2	D														
3C Field Burning of Agriculture Residues			T1	D	T1	D	T1	D	T1	D										
3D Liming	T1	D																		
3E Urea Fertilization	T1	D																		
3F Direct N_2O Emission from Managed Soils					T1	D														
3G Indirect N_2O Emission from Managed Soils					T1	D														
3H Indirect N_2O Emission from Manure Management					T2	D														
3I Rice Cultivation			T2	CS																
4. Land Use, Land-Use Change and Forestry (LULUCF)	T1, T2	CS, D	T1, T2	CS, D	T1, T2	CS, D	T1, T2	CS, D	T1, T2	CS, D										
4A Forest Land Remaining Forest Land	T1, T2	CS, D																		
4B Cropland Remaining Cropland	T1, T2	CS, D																		
4C Land Converted to Cropland	T1, T2	CS, D																		
4D Land Converted to Other Land	T1, T2	CS, D																		
4E Biomass Burning			T1, T2	CS, D	T1, T2	CS, D	T1, T2	CS, D	T1, T2	CS, D										
5. Waste	T1, T2	CS, D	T1, T2	CS, D	T1, T2	CS, D														
5A Solid Waste Disposal			T2	CS, D																
5B Biological Treatment of Solid Waste			T2	D	T2	D														
5C Incineration and Open Burning of Waste	T1, T2	CS, D	T1, T2	CS, D	T1, T2	CS, D														
5D Wastewater Treatment and Discharge			T1	D	T1	CS, D														

Note:
T1 = Tier 1
T2 = Tier 2
T3 = Tier 3
CS = Country specific
D = IPCC default

2.1.3 Uncertainty Analysis

These inventories, prepared in accordance with GPG 2000 Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories (IPCC, 2000), typically contain a wide range of emission calculations. Results of the uncertainty analysis of the data showed that overall, the uncertainties of the Thailand's national GHG inventory with including data on LULUCF for 2000 and 2016 were approximately 14.67% and 24.54% respectively. When the LULUCF was excluded from the analysis, uncertainties were approximately 8.91% for 2000 and 11.53% for 2016.

2.1.4 Key Category Analysis

Key category analysis (KCA) presents the importance of emission sources and sinks. 'Key categories' are defined as the emission sources and sinks that constitute 95% of total annual emissions when ranked from greatest to lowest contribution. A 'key source' has a significant influence on the national inventory of direct GHG emissions in terms of the absolute emissions level. KCA reported in this inventory follows GPG 2000, and is estimated for both level and trend assessments. The results of the 2016 level assessment are presented in Table 2-2, and those of the 2016 trend assessment are available in Table 2-3. There are 16 key categories in the level assessment, among which public electricity and heat production led the KCA, followed by cropland remaining cropland, road transportation, manufacturing industries and construction, and rice cultivation. Results of the KCA changed slightly under trend assessment, where cropland remaining cropland dominated, followed by public electricity and heat production, land converted to cropland, forestland remaining forestland, and manufacturing industries and construction.

Table 2-2: Key category analysis for the year 2016: Approach 1 – Level assessment

A	B	C	D	E	F	G
category code	IPCC category	GHG	2016 Ex,t ($GgCO_2eq$)	2016 |Ex,t| ($GgCO_2eq$)	Lx,t	Cumulative Total of column F
1A1a	Public Electricity and Heat Production	CO_2	96,980.41	96,980.41	0.21	0.21
4B	Cropland Remaining Cropland	CO_2	-73,457.96	73,457.96	0.16	0.37
1A3b	Road transportation	CO_2	63,697.72	63,697.72	0.14	0.51
1A2	Manufacturing Industries and Construction	CO_2	48,769.80	48,769.80	0.11	0.62
3I	Rice Cultivation	CH_4	26,639.52	26,639.52	0.06	0.67
4A	Forest Land Remaining Forest Land	CO_2	-25,117.65	25,117.65	0.05	0.73
2A1	Cement Production	CO_2	17,829.34	17,829.34	0.04	0.77
1A4	Other Sectors	CO_2	15,233.53	15,233.53	0.03	0.80
2B	Chemical Industry	CO_2	11,163.22	11,163.22	0.02	0.83
1B2	Oil and Naturals Gas	CH_4	10,308.03	10,308.03	0.02	0.85
1A1b	Petroleum Refining	CO_2	10,229.60	10,229.60	0.02	0.87
3A	Enteric Fermentation	CH_4	8,477.89	8,477.89	0.02	0.89
3F	Direct N_2O Emission from Managed Soils	N_2O	8,425.98	8,425.98	0.02	0.91
5A	Solid Waste Disposal	CH_4	8,139.72	8,139.72	0.02	0.92
5D	Wastewater Treatment and Discharge	CH_4	7,595.01	7,595.01	0.02	0.94
4C	Land Converted to Cropland	CO_2	7,100.54	7,100.54	0.02	0.96

Table 2-3: Key category analysis for the year 2016: Approach 2 – Trend assessment

A	B	C	D	E	F	G	H
category code	IPCC category	GHG	2000 Ex,0 ($GgCO_2eq$)	2016 Ex,t ($GgCO_2eq$)	Lx,t	% contribution to trend	Cumulative Total of column G
4B	Cropland Remaining Cropland	CO_2	-36,665.42	-73,457.96	0.13	28.75	28.75
1A1a	Public Electricity and Heat Production	CO_2	58,182.12	96,980.41	0.07	16.79	45.55
4C	Land Converted to Cropland	CO_2	22,654.63	7,100.54	0.06	13.15	58.70
4A	Forest land Remaining Forest land	CO_2	-50,240.79	-25,117.65	0.04	9.12	67.82
1A2	Manufacturing Industries and Construction	CO_2	31,940.86	48,769.80	0.03	6.35	74.17
1A3b	Road transport	CO_2	45,479.14	63,697.72	0.02	5.35	79.52
3I	Rice Cultivation	CH_4	26,553.26	26,639.52	0.02	3.65	83.18
2B	Chemical Industry	CO_2	5,089.85	11,163.22	0.01	3.19	86.37
5A	Solid Waste Disposal	CH_4	3,447.59	8,139.72	0.01	2.53	88.90
3A	Enteric Fermentation	CH_4	9,386.19	8,477.89	0.01	1.89	90.79
1B2	Oil and Naturals Gas	CH_4	6,186.22	10,308.03	0.01	1.78	92.58
1A4	Other Sectors	CO_2	11,044.67	15,233.53	0.00	1.15	93.72
1A1b	Petroleum Refining	CO_2	6,948.61	10,229.60	0.00	1.14	94.86
4E2	Biomass Burning (Cropland)	CH_4	1,408.27	154.94	0.00	1.00	95.86

2.1.5 Time Series

Activity data for each source category presented in this inventory was based on the same sources as the national statistics for all years (2000-2016). The same emission factors were also used, in line with 2006 IPCC Guidelines. Thus, this inventory allows for consistent comparison of data points across time, with good confidence in the emission trends.

2.1.6 Quality Assurance and Quality Control

As dictated by 2006 IPCC Guidelines, quality control (QC) and quality assurance (QA) procedures were implemented during the preparation of this inventory. In addition, Thailand has utilized its own national system for quality control of data collection among ministerial agencies (Figure 1-27). Data was controlled at each stage of the data collection process by each respective institute, and further underwent a final quality assurance process, conducted by the lead agency for each sector.

2.1.7 Completeness Assessment

A completeness assessment of the inventory was conducted within each source category, following 2006 IPCC Guidelines. Results of the assessment for the Energy, IPPU, Agriculture, LULUCF, and Waste sectors are presented in Table 2-4. The following notation keys are used in the assessment.

- NA Not Applicable
- NO Not Occurring
- NE Not Estimated

Table 2-4: National greenhouse gas inventory of Thailand 2016

Unit: Gg

Greenhouse gas source and sink categories	CO_2 emissions	CO_2 removals	CH_4	N_2O	NO_x	CO	NMVOCs	SO_2	HFCs	PFCs	SF_6
Total national emissions and removals	322,507.46	-143,427.09	2,712.28	55.06	1,384.01	7,253.94	971.02	452.09			
1. Energy	237,877.20	NO	547.38	7.83	1,344.24	5,783.29	845.68	446.46			
1A Energy Combustion Activities	237,873.92		112.93	7.83	1,344.24	5,783.29	739.01	446.46			
1A1 Energy Industries	107,210.01		13.80	2.29	340.49	436.21	28.30	57.12			
1A2 Manufacturing Industries and Construction	48,769.80		11.51	1.61	171.01	1,238.75	21.65	347.91			
1A3 Transport	66,660.58		25.93	3.19	660.62	2,839.49	527.29	7.54			
1A4 Other Sectors	15,233.53		61.70	0.73	172.12	1,268.83	161.77	33.88			
1B Fugitive Emissions from Fuel	3.28		434.45				106.67				
1B1 Solid Fuels	NO		22.13				NO				
1B2 Oil and Natural Gas	3.28		412.32				106.67				
1C Carbon dioxide Transport and Storage	NO	NO									
1C1 Transport of CO_2	NO	NO									
1C2 Injection and Storage	NO	NO									
1C3 Other	NO	NO									
2. Industrial Processes and Product Use	30,797.78	NO	13.09	1.61	1.21	4.51	125.34	5.63	NO	NO	NO
2A Mineral Industry	18,968.93										
2A1 Cement Production	17,829.34										
2A2 Lime Production	124.61										
2A3 Glass Production	217.13										
2A4b Other Uses of Soda Ash	267.09										
2A4d Other	530.76										
2B Chemical Industry	11,163.22		13.09	1.61							
2C Metal Production	296.65		NA								
2C1 Iron and Steel Production	296.65		NA								
2D Non-Energy Products from Fuels and Solvent Use	295.19										
2D1 Lubricant Use	295.19										
2H Other	NA				1.21	4.51	2.98	5.63			
2H1 Pulp and Paper Industry					1.21	4.51	2.98	5.63			

Table 2-4: National greenhouse gas inventory of Thailand 2016 (Cont'd)

Unit: Gg

Greenhouse gas source and sink categories	CO_2 emissions	CO_2 removals	CH_4	N_2O	NO_x	CO	NMVOCs	SO_2	HFCs	PFCs	SF_6
2H2 Food and Beverages Industry							122.36				
3. Agriculture	1,546.94		1,513.66	42.85	36.87	1,356.80					
3A Enteric Fermentation			339.12								
3B Manure Management			69.14	1.59							
3C Field Burning of Agricultural Residues	NA		39.82	1.03	36.87	1,356.80					
3D Liming	29.92										
3E Urea Fertilization	1,517.01										
3F Direct N_2O Emission from Managed Soils				28.28							
3G Indirect N_2O Emission from Managed Soils				10.23							
3H Indirect N_2O Emission from Manure Management				1.73							
3I Rice Cultivation			1,065.58								
4. Land Use, Land-Use Change and Forestry	52,015.55	-143,427.09	7.15	0.21	1.69	109.34					
4A Forest Land Remaining Forest Land	16,467.91	-41,585.56									
4B Cropland Remaining Cropland	28,383.57	-101,841.53									
4C Land Converted to Cropland	7,100.54	NO									
4D Land Converted to Other land	99.53	NO									
4E Biomass Burning	NO	NO	7.15	0.21	1.69	109.34	NO	NO	NO	NO	NO
5. Waste	233.99		631.00	2.56	NO, NA	NO, NA	NA	NA			
5A Solid Waste Disposal			325.59				NA				
5B Biological Treatment of Solid Waste			1.61	0.13	NO		NA				
5C Incineration and Open Burning of Waste	233.99		0.004	0.03	NA	NA	NA	NA			
5D Wastewater Treatment and Discharge			303.80	2.40	NO	NO	NA				
6. Other Memo Items (not accounted in Total Emissions)	NA		NA	NA	NA	NA	NA	NA	NA	NA	NA
International Bunkers	NA		NA	NA	NA	NA	NA	NA	NA	NA	NA
CO_2 from Biomass	NA		NA	NA	NA	NA	NA	NA	NA	NA	NA

2.2 Key Findings from the National GHG Inventory

In this report, the trends of Thailand's GHG emissions for the period 2000 to 2016, from all emission sources and removals, were conducted according to the 2006 IPCC Guidelines. The GHG emissions are estimated from the Energy, IPPU, Agriculture, LULUCF, and Waste sectors which include both direct and indirect emissions. Direct GHGs consist of Carbon Dioxide (CO_2), Methane (CH_4), and Nitrous Oxide (N_2O); whereas indirect GHGs consist of Nitrogen Oxides (NO_x), Carbon Monoxide (CO), Non-Methane Volatile Organic Compounds (NMVOCs) and Sulfur Dioxide (SO_2). Table 2-5 shows Thailand's 2000 to 2016 national GHG inventory.

2.2.1 Trend of Thailand's GHG Emissions and Removals by Sector 2016

Total GHG emissions (excluding those from LULUCF) increased from 245,757.14 $GgCO_2eq$ in 2000 to 354,357.61 $GgCO_2eq$ in 2016, with an average annual increase of 2.31%. The net removal of CO_2 increased from 61,960.76 $GgCO_2eq$ in 2000 to 91,134.15 $GgCO_2eq$ in 2016. Net GHG emissions therefore increased overall from 183,796.37 $GgCO_2eq$ in 2000 to 263,223.46 $GgCO_2eq$ in 2016, with an average annual increase of 2.27% (Table 2-5, Figure 2-1). Between 2000-2016, the main source of GHG emissions was the Energy sector, which saw an increase of 53.74% from 165,143.84 $GgCO_2eq$ in 2000 to 253,895.61 $GgCO_2eq$ in 2016. The proportion of GHG emissions in the Energy sector accounted for 67.20% of total emission sources in 2000, increasing to comprise 71.65% of total emission sources in 2016. In the same period, the share of emissions from the Agriculture sector decreased from 19.93% in 2000 to 14.72% in 2016, the share of emissions from the IPPU and Waste sectors remained constant (Figure 2-2).

Table 2-5: National GHG emissions/removals by sector 2000-2016

Unit: $GgCO_2eq$

Year	Source category					Net emissions (Including LULUCF)	Total emissions (Excluding LULUCF)
	Energy	IPPU	Agriculture	LULUCF	Waste		
2000	165,143.84	21,169.48	48,976.87	-61,960.76	10,466.94	183,796.37	245,757.14
2001	172,958.64	22,605.87	49,934.47	-55,291.08	11,281.28	201,489.17	256,780.26
2002	182,371.47	24,565.54	48,613.37	-45,432.78	12,813.68	222,931.44	268,364.06
2003	191,364.15	23,250.83	52,174.05	-47,615.92	14,281.85	233,454.94	281,070.87
2004	208,244.91	24,390.54	51,859.31	-56,126.20	14,844.36	243,212.91	299,339.11
2005	212,381.18	26,594.33	51,335.05	-50,067.10	15,167.72	255,411.19	305,478.29
2006	213,106.27	27,426.69	53,765.66	-52,554.99	16,188.61	257,932.24	310,487.23
2007	219,468.05	28,887.84	57,036.76	-59,993.21	16,569.69	261,969.14	321,962.34
2008	221,805.79	26,876.58	58,942.63	-64,299.65	17,652.74	260,978.09	325,277.74
2009	221,442.71	26,115.58	60,997.75	-65,552.69	17,455.59	260,458.95	326,011.64
2010	233,218.15	27,947.35	60,592.52	-61,536.88	15,778.55	275,999.69	337,536.57
2011	229,940.75	28,794.76	61,118.83	-68,465.55	14,900.97	266,289.77	334,755.32
2012	242,954.38	30,339.30	64,112.18	-81,384.08	11,866.89	267,888.68	349,272.75
2013	239,327.45	29,867.98	58,939.70	-82,183.85	13,978.13	259,929.41	342,113.26
2014	239,816.77	30,764.67	57,856.16	-103,292.72	14,237.77	239,382.64	342,675.36
2015	242,015.74	31,068.63	52,174.30	-90,260.87	15,998.67	250,996.47	341,257.34
2016	253,895.61	31,531.41	52,158.70	-91,134.15	16,771.89	263,223.47	354,357.61

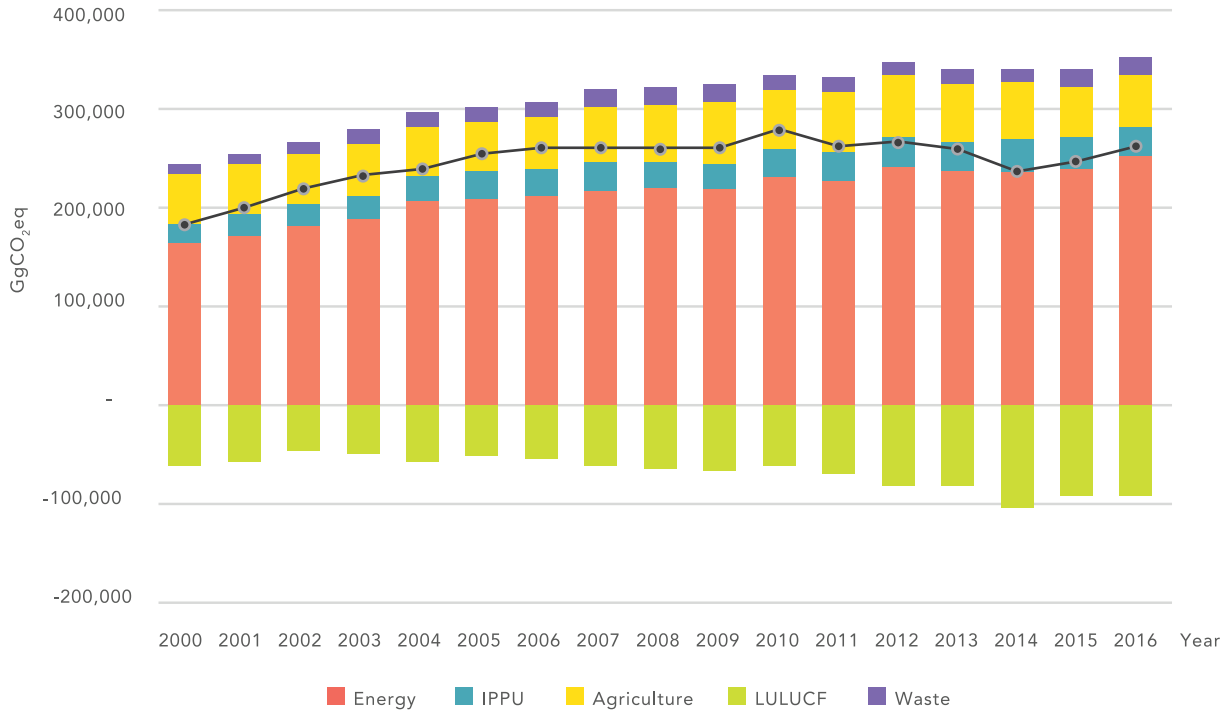


Figure 2-1: National GHG emissions/removals by sector 2000-2016

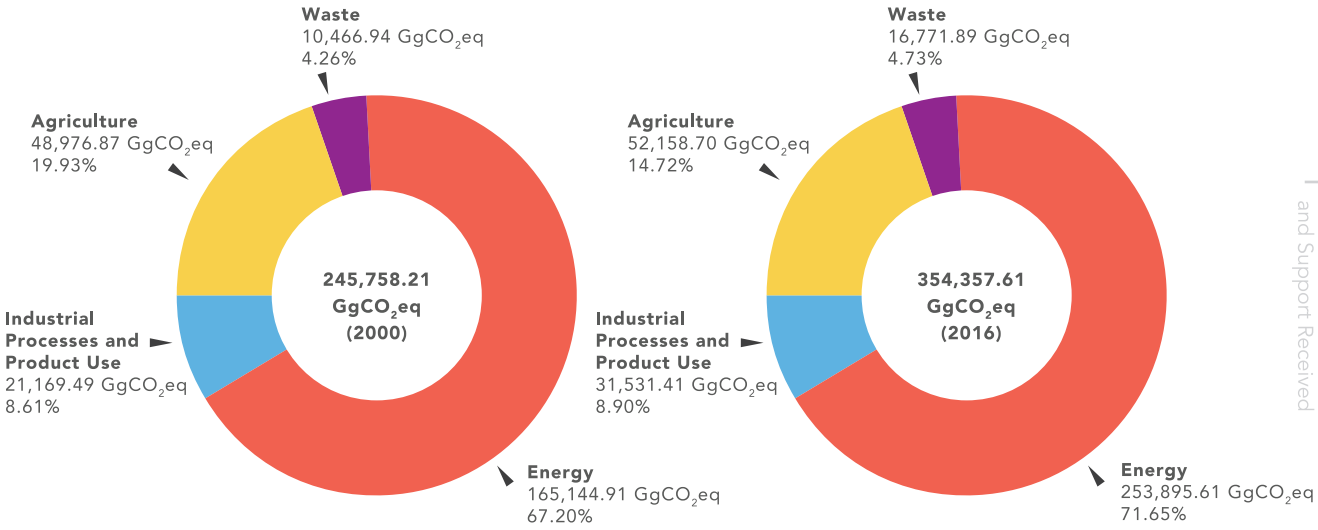


Figure 2-2 Total GHG emissions by sector (excluding LULUCF) 2000 and 2016

2.2.2 Trend of Indirect GHG Emissions

The indirect GHG emissions include NO_x, CO, and NMVOCs and SO_2. The trends of indirect GHG emissions for the period of 2000 to 2016 are shown in Table 2-6. The estimated emissions from these indirect gases are as follows:

- NO_x: 928 Gg (2000) to 1,382.31Gg (2016) – average annual increase of 2.53%
- CO: 5,104.72 Gg (2000) to 7,144.59 Gg (2016) – average annual increase of 2.22%
- NMVOCs: 731.44 Gg (2000) to 971.01Gg (2016) – average annual increase of 1.79%
- SO_2: 594.97 Gg (2000) to 452.09Gg (2016) – average annual decrease of 1.70%

Table 2-6: Indirect GHG emissions by gases 2000-2016

Unit: Gg

Year	Indirect Gases			
	NO_x	CO	NMVOCs	SO_2
2000	928.00	5,104.72	731.44	594.97
2001	972.94	5,150.05	746.09	643.73
2002	1,025.73	5,402.33	828.22	688.52
2003	1,097.21	5,798.59	878.38	617.62
2004	1,185.61	5,958.75	895.95	719.97
2005	1,192.84	5,789.42	828.47	756.02
2006	1,183.27	5,995.21	853.78	692.78
2007	1,217.55	6,127.17	868.28	627.17
2008	1,210.14	6,270.75	834.30	631.13
2009	1,234.60	6,384.64	856.74	600.83
2010	1,275.12	6,532.17	865.80	633.92
2011	1,296.44	6,791.20	900.58	607.29
2012	1,350.31	6,955.01	897.19	564.76
2013	1,335.67	7,104.82	924.94	554.99
2014	1,331.15	7,137.18	981.10	447.44
2015	1,351.94	7,091.11	1,034.16	416.77
2016	1,382.31	7,144.59	971.01	452.09
Average Annual Growth Rate	2.53%	2.22%	1.79%	-1.70%

2.2.3 Recalculations of Total GHG emissions

Previous inventories submitted in the SBUR were calculated using the revised 1996 IPCC Guidelines. To provide a consistent data series, recalculations were performed for past inventories (2000-2013). As part of this current inventory submission, emissions for the period 2000-2013 were recalculated using updated activity data and revised emission factors according to 2006 IPCC Guidelines. Results of the recalculated national GHG emissions data for 2000-2013 are presented in Figure 2-3. The newly calculated emissions for the period 2000-2013 were higher than those in the previous inventories submitted in the SBUR, in the range of an additional 5.81% to 8.00%.

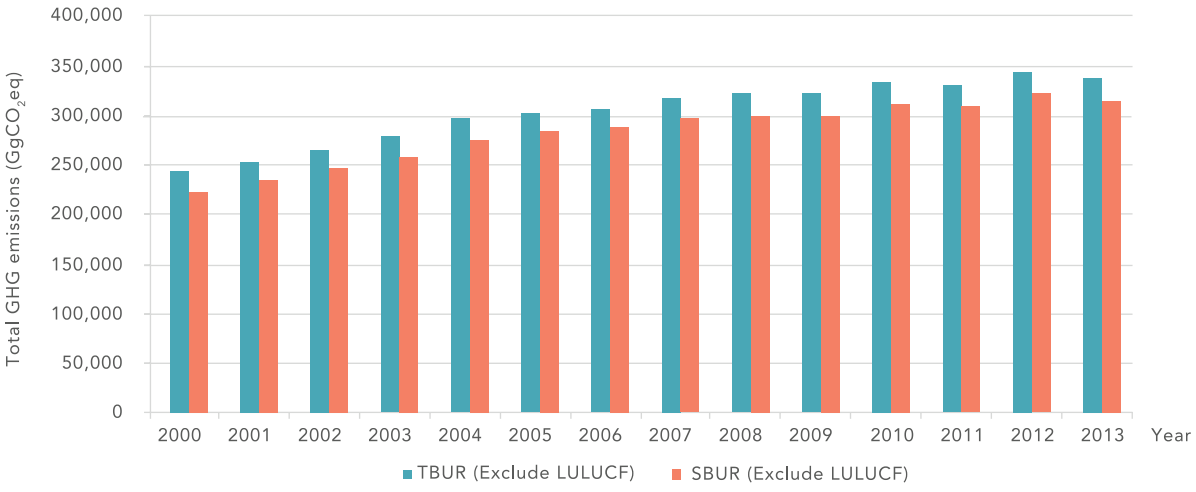


Figure 2-3: Comparison of Thailand's GHG emissions between SBUR and TBUR

2.3 Greenhouse Gas Emission by Sector

2.3.1 Energy

Total direct GHG emissions from the Energy sector in 2016 were estimated to be 253,895.61 $GgCO_2eq$. The majority of GHG emissions in the Energy sector were generated by fuel combustion, consisting mostly of grid-connected electricity and heat production at around 108,238.60 $GgCO_2eq$ (42.84%). GHG emissions from Transport, Manufacturing Industries and Construction, and other sectors were 68,260.17 $GgCO_2eq$ (27.21%), 49,538.34 $GgCO_2eq$ (19.53%) and 16,993.90 $GgCO_2eq$ (6.10%). Fugitive Emissions from fuel comprised only 10,864.61 $GgCO_2eq$ or a little over 4.33% of total GHG emissions from the Energy sector. Details of GHG emissions in the Energy sector by gas type and source in 2016 are presented in Figure 2-4 and Table 2-7.

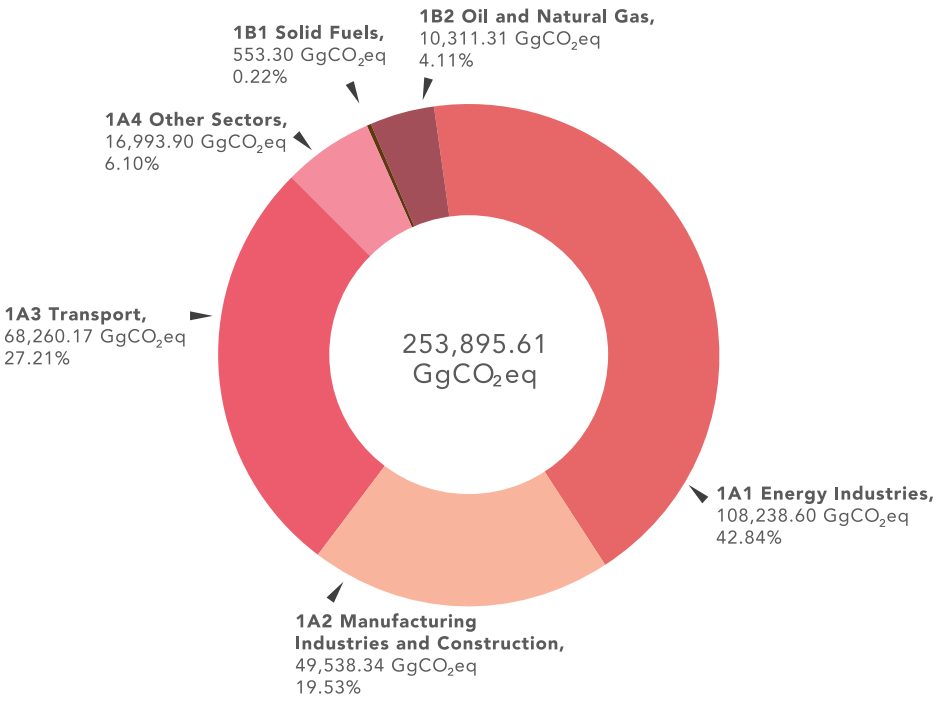


Figure 2-4: GHG emissions in Energy sector 2016

Table 2-7: GHG emissions from various sources relative to total GHG emissions in the Energy sector 2016

Greenhouse gas source and sink categories	CO_2 emissions	CO_2 removals	CH_4		N_2O		NO_x	CO	NMVOCs	SO_2	HFCs	PFCs	SF_6	Total
Unit	$GgCO_2eq$	$GgCO_2eq$	Gg	$GgCO_2eq$	Gg	$GgCO_2eq$	Gg	Gg	Gg	Gg	$GgCo_2eq$	$GgCo_2eq$	$GgCo_2eq$	$GgCo_2eq$
1. Energy	237,877.20	NO	547.39	13,684.69	7.82	2,333.72	1,344.24	5,783.28	845.68	446.45				253,895.61
1A Energy Combustion Activities	237,873.92		112.94	2,823.28	7.82	2,333.72	1,344.24	5,783.28	739.01	446.45				243,030.92
1A1 Energy Industries	107,210.01		13.80	345.04	2.29	683.55	340.49	436.21	28.30	57.12				108,238.60
1A2 Manufacturing Industries and Construction	48,769.80		11.51	287.65	1.61	480.89	171.01	1,238.75	21.65	347.91				49,538.34
1A3 Transport	66,660.58		25.93	648.25	3.19	951.33	660.62	2,839.49	527.29	7.54				68,260.17
1A4 Other Sectors	15,233.53		61.70	1,542.42	0.73	217.95	172.12	1,268.83	161.77	33.88				16,993.90
1B Fugitive Emissions from Fuel	3.28		434.45	10,861.33					106.67					10,864.61
1B1 Solid Fuels	NO		22.13	553.30					NO					553.30
1B2 Oil and Natural Gas	3.28		412.32	10,308.03					106.67					10,311.31
1C Carbon dioxide Transport and Storage	NO	NO												
1C1 Transport of CO_2	NO	NO												
1C2 Injection and Storage	NO	NO												
1C3 Other	NO	NO												

Note: NO = Not Occurring

2.3.2 Industrial Processes and Product Use (IPPU)

The estimation of GHGs for the IPPU sector covered all gases indicated in 2006 IPCC Guidelines, with the exception of the Fluorinated (F)-gases inventory due to a limitation on available activity data. Total direct GHG emissions from the IPPU sector in 2016 were estimated to be 31,531.41 $GgCO_2eq$. The majority of GHG emissions in this sector were attributed to mineral production, which accounted for approximately 18,968.93 $GgCO_2eq$ (60.16%). GHG emissions from chemical industry, metal production and non-energy products were estimated at 11,970.64 $GgCO_2eq$ (37.96%), 296.65 $GgCO_2eq$ (0.94%) and 295.19 $GgCO_2eq$ (0.94%), respectively. This estimation of GHGs for the IPPU sector covered all gases indicated in 2006 IPCC Guidelines, with the exception of the Fluorinated (F)-gases inventory due to a limitation on available activity data. Details of direct and indirect GHG emissions in the IPPU sector by gas type and source in 2016 are presented in Figure 2-5 and Table 2-8.

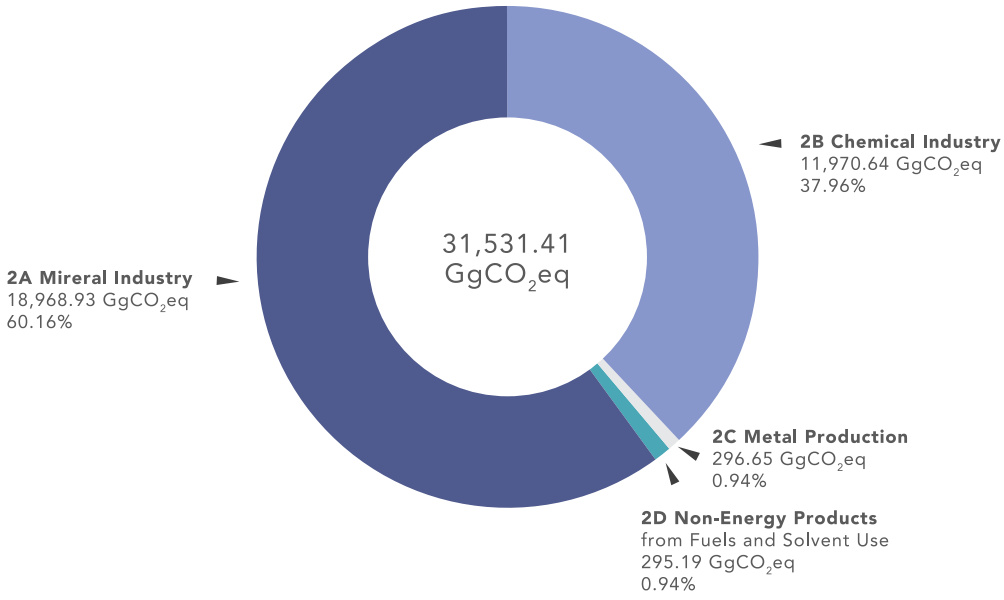


Figure 2-5: GHG emissions in IPPU sector 2016

Table 2-8: GHG emissions from various sources relative to total GHG emissions in the IPPU sector 2016

Greenhouse gas source and sink categories	CO_2 emissions	CO_2 removals	CH_4		N_2O		NO_x	CO	NMVOCs	SO_2	HFCs	PFCs	SF_6	Total
Unit	$GgCO_2eq$	$GgCO_2eq$	Gg	$GgCO_2eq$	Gg	$GgCO_2eq$	Gg	Gg	Gg	Gg	Gg	Gg	$GgCo_2eq$	$GgCo_2eq$
2. Industrial Processes and Product Use	30,797.78	NO	13.09	327.39	1.61	480.03	1.21	4.51	125.34	5.63	NO	NO	NO	31,531.41
2A Mineral Industry	18,968.93													18,968.93
2A1 Cement Production	17,829.34													
2A2 Lime Production	124.61													
2A3 Glass Production	217.13													
2A4b Other Uses of Soda Ash	267.09													
2A4d Other	530.76													
2B Chemical Industry	11,163.22		13.09	327.39	1.61	480.03								11,970.64
2C Metal Production	296.65		NA.	NA.										296.65
2C1 Iron and Steel Production	296.65		NA	NA.										
2D Non-Energy Products from Fuels and Solvent Use	295.19													295.19
2D1 Lubricant Use	295.19													
2H Other	NA						1.21	4.51	125.34	5.63				
2H1 Pulp and Paper Industry							1.21	4.51	2.98	5.63				
2H2 Food and Beverages Industry									122.36					

Note: NA = Not Applicable, NO = Not Occurring

2.3.3 Agriculture

Total GHG emissions from the Agriculture sector in 2016 were 52,158.70 $GgCO_2eq$. Livestock contributed 11,195.20 $GgCO_2eq$ (21.46%), comprising 8,477.89 $GgCO_2eq$ from enteric fermentation, and 2,201.47 and 515.84 $GgCO_2eq$ for direct and indirect manure management, respectively. Meanwhile, crop-related GHG emissions accounted for 40,963.49 $GgCO_2eq$ (78.54%). Rice cultivation was the main GHG contributor in Thailand's Agriculture sector, at 26,639.52 $GgCO_2eq$ (51.07%). Agricultural soils emitted 11,473.92 $GgCO_2eq$ (22.00%), with direct and indirect emissions contributing 8,425.98 and 3,047.94 $GgCO_2eq$, respectively. Field burning of agricultural residues and urea fertilizer contributed similar GHG emissions of 1,303.12 and 1,517.01 $GgCO_2eq$ (2.50% and 2.91%), respectively. The lowest agricultural GHG emission in 2016 was from liming (29.92 $GgCO_2eq$ or 0.06%). Details of 2016 GHG emissions in the Agriculture sector by gas type and source are presented in Figure 2-6 and Table 2-9.

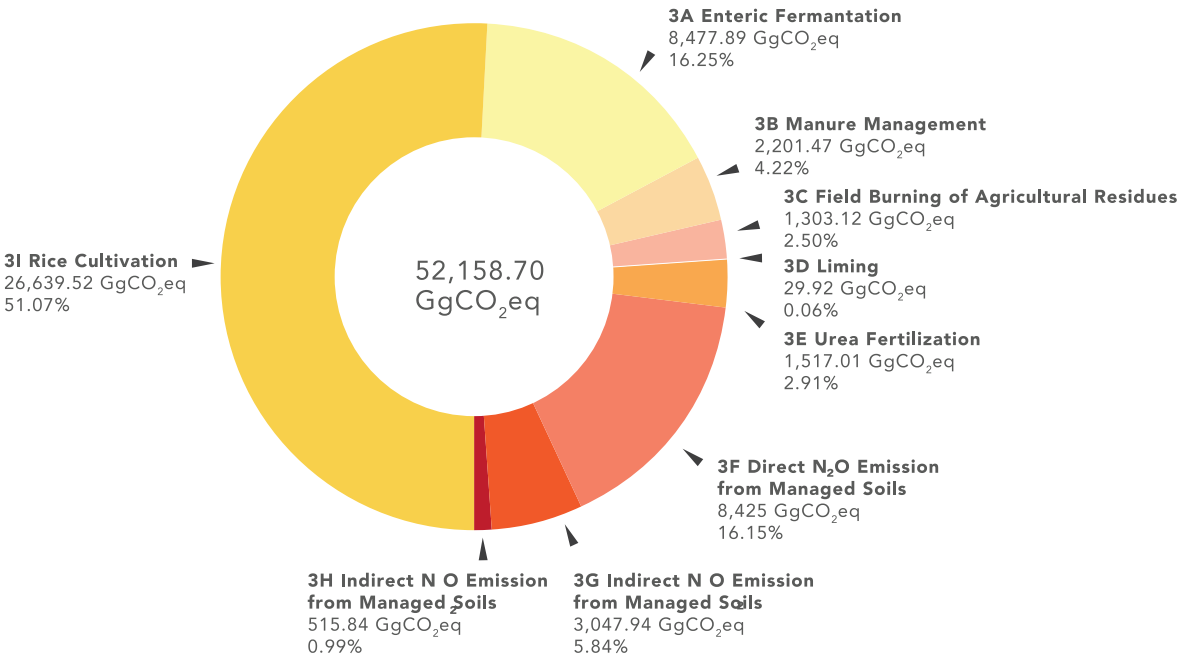


Figure 2-6: GHG emissions in Agriculture sector 2016

Table 2-9: GHG emissions from various sources relative to total GHG emissions in the Agriculture sector 2016

Greenhouse gas source and sink categories	CO_2 emissions	CO_2 removals	CH_4		N_2O		NO_x	CO	NMVOCs	SO_2	HFCs	PFCs	SF_6	Total
Unit	$GgCO_2eq$	$GgCO_2eq$	Gg	$GgCO_2eq$	Gg	$GgCO_2eq$	Gg	Gg	Gg	Gg	$GgCo_2eq$	$GgCo_2eq$	$GgCo_2eq$	$GgCo_2eq$
3. Agriculture	1,546.94		1,513.66	37,841.44	42.85	12,770.32	36.87	1,356.80						52,158.70
3A Enteric Fermentation			339.12	8,477.89										8,477.89
3B Manure Management			69.14	1,728.55	1.59	472.92								2,201.47
3C Field Burning of Agricultural Residues	NA		39.82	995.48	1.03	307.64	36.87	1,356.80						1,303.12
3D Liming	29.92													29.92
3E Urea Fertilization	1,517.01													1,517.01
3F Direct N_2O Emission from Managed Soils					28.28	8,425.98								8,425.98
3G Indirect N_2O Emission from Managed Soils					10.23	3,047.94								3,047.94
3H Indirect N_2O Emission from Manure Management					1.73	515.84								515.84
3I Rice Cultivation			1,065.58	26,639.52										26,639.52

Note: NA = Not Applicable

2.3.4 Land Use, Land-Use Change and Forestry (LULUCF)

In 2016, LULUCF sector contributed to a net removal of 91,134.15 $GgCO_2eq$, an increase of approximately 47% compared with the year 2000. The net removal estimated for Cropland Remaining Cropland was 73,457.96 $GgCO_2eq$, accounting for approximately 81% of overall net removals in this sector. Forest land conversion produced 7,100.54 and 99.53 $GgCO_2eq$ from land converted to cropland and other land, respectively. Non-CO_2 emissions from biomass burning in LULUCF sector resulted in the emission of 241.40 $GgCO_2eq$.

These GHG emissions and sinks from LULUCF sector were estimated using 2006 IPCC Guidelines for three land categories: forest land, cropland, and other land. Total CO_2 emissions/removals from Carbon (C) stock changes for each land use category was calculated based on the sum of each subcategory, taking into account three carbon pools: 1) above ground biomass, 2) below ground biomass, and 3) dead organic matter (deadwood and litter). LULUCF sector in Thailand showed a trend of increased net removals as total removals exceeded total emissions. Since 2000, LULUCF activities has contributed to a tremendous increase of net removal from the atmosphere as a result of net removals attributed to rubber plantations. Croplands, therefore, dominated net removal estimates for Thailand's LULUCF sector. Details of GHG emissions/removals in LULUCF sector by gas type and source in 2016 are presented in Table 2-10 and Figure 2-7.

Figure 2-7: GHG emissions in LULUCF sector 2016

Table 2-10: GHG emissions from various sources relative to total GHG emissions in the LULUCF sector 2016

Greenhouse gas source and sink categories	CO_2 emissions	CO_2 removals	CH_4		N_2O		NO_x	CO	NMVOCs	SO_2	HFCs	PFCs	SF_6	Total
Unit	$GgCO_2eq$	$GgCO_2eq$	Gg	$GgCO_2eq$	Gg	$GgCO_2eq$	Gg	Gg	Gg	Gg	$GgCo_2eq$	$GgCo_2eq$	$GgCo_2eq$	$GgCo_2eq$
4. Land Use, Land-Use Change and Forestry	52,015.55	-143,427.09	7.15	178.74	0.21	62.67	1.69	109.34	NO	NO	NO	NO	NO	-91,134.15
4A Forest Land Remaining Forest Land	16,467.91	-41,585.56	NO		NO		NO	NO	NO	NO	NO	NO	NO	-25,117.65
4B Cropland Remaining Cropland	28,383.57	-101,841.53	NO		NO		NO	NO	NO	NO	NO	NO	NO	-73,457.96
4C Land Converted to Cropland	7,100.54	NO	NO		NO		NO	NO	NO	NO	NO	NO	NO	7,100.54
4D Land Converted to Other Land	99.53	NO	NO		NO		NO	NO	NO	NO	NO	NO	NO	99.53
4E Biomass Burning	NO	NO	7.15	178.74	0.21	62.67	1.69	109.34	NO	NO	NO	NO	NO	241.40
4E1 Biomass Burning (Forest Land)	NO	NO	0.88	22.01	0.03	7.72	0.21	13.46	NO	NO	NO	NO	NO	29.72
4E2 Biomass Burning (Cropland)	NO	NO	6.20	154.94	0.18	54.32	1.46	94.79	NO	NO	NO	NO	NO	209.27
4E3 Biomass Burning (Other Land)	NO	NO	0.07	1.79	0.00	0.63	0.02	1.09	NO	NO	NO	NO	NO	2.41

Note: NO = Not Occurring

2.3.5 Waste

Total direct GHG emissions from the Waste sector in 2016 were estimated to be 16,771.89 $GgCO_2eq$. GHG emissions in the Waste sector were mainly from wastewater treatment and discharge, at an estimated 8,310.24 $GgCO_2eq$ (49.55%), and solid waste disposal, at 8,139.72 $GgCO_2eq$ (48.53%). Waste incineration accounted for 244.21 $GgCO_2eq$ (1.46%), while biological treatment of solid waste was estimated at 77.72 $GgCO_2eq$ (0.46%): the smallest proportion of total GHG emissions in this sector. Details of GHG emissions in the Waste sector by gas type and source in 2016, are presented in Figure 2-8 and Table 2-11.

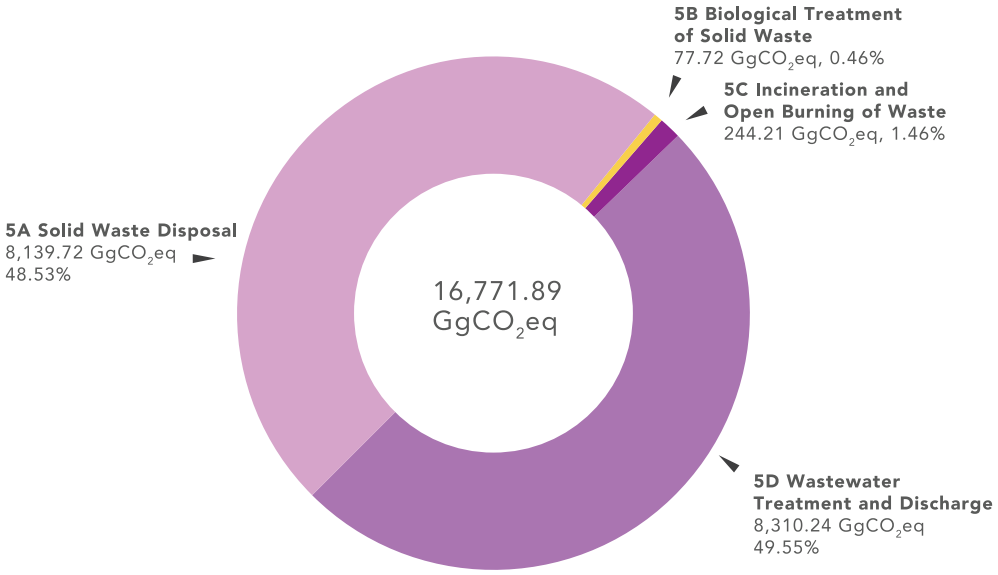


Figure 2-8: GHG emissions in Waste sector 2016

Table 2-11: GHG emissions from various sources relative to total GHG emissions in the Waste sector 2016

Greenhouse gas source and sink categories	CO_2 emissions	CO_2 removals	CH_4		N_2O		NO_x	CO	NMVOCs	SO_2	HFCs	PFCs	SF6	Total
Unit	$GgCO_2eq$	$GgCO_2eq$	Gg	$GgCO_2eq$	Gg	$GgCO_2eq$	Gg	Gg	Gg	Gg	$GgCo_2eq$	$GgCo_2eq$	$GgCo_2eq$	$GgCo_2eq$
5. Waste	233.99		631.00	15,775.01	2.56	762.89	NO/NA	NO/NA	NA	NA				16,771.89
5A Solid Waste Disposal			325.59	8,139.72					NA					8,139.72
5A1 Managed Waste Disposal Sites			194.97	4,874.26					NA					
5A2 Unmanaged Waste Disposal Sites			130.62	3,265.46					NA					
5B Biological Treatment of Solid Waste			1.61	40.19	0.13	37.53	NO		NA					77.72
5C Incineration and Open Burning of Waste	233.99		0.004	0.09	0.03	10.13	NA	NA	NA	NA				244.21
5C1 Waste Incineration	233.99		0.004	0.09	0.03	10.13	NA	NA	NA	NA				
5D Wastewater Treatment and Discharge			303.80	7,595.01	2.40	715.23	NO	NO	NA					8,310.24
5D1 Domestic Wastewater Treatment and Discharge			75.64	1,891.08	2.40	715.23	NO	NO	NA					
5D2 Industrial Wastewater Treatment and Discharge			228.16	5,703.93			NO	NO	NA					

Note: NA = Not Applicable, NO = Not Occurring

2.4 Constraints, Gaps, and Needs in the National GHG Inventory by Sector

During the TBUR's national GHG inventory development, Thailand faced several constraints and gaps that need to be addressed. This includes limitations and barriers that affect the quality of GHG inventory estimation and compilation. It is important to improve the quality of the national statistics compiled by relevant agencies to further improve the overall quality of the national GHG inventory.

Thailand aims to improve its inventory quality in terms of transparency, accuracy, completeness, consistency, and comparability. Two key areas of support needed are 1) activity data and 2) emission factors which can be summarized as follows:

- Country-specific emission factors should be developed and introduced for the main fuels used in Thailand, including bio-fuels.
- Approaches need to be developed to collect activity data up to a Tier 3 standard for Manufacturing and Construction categories, for the benefit of both inventory quality and transparency in mitigation.
- Although Thailand already adopted 2006 IPCC Guidelines in all sectors, Thailand needs to enhance the professional capacities of national experts involved in the inventory process. A transition from default emission factors and Tier 1 methodologies to country-specific emission factors and Tier 2 and 3 methodologies is needed, with particular focus on key categories.

With international level supports through bilateral collaboration and international organizations, Thailand's national inventory has been drastically improved the calculation and reporting in all sectors. However, several supports needed remain which can be identified by sector, as follows.

The main areas of support needed in the Energy sector are:

- The Ministry of Transport, via the Department of Land Transport, is developing an approach to collect data on vehicle characteristics such as mileage, vehicle kilometer traveled (VKT), and fuel economy which needs some technical assistance; and
- The Ministry of Transport, via the Civil Aviation Authority of Thailand (CAAT), is developing an approach to collect data on fuel consumption for international aviation.

The main areas of support needed in **the IPPU sector** are:

- Estimation of GHG emissions from the IPPU sector is considered a challenge for Thailand due to the diversity of GHG sources and gas types, as well as the complexity of calculation methodologies and data requirements. Currently, the emissions from most sub-categories under the IPPU sector can be estimated using Tier 1 approach with adequate activity data and the use of default EF values. Tier 2 estimation is only possible for the cement industry, of which country-specific

emission factors are available. For other sub-categories, specific emission factors need to be developed in order to shift to a more accurate Tier 2 estimation. Other key issues/challenges include a lack of regulatory requirements to collect plant-specific data, and confidentiality of data from some unique industries.

- Currently, F-gases are not yet included in Thailand's GHG emission inventory due to difficulty in data collection and classification, as well as a lack of specific technical data, such as, initial charge, lifetime of equipment, and emission factors. The Department of Industrial Works, Thailand, has imposed reporting requirements on F-gases consumption and import-export statistics. However, such aggregate data can be useful and possible for Tier 1 estimation. Improvement of data reporting forms are underway to collect disaggregate data at application or sub-application levels. Advanced techniques, such as, monitoring and modeling approaches, are also required to obtain the activity and emission data for F-gas estimation in order to fulfill the gaps according to the 2006 IPCC guideline.
- Further works and supports are needed to improve the inventory quality, particularly in terms of transparency, accuracy, completeness, consistency and comparability. The existing TGEIS database also needs to be updated periodically to reflect the progress of GHG inventory quality. Enhancing the knowledge and understanding of GHG estimation methodologies among key stakeholders, particularly industrial partners, including a training on sensitivity analysis and calculation, is also needed to strengthen the national GHG inventory development for the IPPU sector.

The main areas of support needed in **the Agriculture sector** are:

- To achieve more accurate GHG estimations and to adopt higher IPCC methodologies in the Agriculture sector, specific data needs to be collected or revised; this includes data on updated livestock characteristics and fractions of manure in management systems. More appropriate methods to estimate areas burnt in croplands through the use of satellite images is also required, in addition to revising fractions of crop residues, gathering data on lime application to croplands from the private sector, determining fertilizer application rates of major crops according to bottom-up approaches, and developing or revising country-specific emission factors for agricultural soils and rice cultivation with water management (e.g. from alternative wetting and drying).
- Due to limitations in quality assurance and quality control (QA/QC) in addition to the uncertainty of the country's activity data and emission factors, improving QA/QC procedures coupled with conducting uncertainty analysis of this data may enhance the accuracy of the inventory systems.
- Better understanding of 2006 IPCC Guidelines, GHG estimation methodologies and quality control systems, through activities on capacity building and technical transfer, should be provided for relevant government agencies and other parties. This may be of importance for strengthening the capacity of institutions in data collection, quality control of data, and enhancing mitigation measures.

The main areas of support needed in **the LULUCF sector** are:

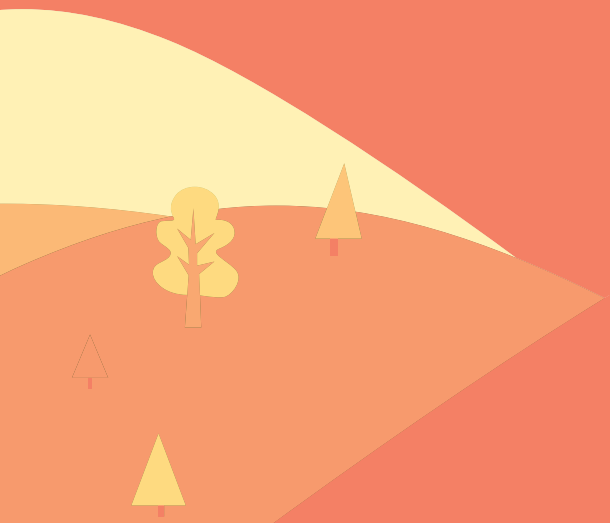
- Although MRV systems for the LULUCF sector have been developed and implemented among relevant stakeholders, activity data relevant to forest land remains incomplete because forest areas in the LULUCF sector are under the purview of multiple departments (including the Royal Forest Department and the Forest Industry Organization). There is also a gap between public and private data on forest plantation areas. In addition, activity data for biomass burning in forest land reported by various departments remains unclear in terms of burned areas and/or land categories. To provide more accurate GHG estimations and adopt higher levels of IPCC methodologies, remote-sensing-based monitoring of land use and land cover is needed to classify types of natural forests and forest plantations and monitor their changes, as well as to detect forest area burning.
- Although cropland and forest land are key land categories contributing to net GHG removals in the LULUCF sector, wood harvested from either cropland or forest plantations was not reported, only from the Forest Industry Organization. Thus, a standardized approach must be developed for the government and private sector to enhance MRV systems of essential activity data within the LULUCF sector.
- Country-specific values have been applied in most LULUCF categories, however some emission factors have continued to be adopted from IPCC defaults due to the use of the 2006 IPCC Guidelines (i.e. the below-ground to above-ground biomass ratio for natural forest and woody crops, dead wood and organic litter, trace gases emission ratio and uncertainty estimation). Furthermore, some parameters are not adequate to be used as national representatives due to a limitation on available information (i.e. country-specific values relevant to croplands). A new process for the development of country-specific values is therefore recommended to improve the accuracy of the GHG inventory and adopt higher tier methodologies for the LULUCF sector.

The main areas of support needed in **the Waste sector** are:

- Although MRV systems in the Waste sector has been developed and implemented among relevant stakeholders, some parameters are still out-of-date; for example, those of solid waste composition and annual per capita protein consumption. Other parameters are not adequate to be used as nationally representative, including industrial production, wastewater generated and Chemical Oxygen Demand (COD) in specific industrial wastewater. Meanwhile some other parameters are not available altogether, such as the degree of utilization of treatment discharge pathways or systems including septic tanks, latrines, sewers, centralized wastewater treatment, and no treatment. Therefore, data collection systems and the creation of a centralized database need to be developed.

Technical and funding support is required for capacity building within relevant agencies.

- Development of country-specific values of emission factors for solid waste disposal and wastewater treatment and discharge of both domestic and industrial sources are also needed to improve data collection according to 2006 IPCC Guidelines. This includes, for example, reaction constants and half-lives in the degradation of specific compositions of solid waste, the maximum methane producing capacity and a methane correction factor for the wastewater treatment and discharge system. Technical and funding support is needed for initiating these studies.
- Some cross-cutting issues need to be addressed including archiving procedures, in addition to the planning, development and implementation of a QA/QC system, and a process for uncertainty assessment.



CHAPTER 3

INFORMATION ON MITIGATION ACTIONS

CHAPTER 3: INFORMATION ON MITIGATION ACTIONS

Thailand has made significant efforts, as a signatory Party under the UNFCCC, in mitigating the country's GHG emissions with available resources and capabilities according to its capabilities. Thailand has incorporated climate change into its national economic and social development plans since 2007. Climate change is currently addressed at the highest policy level under the National Strategy (2018-2037) to ensure a long-term continuity of the issue alongside other economic and social considerations, including poverty eradication.

Thailand's NAMA target to reduce GHG emission by 7-20% by 2020 below BAU includes measures in energy and transport sectors. Under NAMA, we have achieved a GHG emission reduction of 15.76% in 2018 which lays a solid foundation for our post-2020 efforts.

Thailand intends to reduce its GHG emissions by 20% from the projected BAU level 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. Thailand's NDC target has been integrated into the National Strategy. It will be implemented through the NDC Roadmap on Mitigation 2021 – 2030 and the NDC Action Plan. Moreover, Thailand is in the process of formulating its Long-term Low Greenhouse Gas Emission Development Strategy (LT-LEDS) which will guide Thailand towards a climate-resilient and low GHG emissions development and serve as a basis for enhancing its subsequent NDC.

As one of the top vulnerable countries in the world facing climate risk, Thailand has taken urgent step to address climate change and established GHG mitigation goal committed to UNFCCC, which can be divided into 2 phases:

1) Pre-2020: Thailand's NAMA pledge in 2014 with the highlight that Thailand will endeavor, on a voluntary basis, to reduce its GHG emissions in the range of 7-20% below the business-as-usual (BAU) in energy and transportation sectors by 2020, subject to the level of international support provided.

2) Post-2020: On 1 October 2015, Thailand submitted its Intended Nationally Determined Contribution (INDC) to UNFCCC, which was later become Thailand's NDC. With the target to reduce its GHG emissions by 20% from the projected BAU level by 2030. This 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 through a balanced and ambitious global agreement under UNFCCC for the implementation of mitigation actions.

The progress and information updated toward NAMA and NDC are as follows:

3.1 Nationally Appropriate Mitigation Action (NAMA)

3.1.1 NAMA Roadmap

In 2014, Thailand submitted its Nationally Appropriate Mitigation Action (NAMA) pledging to reduce its GHG emissions by 7-20% from the projected BAU level by 2020, with subject to the level of international supports provided in the form of technology, finance, and capacity building for NAMA preparation and implementation. The key mitigation actions committed and implemented in Thailand's NAMA Roadmap to serve the target under energy and transportation sectors are as following group of measures:

- Development of renewable energy and alternative energy sources;
- Energy efficiency improvements in power generation, industries, buildings, and transportation;
- Substitution of bio-fuels for fossil fuels in the Transportation sector; and
- Thailand's Transport Infrastructure Development Plan.

Roadmap to Thailand's NAMA presents the pathway on a voluntary basis for GHG mitigations within 2020. The mitigation measures under NAMA specific in energy and transportation sectors are under 3 main plans: the Alternative Energy Development Plan (AEDP 2015), the Energy Efficiency Plan (EEP 2015) and the Power Development Plan (PDP 2015). To date, NAMA implementation has offered promising mitigation outcomes and has ensured that Thailand is on a strong track to meet its 2020 target.

3.1.2 Progress toward NAMA Roadmap between 2016-2018

In this BUR, Thailand reported NAMA achievement of a 57.84 MtCO2eq GHG reduction in 2018; accounting to a 15.76% reduction from the BAU level. The majority of GHG reduction has been conducted from the measure of *Heat Generation from Bio-Renewable Energy,* while the measure of *Heat Generation from Natural Renewable Energy (Solar)* has contributed the least of GHG reduction. *The Energy Efficiency Improvement by Thermal Power Plants and Clean Technology Power Plants measures* (measure no. 7 and 8) were classified into the new group unitedly under the measure no. 9; *Energy Efficiency Improvement in Thermal Power Plants (Natural Gas and Lignite)* since 2017. The details of the progress toward NAMA Roadmap between 2016 -2018 additionally updated from the SBUR are presented in Table 3-1.

Table 3-1: Description of NAMA Roadmap and achievement between 2016-2018

Mitigation Measures	GHGs	Target	Indicator	Methodology of GHG reduction calculation	Mitigation policy	Assumptions	Achieved outcome	GHG Reduction ($MtCO_2eq$)		
								2016	2017	2018
1. Electricity Generation from Natural Renewable Energy (RE)	CO_2	Increase the ratio of electricity generation from RE to 20% of total electricity generation by 2036	GWh of electricity generation from RE	Calculated from GWh of electricity generation from RE multiplied by grid emission factors	Promote RE to generated electricity under the Alternative Energy Development Plan (AEDP2015)	Natural renewable energy includes solar, wind and hydropower	13,747 GWh of electricity was generated from solar photovoltaics, wind power and hydropower in 2018	3.99	5.53	7.27
2. Electricity Generation from Bio-Renewable Energy (Biomass and Biogas)	CO_2	Increase the ratio of electricity generation from RE to 20% of total electricity generation by 2036	GWh of electricity generation from bio-renewable energy	Calculated from GWh of electricity generation from bio- renewable multiplied by grid emission factors	Promote RE to generated electricity under AEDP2015	Bio-renewable energy includes biomass, biogas and waste	20,983 GWh of electricity was generated from biomass, biogas and waste in 2018	9.86	9.95	11.10
3. Heat Generation from Natural Renewable Energy (Solar)	CO_2	Increase the ratio of heat production from RE to 30-35% of heat demand by 2036	ktoe of heat generation from RE	Calculated from ktoe of heat generation from RE multiplied by CO_2 emission factors of heat generation from the manufacturing industry	Promote RE to generated heat under AEDP2015	Heat from renewable energy includes solar thermal	10.10 ktoe of heat was generated from solar thermal energy in 2018	0.02	0.03	0.03
4. Heat Generation from Bio-Renewable Energy (Biomass and Biogas)	CO_2	Increase the ratio of heat production from RE to 30-35% of heat demand by 2036	ktoe of heat generation from bio-renewable energy	Calculated from ktoe of heat generation from bio-renewable energy multiplied by CO_2 emission factor of heat generation from the manufacturing industry	Promote RE to generated heat under AEDP2015	Heat from bio-renewable energy includes biomass, biogas and waste	7,909 ktoe of heat was generated from biomass, biogas and waste in 2018	23.46	24.04	26.55

Table 3-1: Description of NAMA Roadmap and achievement between 2016-2018 (cont'd)

Mitigation Measures	GHGs	Target	Indicator	Methodology of GHG reduction calculation	Mitigation policy	Assumptions	Achieved outcome	GHG Reduction ($MtCO_2eq$)		
								2016	2017	2018
5. Biodiesel Consumption for Transportation	CO_2	Biodiesel consumption to 14.0 million liters per day by 2036	Million liters of Biodiesel consumed by transportation	TJ of fossil fuel (converted from Specific Energy Consumption (SEC) reduced by clean technology power plants	Promote consumption in diesel vehicles by using biofuel blends (e.g. B5 biofuel) under AEDP2015	Biodiesel substitutes for diesel	1,550 million liters of Biodiesel consumed by transportation in 2018	3.32	3.76	4.18
6. Ethanol Consumption for Transportation	CO_2	Ethanol consumption to 11.3 million liters per day by 2036	Million liters of ethanol consumed by transportation	Calculated from liters of ethanol consumed multiplied by NCV and CO_2 emission factor of gasoline	Promote ethanol consumption in gasoline vehicles by using ethanol fuel blends (e.g. E10, E20, E85) under AEDP2015	Ethanol substitutes for gasoline	1,532 million liters of ethanol consumed by transportation in 2018	2.92	3.13	3.34
7. Energy Efficiency Improvement by Thermal Power Plants	CO_2	Retrofit and improve efficiency of power plants was in accordance with schedule of the Power Development Plan (PDP	TJ of fossil fuel (converted from Specific Energy Consumption (SEC) reduced by thermal power plan	Calculated from TJ of lignite savings in thermal power plant multiplied by NCV and CO_2 emission factor of lignite	Improve the heat rate of thermal power plants under the Power Development Plan (PDP2015)	Thermal power plants use lignite	Lignite saved by thermal power plants from improving Specific Energy Consumption	0.12	-	-
8. Energy Efficiency Improvement by Clean Technology Power Plants	CO_2	Improve efficiency of the clean technology power plants was in accordance with schedule of the Power Development Plan (PDP)	TJ of fossil fuel (converted from Specific Energy Consumption (SEC) reduced by clean technology power plants	Calculated from TJ of natural gas savings in clean technology power plant multiplied by NCV and CO_2 emission factors of natural gas	Improve the heat rate of clean technology power plants under PDP2015	Thermal power plants use natural gas	Natural gas saved by thermal power plants from improving Specific Energy Consumption	1.37	-	-

Table 3-1: Description of NAMA Roadmap and achievement between 2016-2018 (cont'd)

Mitigation Measures	GHGs	Target	Indicator	Methodology of GHG reduction calculation	Mitigation policy	Assumptions	Achieved outcome	GHG Reduction ($MtCO_2eq$)		
								2016	2017	2018
9. Energy Efficiency Improvement in Thermal Power Plants (Natural Gas and Lignite)	CO_2	Improve efficiency of power plants in accordance with PDP2015 timeline	tCO_2/MWh of thermal power plants using natural gas and tCO_2/MWh of thermal power plants using lignite	Calculated from difference in tCO_2/MWh of thermal power in plants before and after the measure, multiplied by MWh of electricity generated from that plant	Improve the heat rate of thermal power plants (natural gas and lignite) under PDP2015	Thermal power plants use either natural gas or lignite	0.457 tCO_2/MWh for thermal power plants using natural gas and 0.9455 tCO_2/MWh for thermal power plants using lignite in 2018	-	4.56	4.62
10. Energy Efficiency Standard Labelling for Electric Devices	CO_2	4,149 ktoe of electricity saved by high efficiency devices approved by energy efficiency standards/ labelling by 2036	GWh of electricity saved by high efficiency devices	Calculated from GWh of electricity saved by high efficiency devices multiplied by grid emission factor	Promote energy efficiency standards for electric devices under the Energy Efficiency Plan (EEP2015)	GWh of electricity saved comes from the grid	1,554.33 GWh of electricity saved by high energy efficient devices in 2018	0.62	0.72	0.75
TOTAL								45.68	51.72	57.84

3.2 Nationally Determined Contribution (NDC)

3.2.1 NDC Roadmap

As Thailand's NDC committing to a 20-25% emissions reduction compared to BAU by 2030, Thai Cabinet endorsed an NDC Roadmap (2021-2030) in 2017 to deliver on the country's NDC targets. Developed through a national consultative process which identified a set of mitigation actions in the energy, transportation, IPPU and waste management sectors, the NDC Roadmap constitutes a tangible action plan to achieve ambitious gals.

The NDC Action Plan 2021-2030, together with supportive plan as a driven mechanism for action plan were carried out with the wild range of stakeholder consultation and public participation processes at the national and local levels and were identified emission reduction targets in each measure to facilitate the relevant agencies to be able to achieve the target under the assigned mitigation measures. Under the responsibility of sectoral agencies, action plans for each sector have been conducted to determine activities/ projects, goals, indicators and funding/budget sources to support NDC implementation starting in 2021. The NDC Action Plan is currently approved by the NCCC and it consists of 15 groups of mitigation measures summarized as shown in Table 3-2.

Table 3-2: Mitigation measures under Thailand's NDC Action Plan (2021-2030)

Sector	Mitigation measure
1. Energy	A total of 5 measures are as follows: *Energy Generation* 1. Increase power generation efficiency 2. Renewable energy generation *Energy Consumption in Households* 3. Increase energy efficiency in households 4. Renewable energy in households *Energy Consumption in Buildings (Commercial and Public)* 5. Increase energy efficiency in buildings
2. Transportation	A total of 3 measures are as follows: 1. Avoid/Reduce traveling 2. Shift/Maintain travel modes 3. Improve energy efficiency in transport
3. IPPU and Industrial Wastewater	A total of 3 measures are as follows: 1. Clinker substitution 2. Refrigerant replacement/modification 3. Industrial wastewater management
4. Municipal Waste Management	A total of 4 measures are as follows: *Waste Management* 1. Reducing the amount of waste (e.g. reducing disposal rates, increasing recycling and waste utilization, etc.) *Wastewater Management* 2. Increasing biogas production from industrial wastewater through re-utilization of methane 3. Industrial wastewater management 4. Municipal wastewater management

3.2.2 The Preparation for NDC Implementation

In preparation to support mitigation actions under NDC, which commence in 2021, ONEP developed an updated NDC, consistent with the country's relevant policies and based on the national following plans:

- 12th National Economics and Social Development Plan 2017-2021
- Climate Change Master Plan 2015-2050
- Power Development Plan 2015-2036
- Thailand Smart Grid Development Master Plan 2015-2036
- Energy Efficiency Plan 2015-2036
- Alternative Energy Development Plan 2015-2036
- Environmentally Sustainable Transport System Plan 2013-2030
- National Industrial Development Master Plan 2012-2031
- Waste Management Roadmap

The updated NDC addresses Thailand's commitment on the NDC target of 20-25% GHG emission reductions and updated its post-2020 efforts. Moreover, Thailand is in the process of formulating its Long-term Low Greenhouse Gas Emission Development Strategy (LT-LEDS) and developing several projects to support NDC targets such as Tracking System of Thailand's GHG Emissions Reduction (Web based), Application of NDC Tracking, Public Handbook for the GHG Emissions Reduction and Climate Change Resilience, etc.

Thailand's updated NDC was approved by the NCCC and the Cabinet in 2020 and later on submitted to the UNFCCC.

CHAPTER 4

CONSTRAINTS, GAPS, NEEDS AND SUPPORT RECEIVED

CHAPTER 4: CONSTRAINTS, GAPS, NEEDS AND SUPPORT RECEIVED

Thailand has made significant efforts as a signatory party to implement the UNFCCC according to its capabilities. We have incorporated climate change into its national economic and social development plans since 2007. Climate change is currently addressed at the highest policy level under the National Strategy (2018-2037) to ensure a long-term continuity of the issue alongside other economic and social considerations. The Climate Change Master Plan 2015-2050 reflects on climate change mitigation, adaptation and enabling environment issues.

Nevertheless, key constraints and gaps were identified which include capacities and resources of governmental agencies, private sectors, and public for preparing and implementing climate actions. The provision of support and cooperation are important to achieving mitigation and adaptation objectives and increasing ambition. To enhance Thailand's effective implementation of mitigation, adaptation and climate resilient actions towards the ultimate objective of the UNFCCC and the goal of Paris Agreement, adequate and predictable means of implementation in terms of finance, technology transfer, and capacity building are needed.

This chapter shared Thailand's updated information on constraints and gaps, and related support needed for NDC implementation which were nationally determined through a participatory process. In addition to our domestic efforts, the success of NDC will be subject to adequate and predictable access to enhanced means of implementation agreed under the UNFCCC. The chapter follows the guidelines for the preparation of BURs from Non-Annex I Parties contained in Annex III of Decision 2/CP.17

4.1 Constraints and Gaps

Main constraints and gaps of Thailand to implement climate change mitigation and adaptation action and enhancing enabling environment can be described below.

4.1.1 Mitigation

Thailand intends to reduce its GHG emissions by 20% from the projected BAU level by 2030 and has integrated the target into the National Strategy. This will be implemented through the NDC Roadmap on Mitigation 2021 – 2030 and the NDC Action Plan. As the energy sector has been the largest contributor to Thailand's GHG emission, it will play an important role to the success of NDC. Ambitious energy targets are put forward in the Power Development Plan (PDP), the Alternative Energy Development Plan

(AEDP) and the Energy Efficiency Plan (EEP). For the transportation sector, Thailand is implementing the Environmentally Sustainable Transport System Plan to promote road-to-rail modal shift for both freight and passenger transport. The Waste Management Roadmap promotes waste-to-energy technologies and 3Rs (Reduce, Reuse and Recycle) principle.

It is important to incorporate concerns that several of the proposed measures and actions in these ambitious plans require high investment, particularly costs of technologies and infrastructures. They also require a high level of technical capacity and effective coordination across different sectoral agencies which can become main barriers. For the energy sector, key constraints and gaps include, for instance, limitation of grid connection due to inadequate capacity of transmission lines, insufficient funding from financial institutions, limited domestic technological and technical resources and negative public perception particularly against waste-to-energy and biomass power plants. For the transportation sector, main barriers include limited resources to develop and invest in electrification of transport and battery charging technologies. Furthermore, large capital investment is required to support road-to-rail modal shift for both freight and passenger transport. For the waste management, limited resources and capacity, shortage of proper technology at subnational and local levels for waste management system remain key barrier.

4.1.2 Adaptation

Thailand is a developing country highly vulnerable to the impacts of climate change which is ranked, by Global Climate Risk Index (CRI), as the 8th most affected countries in the period 1999-2018. This shows that Thailand is increasingly at risk of either frequent events or rare, but extraordinary catastrophes.

To build adaptive capacity and enhance climate resilience, Thailand has developed the National Adaptation Plan (NAP) through a participatory process of extensive stakeholder consultations with involvement by representatives from relevant government agencies, technical experts, academia, civil society, international organizations and private sectors as well as vulnerable groups to identify climate impacts, vulnerability and adaptation gaps and needs; analyze current climate and future climate change projection, assess climate risks, and identify adaptation measures covering 6 priority sectors including water resources management, agriculture and food security, tourism, public health, natural resources management, and human settlements and security.

During the NAP development, major constraints and gaps were identified which include uncertainties of climate change and its impacts, insufficient data and researches on coping capacities and vulnerabilities in sectors and local area, shortage of tools and methods to support implementation, and high institutional barriers to encompass sectoral and political boundaries. Furthermore, we found that key responsible public agencies have limited capacity to develop climate information services for facilitating climate-smart decision. They do not have appropriate data and technology for conducting efficient detailed climate change vulnerability assessment in 6 sectors under NAP. For private

sector, main challenges include limited knowledge to properly integrate climate risks into Business Continuity Plan (BCP), shortage of innovative technology such as early warning technology, smart farming, or technology to improve crop/livestock varieties and management systems. These are very crucial gaps to overcome in order to build climate resilience across value chains, in particular for agricultural sector which is key sector of the Thai economy employing around 30% of the workforce but is highly vulnerable to climate change.

4.1.3 Enabling Environment

A proper enabling environment can provide a set of solid foundations for Thailand in establishing priorities in climate actions, setting up legislations to drive climate action across government and economy, and transparency tracking progress of Thailand towards a climate-resilient and low greenhouse gas emissions development.

Climate Change Master Plan 2015-2050 has established to build enabling environment in 4 main areas which include 1) research and development in data and technology for climate, 2) development of legislations, economic instruments, financial mechanisms, and technical tools to support climate actions, 3) capacity building for relevant stakeholders and raising climate ethic and awareness for all, 4) development of Measurement, Reporting and Verification (MRV) and Monitoring and Evaluation (M&E) systems for climate actions in all levels.

Nevertheless, key barriers and gaps remain in building the effective enabling environment for climate actions in Thailand. These include limited capacity of sectoral and subnational agencies to integrate adaptation and mitigation measures into their respective planning processes, unclear of the national monitoring and evaluation system of climate finance-related policies, shortage of knowledge and best practices on legislative framework and modalities to support NDC implementation and limited formal and non-formal education and training programs to strengthen teachers and educators focusing on climate change at all levels.

4.2 Support Needed in Finance, Technology Development and Transfer, and Capacity Building

Thailand has actively implemented several climate actions towards the goals of the Paris Agreement. To continue to enhance domestic climate action in mitigation, adaptation and building the enabling environment. Adequate and predictable access to finance, technology development and transfer, and capacity building from international cooperation is very crucial. To unlock potentials of climate actions in Thailand, international supports are required to address key barriers, make technological solutions more affordable and strengthen the capacity of relevant and responsible stakeholders.

In this session, the international support needed are reported in three areas namely mitigation, adaptation and enabling environment. Under each area, description of support

needed is briefly summarized in the table and categorized into four groups which include:

a. *Technology Development and Transfer (TT):* a support needed from developing and transferring innovative and practical technologies to support Thailand's actions on climate change.
b. *Technical support/assistance (TS):* a non-financial assistance needed from international specialists which can take a form of sharing information and expertise, transmission of working knowledge, and consulting services and may also involve the transfer of technical data, know-how and knowledge. This may include but not limited to the support in policy development and implementation, development of mechanisms and instruments, climate information and MRV, M&E systems, etc.
c. *Capacity building (CB):* a support needed for developing and strengthening the skills, abilities, processes, and resources of organizations and stakeholders for planning and taking climate actions.
d. *Financial support (FS):* a support needed in a form of money or financial instruments such as grant, soft loan, equity or guarantee to support and leverage government and private sector investment in climate actions, in particular for incremental cost or risk premium required to make the investment of climate action viable, or to cover specific activities such as technical assistance or capacity building.

4.2.1 Mitigation

The primary target sector is energy and transportation which responsible for more than 95% of the targeted GHG emission reductions. For energy sector, Thailand has initiated various domestic efforts to launch several mechanisms such as feed-in tariffs, tax incentives and access to investment grants and venture capital to promote renewable energy and energy efficiency. However, to achieve ambitious and more rapid deployment, incentives must be created for technology developers to cooperate and share technology knowledge to enable technology transfer on a larger scale.

Advanced technology development and transfer, including technical assistance and capacity building to support climate action is needed. This includes, for example, applications of sensor technology, data analysis and artificial intelligence for improving energy efficiency in Building Energy Management (BEM) and Factory Energy Management (FEM) and electrification of the transportation. International financial support mechanisms such as technical assistance and technology transfer funds for purchasing intellectual property rights for a free distribution of clean energy technologies would be highly valuable to accelerate diffusion of energy technologies.

At present, government agencies and especially local administrative organizations (LAO) in Thailand are facing a waste and wastewater management problem. We need proper wastewater treatment and waste-to-energy technology at subnational and local levels.

The overall support needed in relation to mitigation action is summarized in Table 4-1.

Table 4-1: Summary of finance, technology and capacity building support needed for mitigation actions

Sector	Support needed (Policy/Plan/Measure/Programme/Project)	Key stakeholder	Support type			
			TT	TS	CB	FS
Energy	Development of Energy efficiency and renewable energy technologies, including innovative and cost-effective technologies and approaches in advanced energy storage system and demand-side management.	EPPO, DEDE	X	X		
Energy	Exploration of the potential of offshore renewable power generation systems to provide alternative energy source.	DEDE	X	X		X
Energy	Deployment of smart generation and dispatch, smart transmission, smart consumers, smart grid, electricity grid industry and the establishment of a smart grid environment.	EPPO, EGAT, MEA, PEA	X	X	X	X
Energy	Applications of sensor technology, data analysis and artificial intelligence for improving energy efficiency in Building Energy Management (BEM) and Factory Energy Management (FEM).	DEDE	X	X		X
Energy	Design of compulsory energy management for large corporates with non-designated buildings.	DEDE		X	X	X
Energy	Advanced biofuel technology for improving cost-effectiveness of ethanol and biodiesel production.	DEDE	X		X	
Energy	Development of solar cooling and solar heating technology.	DEDE	X	X	X	X
Energy	Promotion of waste-to-energy technologies.	DEDE	X	X		X
Transport	Enhancement of electrification of transport, and technical support for battery charging technologies.	OTP	X	X		
Transport	Transformation of public transport vehicles in major cities in Thailand into hybrid or electric vehicles (e.g. buses, minibuses, vans, taxis, motorcycle taxis, etc.).	OTP	X	X	X	X
Transport	Improvement of Non-Motorized Transport (NMT) such as Bike Sharing and Bike Lanes.	OTP, BMA, LAOs	X	X		X
Waste	Study of country-specific emission factors for municipality/community-based wastewater treatment.	PCD, TGO, ONEP		X	X	X
Waste	Development of wastewater treatment technology for GHG emission reductions that are suitable for Thailand at subnational and local levels.	PCD, ONEP, DEQP, LAOs, DPT	X	X		X

Remark:

TT: Technology Development & Transfer / TS: Technical Support & Assistance /

CB: Capacity Building / FS: Financial Support

4.2.2 Adaptation

Thailand has developed our first NAP to provide a framework towards climate-resilient society with the focus on water management, agriculture and food security, tourism, health, natural resource management, and human settlement and security. The NAP aims to minimize risks and vulnerability as well as to improve resilience of the country in accordance with sustainable development pathway.

Thailand needs various supports to successfully drive climate change adaptation agenda. For example, the capacity building of sectoral and subnational agencies to integrate adaptation measures into their respective planning processes. The capacity building and technical support for responsible public agencies to develop climate information services for facilitating climate-smart decision, including the development of climate resilient index and tools for conducting detailed climate change vulnerability assessment in 6 sectors under NAP. The technical support to develop an application of Integrated Water Resources Management (IWRM) and Ecosystem-based Approach (EbA) practices would be very useful to assist Thailand to effectively manage and improve water resources and the ecosystem to be resilient from climate risks. It is also crucial to build capacity in the M&E system of NAP for relevant stakeholders in Thailand.

Overall, the support needed to support adaptation actions is summarized in Table 4-2.

Table 4-2: Summary of finance, technology and capacity building support needed for adaptation actions

Sector	Support needed (Policy/Plan/Measure/ Programme/Project)	Key stakeholder	Support type			
			TT	TS	CB	FS
Agriculture & Food Security	Technology for Improvement of plant, animal and fishery breeds for climate resilience focused on drought, heat, waterlogging, and pest tolerances, early maturity, and crop water use efficiency.	DOA, DLD, RD, DOF	X	X		X
Agriculture & Food Security	Development of early warning systems in agriculture.	DOA, RD	X	X		X
Agriculture & Food Security	Promotion of climate smart agriculture technologies and precision farming technologies to increase cost-effectiveness and climate resilience.	DOA, DLD, RD, DOF, RID	X	X	X	X
Water Management	Application of Integrated Water Resources Management (IWRM) and Ecosystem-based Approach (EbA) practices.	ONWR	X	X		X
Water Management	High-impact technologies in water resource management including networking and management of infrastructure, seasonal climate prediction as part of weather and hydrological modelling, sensor webs using observation and/or modelling data as a part of an early warning system.	ONWR	X	X		X
Water Management	Precision irrigation areas according to typhoon disaster risk based on climate models.	RID	X	X	X	X
Water Management	Provide accurate and timely forecasting information using a multi-hazard program.	RID	X	X	X	X
Water Management	Development of a real-time flood monitoring and warning system.	RID	X	X	X	X
Natural Resource	Technical support to promote community participation in the preservation and conservation of natural resources, ecosystems, and biodiversity.	DNP, DMCR		X	X	
Public Health	Formulation of climate economic models to forecast economic impacts resulting from health impacts from climate change.	DOH		X	X	X
Public Health	Strengthening health systems on climate change adaptation and resilience due to health impacts from extreme weather events and related emerging diseases.	DOH		X	X	X
Multi-Sectoral	Support to sectoral agencies to develop climate resilient index in 6 sectors under NAP to provide updated information and climate resilient evaluation for both policy makers and the public.	ONEP, ONWR, OAE, DOT, DOH, DPT, Office of the Permanent Secretary of MONRE		X	X	

Table 4-2: Summary of finance, technology and capacity building support needed for adaptation actions (cont'd)

Sector	Support needed (Policy/Plan/Measure/Programme/Project)	Key stakeholder	Support type			
			TT	TS	CB	FS
Multi-Sectoral	Tools for Climate Change Vulnerability Assessment in 6 sectors under NAP.	ONEP, ONWR, OAE, DOT, DOH, DPT, Office of the Permanent Secretary of MONRE	X	X		X
Multi-Sectoral	Capacity-building of responsible agencies to develop climate information services for facilitating climate-smart decision in 6 sectors under NAP.	ONEP, ONWR, OAE, DOT, DOH, DPT, Office of the Permanent Secretary of MONRE		X	X	X
Multi-Sectoral	Capacity-building of responsible agencies to enhance early warning systems for disaster. management in human settlement and security, agriculture, tourism, and health sectors.	DDPM			X	X
Multi-Sectoral	Support to UNFCCC National Focal Point to develop reporting, monitoring, and evaluation system of NAP.	ONEP		X		
Multi-Sectoral	Systematic climate model and atmospheric observation.	TMD		X		X

Remark:
TT: Technology Development & Transfer / TS: Technical Support & Assistance /
CB: Capacity Building / FS: Financial Support

4.2.3 Enabling Environment

As described, to effectively implement climate change mitigation and adaptation, Thailand needs not only NDC and NAP, but also enabling environment to support the implementation by encouraging innovation, creating co-benefits, integrating climate actions into day-to-day operations of public and private agencies. Efforts to strengthen government planning, budgeting, monitoring, and evaluating are crucial for the better management of scarce domestic resources in a climate response and to effectively use of international climate finance and support.

Thailand needs international supports to build proper enabling environment in climate actions, for example, in developing the subsequent NDC, especially on the assessment of mitigation potentials, and cost-benefit analysis. Development of the national monitoring and evaluation system of climate finance-related policies. Formulation of long-term climate economic models for use by policy makers to forecast economic impacts from climate policies or measures. In brief, the support needed in building enabling environment is summarized in Table 4-3.

Table 4-3: Summary of finance, technology and capacity building support needed for enabling environment

Area	Support needed (Policy/Plan/Measure/Programme/Project)	Key stakeholder	Support type			
			TT	TS	CB	FS
Awareness Raising	Establishment of reporting and monitoring systems for the Action for Climate Empowerment (ACE)	DEQP		X	X	X
Awareness Raising	Support to promote, develop and implement of formal and non-formal education and training programs as well as to strengthen teachers and educators focusing on climate change at all levels.	DEQP, ONEP, MOE			X	X
Awareness Raising	Awareness-raising for relevant stakeholders and the general public on climate change and NDC.	DEQP, ONEP			X	X
Mechanisms and Instruments	Exchange of knowledge and experiences on the integration of climate change aspect into the national budget system.	ONEP, BB		X	X	
Mechanisms and Instruments	Assistance to develop financial instruments, mechanisms and approaches to engage private sectors in the NDC implementation	ONEP, FPO		X	X	X
Mechanisms and Instruments	Capacity-building of national and subnational actors to develop financial proposals for funding access to implement measures under NDC.	ONEP, MOI		X	X	X
Mechanisms and Instruments	Exchange of knowledge and best practices on legislative framework and modalities to support NDC implementation.	ONEP		X	X	

Table 4-3: Summary of finance, technology and capacity building support needed for enabling environment (cont'd)

Sector	Support needed (Policy/Plan/Measure/Programme/Project)	Key stakeholder	Support type			
			TT	TS	CB	FS
Mechanisms and Instruments	Formulation of long-term climate economic models for use by policy makers to forecast economic impacts from climate policies or measures.	ONEP		X	X	X
MRV / M&E	Development of the national monitoring and evaluation system of climate finance-related policies.	ONEP		X		
MRV / M&E	Development of MRV framework for tracking and reporting climate finance across sectors.	ONEP, TGO		X	X	X
MRV / M&E	The development of M&E system for the implementation of a national financial mechanism related to climate change.	ONEP, BB		X	X	X
Policy Implementation	Capacity building of sectoral and subnational agencies to integrate adaptation and mitigation measures into their respective planning processes.	ONEP, TGO, DEQP, MOI		X	X	X
Policy	Technical support to apply the top-down analysis for GHG emission reduction approaches for policy makers to identify the specific/sectoral targets.	ONEP		X	X	X

Remark:
TT: Technology Development & Transfer / TS: Technical Support & Assistance /
CB: Capacity Building / FS: Financial Support

4.3 International Support Received

Thailand has received supports from a variety of international partners which strengthen the country to overcome some constraints, gaps and barriers of climate actions. We take this opportunity to express our gratitude and appreciation for all supports. To further enhance Thailand's effective implementation of mitigation, adaptation and climate resilient actions towards the goal of Paris Agreement, the adequate means of supports in terms of finance, technology transfer, and capacity building are still needed as described in the previous session.

This session summarizes key messages and overview of the support received by Thailand, excluding global and regional supporting projects, during the year 2017 and 2020. The formal supports received prior the year 2017 can be found in the Third National Communication (TNC) and Second Biennial Update Report (SBUR). The support received were categorized into three main areas: mitigation, adaptation and enabling environment.

4.3.1 Support Received for Preparing National Communications (NC) and Biennial Update Reports (BUR)

Thailand, as a signatory to the UNFCCC, received financial support from the Global Environment Facility (GEF) to compile and publish the TBUR under the three-year project entitled Thailand's Fourth National Communication (FNC) and Third Biennial Update Report (TBUR) to the UNFCCC was supported with GEF funding of 852,000 USD and in-kind support from the Thai Government of 700,000 USD. The United Nations Development Programme (UNDP) has been implementing entity responsible for the management of these funds for the GEF.

4.3.2 Support Received from International Donors/Partners

Thailand has received support from a number of multilateral and bilateral partners in order to facilitate climate action.

Global Environment Facility (GEF)

The Global Environment Facility (GEF) has provided technical and capacity building supports to Thailand through various programmes. From GEF-5 and GEF-6, Thailand received supports to climate change activities, excluding the supports on the NC and BUR preparation, from five key projects with more 9.5 million USD, while Thailand provided co-financing around 201.4 million USD. Key programmes supported by GEF include Sixth Operational Phase of the GEF Small Grants Programme in Thailand, GEF UNIDO Cleantech Programme for SMEs, Greening Industry through Low Carbon Technology Application for SMEs, and Achieving Low Carbon Growth in Cities through Sustainable Urban Systems Management in Thailand (LCC). Furthermore, GEF has provided grant funding, through UNDP, to assist Thailand in the preparation of its NC and BUR as described previously.

Special Climate Change Fund (SCCF)

Thailand received one project supported by the Special Climate Change Fund (SCCF) for strengthening the Capacity of Vulnerable Coastal Communities to Address the Risk of Climate Change and Extreme Weather Events. This project assisted Thailand to develop mechanisms for communities to identify and articulate their climate risk reduction priorities, with the aim of obtaining sustainable financing for concrete adaptation proposals from provincial and sub-district government budgets in three southern provinces and five sub-district in Thailand.

Green Climate Fund (GCF)

Thailand has received several readiness activities supported through GCF's Readiness and Preparatory Support Programme (GCF's Readiness Programme). Key supporting activities include Strengthening the capacities of the Environmental Fund Division to serve as Thailand's key national mechanism for climate finance, Enabling readiness for up scaling investments in Building Energy Efficiency for achieving NDC goals in Thailand, Advancing Thailand's Access to GCF, Scaling up Thailand's climate finance readiness, and recently Increasing resilience to climate change impacts in marine and coastal areas along the Gulf of Thailand which built builds upon the existing NAP process aiming to Integrate climate change adaptation into marine and coastal area related planning and budgeting.

Beyond the readiness supports, Thailand submitted the concept note for the project/ programme, "Enhancing Climate Resilience in Thailand through Effective Water Management and Sustainable Agriculture". The project aims to mitigate the social and economic impacts of climate change in the Yom and Nan river basins. Thailand needs support in building capacity to develop other high-quality project proposals to be submitted to the GCF since Thailand currently have not had any funding proposal approved by the GCF for climate actions.

Multilateral partners

Major multilateral partners include United Nations entities such as United Nations Environment Programme (UNDP), the United Nations Environment Programme (UNEP), United Nations Industrial Development Organization (UNIDO), and The Food and Agriculture Organization of the United Nations (FAO). United Nations partners play a crucial role in assisting Thailand to access the UNFCCC climate funds mentioned above. Multilateral partners also include financial institutions and organizations such as the World Bank, the Asian Development Bank (ADB), and the European Union (EU).

United Nation Entities

Meanwhile, United Nations entities have focused on assisting Thailand to strengthen its institutional and policy frameworks, both of which are crucial to facilitate the country's efforts in achieving national climate targets. For example, Thailand's Office of Natural Resources and Environmental Policy and Planning (ONEP), together with UNDP, recently launched a project entitled "NDC Support Delivering Sustainability through Climate Finance Actions in Thailand" to support Thailand in making progress on its NDCs through the development of financing frameworks for climate action which is funded by the Governments of Germany and Sweden.

The World Bank

The World Bank has been an important partner to Thailand for decades. In recent years, its support of Thailand in enhancing market-based mechanisms through the Partnership for Market Readiness (PMR). The goal is the design and implementation of a domestic market mechanism to reduce energy consumption and GHG emissions attributed to the energy and the industrial processes sector. Participation in the PMR programme consists of two main work streams. The first is the establishment of an energy performance certificate (EPC) scheme, which is a voluntary target-and-trade system seeking to increase energy efficiency in energy-intensive manufacturing facilities and buildings. The second activity is the Low Carbon City (LCC) programme, which aims to promote sustainable development practices in Thai municipalities and local communities, by bolstering the generation of T-VERs from GHG emission reduction projects developed by municipal entities.

The Asian Development Bank (ADB)

Thailand has also been involved in many regional programmes and projects, especially through ADB and various Association of Southeast Asian Nations (ASEAN) working groups. The long-term project, Strengthening SMEs in mitigating and adapting to climate change: Thailand case for ASEAN's SMEs, which strives to enhance the capacity of small and medium enterprises to adapt to the ever-changing environment and to transition towards low-carbon business models, is a collective effort at the ASEAN level to build resilience and increase competitiveness of this important component of the regional economy.

Bilateral partners

Parties included in Annex II to the Convention and other industrialized country parties who provide support to Thailand include, but are not limited to:

Germany

The German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU), through its funding instrument, the International Climate Initiative (IKI), has provided support to Thailand for a project on the Development and Implementation of a Climate Change Policy in Thailand through its flagship programme, including "Thai-German Climate Programme (TGCP)". This programme has assisted Thailand in elaborating and implementing its national climate change strategy and reducing GHG emissions. Moreover, BMU has supported Thailand in developing the NAP through "Risk-based National Adaptation Plan Project (Risk-NAP)".

Australia

The Australian government, the Department of Industry, Science, Energy and Resources has supported the development of the Thailand Greenhouse Gas Emissions Inventory System (TGEIS) to support Thailand in improving its MRV framework for climate action at the national level, which will eventually facilitate policy formulation and decision-making processes, as well as aiding in the preparation of NCs and BURs. The second phase of this project is expected to achieve further development of the TGEIS system in order to assess additional conditions for each sector e.g. IPPU with F-gases or land-use, and will allow for a more complete report of the national GHG inventory according to UNFCCC's requirements.

Japan

The Government of Japan has made different funding sources available to support the development of Joint Crediting Mechanisms (JCM), which provides financial support for the installation of machinery equipment for low carbon technologies in Thailand. Other programmes include the Thailand Climate Change Adaptation Information Platform (T-PLAT), and the programme on Strengthening Institutional and Policy Framework on Disaster Risk Reduction and Climate Change Adaptation Integration.

United Kingdom

The UK government's Foreign and Commonwealth Office through its Prosperity Fund has provided technical assistance to Thailand under ASEAN Low Carbon Energy programme. The programme aims to drive inclusive growth and poverty reduction through increased energy efficiency and adoption of low carbon energy by strengthened policy and regulatory framework for green finance and energy efficiency in Thailand.

4.3.2 Support Received by Sector

When categorized by sector, Thailand has received most supports in climate change mitigation by both amount of support received and number of projects, while climate change adaptation received smallest amount and number of supports. As Thailand one of the top countries highly vulnerable to the impacts of climate change, more supports in climate change adaptation is needed as well as the support in building enabling environment for climate actions.

The breakdown of information for each sector is detailed in the graphs below, providing a bigger picture of the international support Thailand receives. It is important to note that amount of support include non-financial support such as technical assistance, capacity building, technology development and transfer as well as direct financial support.

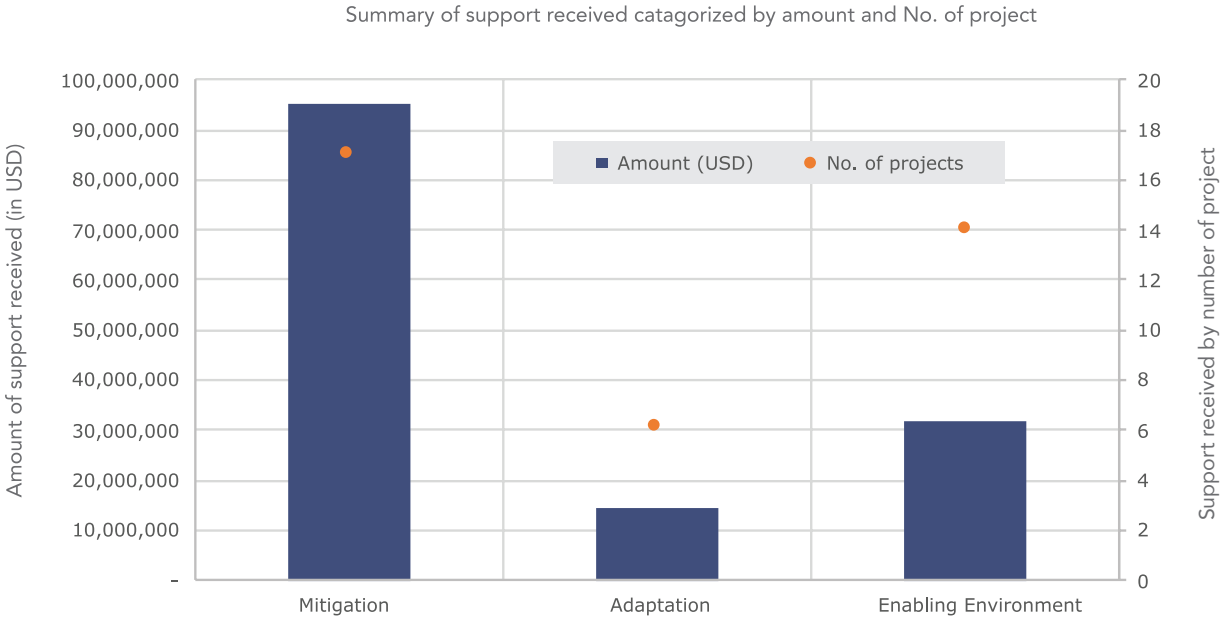


Figure 4-1: Summary of all support received

Mitigation

The support received by sector for mitigation actions is summarized in the Figure 4-2. From the support received for mitigation actions, Energy, IPPU and AFOLU sectors are among top sectors respectively categorized by number of projects. However, when categorized by amount of money, IPPU was the sector that received highest support in climate mitigation. The support received is not fully aligned with the government's priority which the energy and the transportation sectors are the key sectors for climate mitigation actions. As described in the previous session, additional supports are needed for energy and transportation sector to enhance Thailand's NDC implementation.

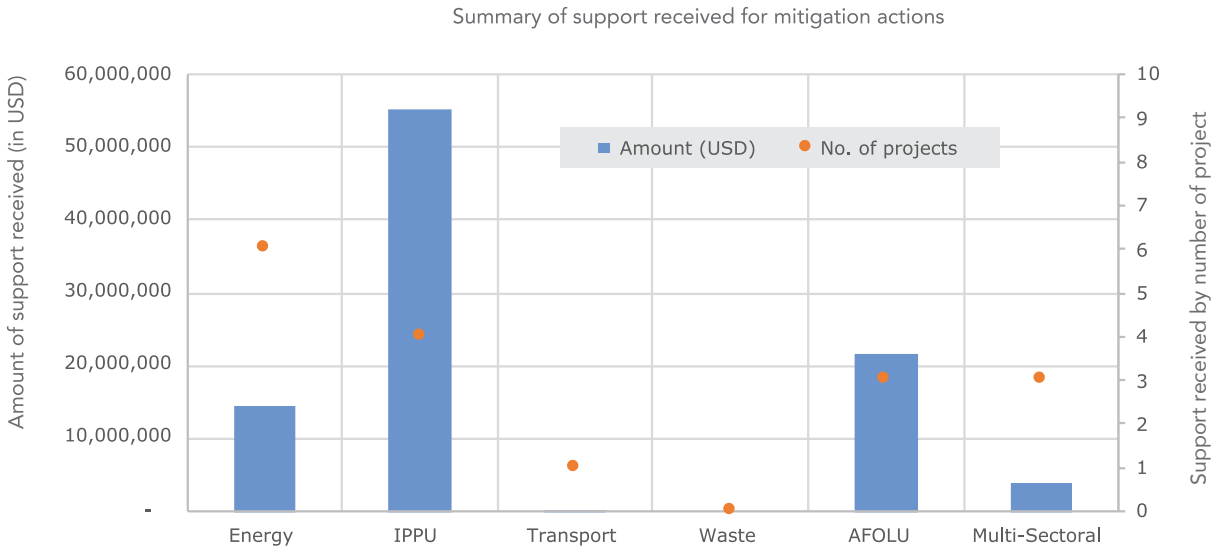


Figure 4-2: Support received for mitigation actions

Adaptation

The support received by sector for adaptation actions is summarized in the Figure 4-3. Thailand's support received for adaptation actions were spread across several sectors in water management, human settlement, natural resources, agriculture, and multi-sectors. However, it is important to note that the amount of support received were far lower than support needed by Thailand to take actions in minimizing risks and vulnerability as well as to improving resilience of the country.

As a highly vulnerable country to the impacts of climate change, Thailand needs more supports in climate change adaptation especially in water management and agricultural sector. As previously described, the agricultural sector alone accounts for over 30% of total employment in Thailand.

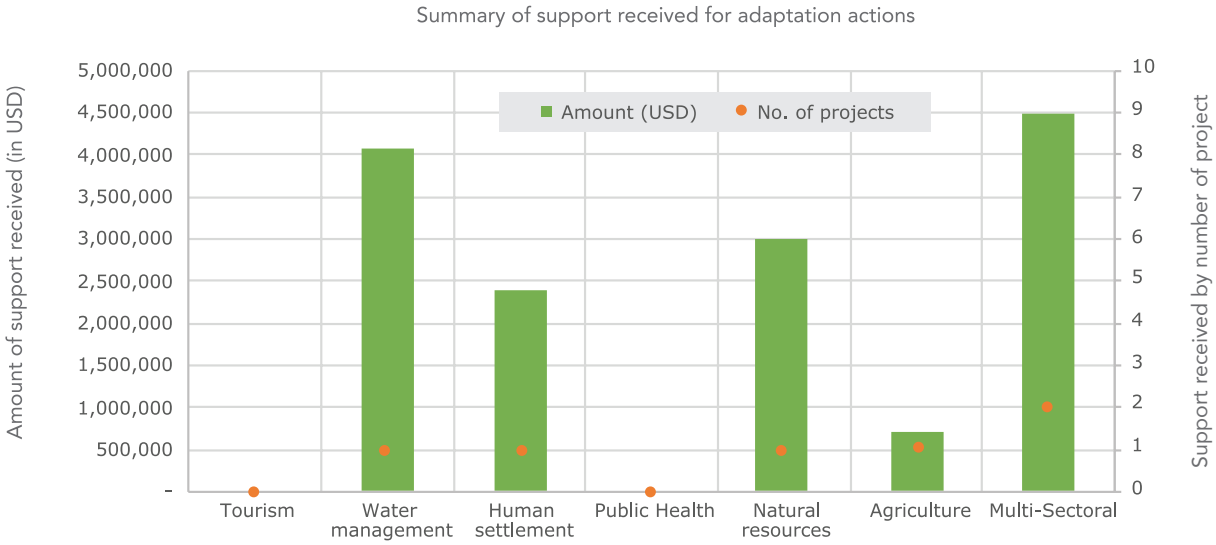


Figure 4-3: Support received for adaptation actions

Enabling Environment

The support received by sector for enhancing enabling environment is summarized in the Figure 4-4. Most supports to enhance enabling environment of climate actions in Thailand are related policy implementation, institutional strengthening, MRV or M&E development. Based on the support needed, Thailand needs more assistance in raising awareness and creating mechanisms and Instruments to effectively enable climate actions. This includes for example an exchange of knowledge and experiences on the integration of climate change aspect into the national budget system and an assistance to develop financial instruments, mechanisms and approaches to engage private sectors in the NDC implementation, etc.

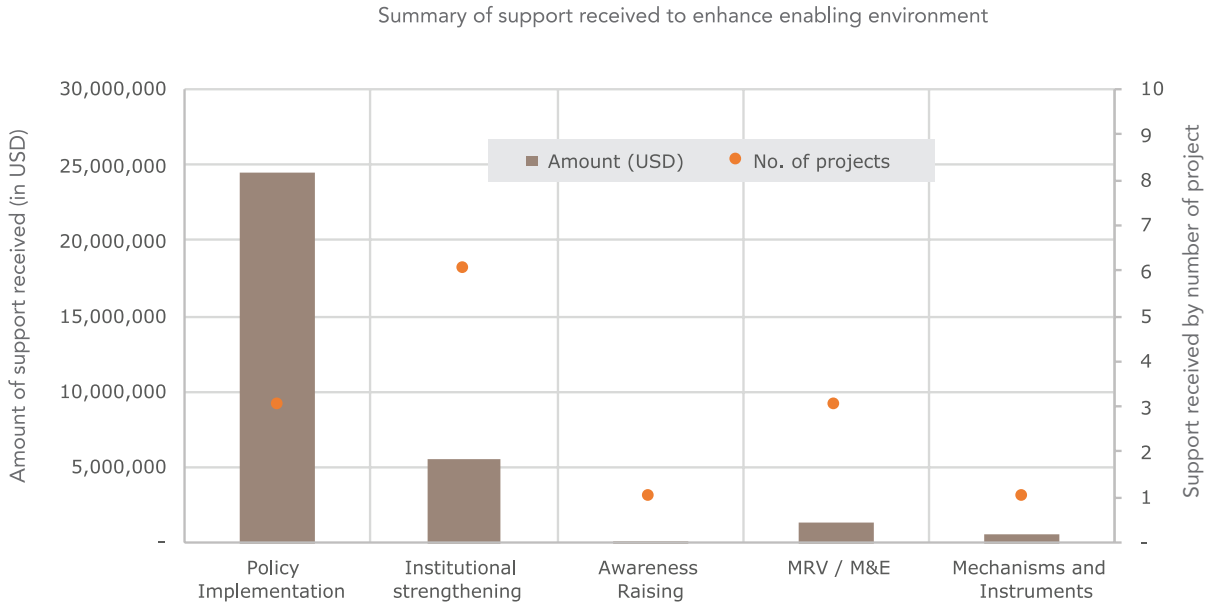


Figure 4-4: Support received for enhancing enabling environment

4.3.3 Support Received by Support Type

The support received in climate actions can also be categorized into 4 supporting types: technology transfer, technical support, capacity building, and financial support (see figure 4-5).

It is important to note that most projects detailed in this report involve more than one type of support. A combination of technical support and capacity building is the most common type of support that Thailand has received. Another important message can be drawn is Thailand only received few projects that provided supports in form of technology development and transfer as well as direct financial support.

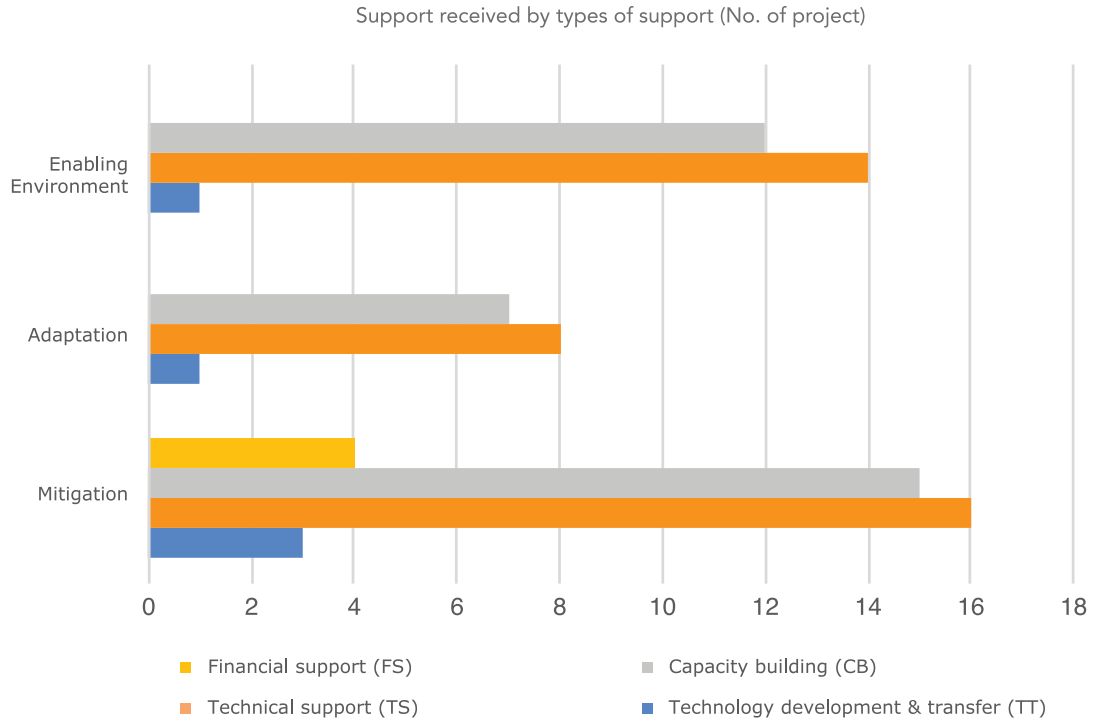


Figure 4-5: Support received by support type

4.3.5 Summary of Support Needed and Received

Although Thailand's GHG emissions represent less 1% of global emissions Thailand has made significant efforts in mitigating the country's GHG emissions with available resources and capabilities according to its capabilities. Thailand is increasingly at risk of either frequent events or rare, but extraordinary catastrophes and therefore needs to take immediate actions to build adaptive capacity and enhance climate resilience. However, several of the proposed measures and actions in climate mitigation and adaptation plans require strong institutional structure, innovative technology as well as human capacity.

Main support needed were identified which include an increase in capacities and resources of governmental agencies, private sectors, and public to take climate actions. At present, the responsible public agencies still have limited capacity to develop information services for facilitating climate-smart decision. Therefore, Thailand needs international supports to build proper enabling environment and take climate actions in both mitigation and adaptation.

Overall, to enhance Thailand's effective implementation of mitigation, adaptation, and climate resilient actions towards the goal of Paris Agreement, the support needed by Thailand and the support provided by international partners shall be aligned.

Table 4-4: Project list of support received for mitigation actions in Thailand

(Projects reported in SBUR and TNC, while remaining active in the TBUR reporting period, are not listed in the tables below.)

Project name	Project description	Subsector	Project period	Donor agency / Partner agency	Supported amount	Support Type			
						TT	TS	CB	FS
Industrial Energy Efficiency Project	Objective: to promote energy efficiency in the industries through introduction of ISO Energy Management Standard incorporating industrial energy systems optimization.	Energy	2011 - 2017	GEF, UNIDO	$ 3,620,000 (GEF)		X	X	
Promoting Energy Efficiency in Commercial Buildings in Thailand (PEECB)	The project aims at improving energy efficiency in the commercial building sector with the following expected outcomes: 1. Enhanced awareness of the government, building sector and banks on EE technologies and practices 2. Effective implementation of favorable policies that encourage EE technologies and practices for commercial building in Thailand 3. Improved confidence in applying EE technologies and practices in commercial buildings in Thailand 4. Improved local technical and managerial capacity to design, manage and maintain EE technologies and practices 5. Replication of demonstration projects withing the commercial building sector.	Energy	2013-2017	GEF, UNDP	$ 3,637,273 (GEF)		X	X	
GEF UNIDO Cleantech Programme for SMEs in Thailand	Objective: The project aims at promoting clean energy technology innovations and entrepreneurship in selected SMEs in Thailand through cleantech innovation platform and entrepreneurship acceleration programme.	Energy	2015 - 2020	GEF, UNIDO	$ 1,826,500 (GEF)		X	X	
Greening Industry through Low Carbon Technology Applications for SMEs	Objective: To promote and support adoption of energy efficient practices and technologies in selected Small and Medium Enterprises (SMEs) in Thailand for improved competitiveness and a greening of industry.	Energy	2016 – 2021	GEF, UNIDO	$ 1,880,000 (GEF)		X	X	

Table 4-4: Project list of support received for mitigation actions in Thailand (cont'd)

Project name	Project description	Subsector	Project period	Donor agency / Partner agency	Supported amount	Support Type			
						TT	TS	CB	FS
Accelerating construction of energy efficient green housing units in Thailand	Objective: to accelerate the process of establishing a labelling scheme for low rise homes in the short term and show case benefits of energy efficient buildings to " build energy efficient green homes and address the greenhouse emission reduction goal of Thailand and enhance the comfort and living space for low and middle income populations living in low rise housing units".	Energy	2019 – 2024	GEF, UNEP	$ 3,141,142 (GEF)		X	X	
Enabling readiness for up scaling investments in Building Energy Efficiency for achieving NDC goals in Thailand	Objective: to support Thailand in achieving national targets for energy efficiency in the building sector as defined in Energy Efficiency Plan of 2015, in NAMAs, and in Thailand's NDC.	Energy	2020	GCF, UNEP, CTCN	$ 244,120		X	X	
HCFC Phase out management plan: stage I	The main activities to be implemented are: 1) conversion of foam enterprises to non-HCFC based technologies, enabling activities in the refrigeration servicing sector, including safety norms, and support to the project implementation and monitoring unit.	IPPU	2013 – 2018	Multilateral Fund (MLF), the World Bank	$ 23,052,037		X	X	X
HCFC Phase out management plan: stage II	In the HCFC Phase out management plan stage I, the reduction in HCFC usage was achieved at 219.54 ODP tons (1,234 MT of HCFC-22 and 1,380 MT of HCFC-141b from the 2012 level). The stage II continues this effort and select the Servicing of Air-Conditioning and Refrigeration as well as Spray Foam as the priority sectors.	IPPU	2020 – 2023	MLF, the World Bank	$ 5,083,929		X	X	X

Table 4-4: Project list of support received for mitigation actions in Thailand (cont'd)

Project name	Project description	Subsector	Project period	Donor agency / Partner agency	Supported amount	Support Type			
						TT	TS	CB	FS
Thailand Refrigeration and Air Conditioning Nationally Appropriate Mitigation Action (RAC NAMA)	Objective: Objective: to support Thailand in reaching its energy saving and climate target through climate friendly and energy efficient cooling technologies and strengthening the industry in staying competitive and bring international climate finance to the country via both demand-side and supply-side approaches.	IPPU	2016 – 2021	NAMA Facility, GIZ	€ 14,700,000	X	X	X	X
Application of Industry-urban Symbiosis and Green Chemistry for Low Emission and Persistent Organic Pollutants free Industrial Development in Thailand	Objective: to reduce greenhouse gas emissions, as well as releases of persistent organic pollutants and other harmful chemicals from industries and urban centers through the application of industry-urban symbiosis and green chemistry technology.	IPPU	2019 – 2024	GEF, UNIDO	$ 8,966,000 (GEF)	X	X	X	
Focus on fuel efficiency data collection platform Moverity	By providing a platform for real-world fuel consumption data collection in the ASEAN region, Moverity addresses this lack of real-world data and aims at enabling consumers and policy makers to make informed choices based on real world, transparent fuel consumption data. Moverity crowd-sources real-word fuel consumption data of car users and provides tips to drivers on how to reduce fuel consumption by eco-driving techniques.	Transport	2019 – 2020	GIZ	€ 88,320		X	X	
Thailand FCPF Readiness Preparation Project	The development objective of Forest Carbon Partnership Facility (FCPF) Reduce Carbon Emissions from Deforestation and Degradation (REDD+) Readiness Project for Thailand is to support the development of the Readiness Preparation Activities. This will be achieved by supporting the preparation of its REDD+ strategy, the design of a national Measurement, Reporting and Verification (MRV) system, and by producing technical work and policy advice.	AFOLU	2016 - 2019	Forest Carbon Partnership Facility (FCPF), World bank	$ 3,980,000		X		

Table 4-4: Project list of support received for mitigation actions in Thailand (cont'd)

Project name	Project description	Subsector	Project period	Donor agency / Partner agency	Supported amount	Support Type			
						TT	TS	CB	FS
Technical Assistance for the Development of REDD+ MRV system and Forest Reference Level for Thailand	The project assists Thailand in developing the Forest Reference Level (FRL), so the country can set a benchmark against which it can measure the emissions reduced from implementing a national REDD+ program. In addition, Thailand's National Forest Monitoring System (NFMS) will be improved and updated as a practical tool for national forest policy and planning.	AFOLU	2018 - 2020	FCPF, World Bank, FAO	$ 825,001		X		
Low Emission Capacity Building (LECD) project in Thailand	The goal of this project is to build capacities for the development of Nationally Appropriate Mitigation Actions (NAMAs) in selected industrial sectors and to systematize the GHG inventory in the sectors of Transport and Waste.	Multi-Sec-toral	2013-2018	EU, Governments of Germany and Australia	$ 930,000			X	
Thai Rice NAMA (Nationally Appropriate Mitigation Action)	Three intervention strategies are used in the program: 1. Low-Emission Rice Production Technology: farmers are trained on how to implement mitigation technologies and sustainable best practices in rice production and are encouraged to switch practices by a Revolving Fund (RF) to cover startup costs for mitigation service provision. 2. Mitigation Technology Services: Support business development by leveraging a national green credit programme for capital investment to provide mitigation technology services to farmers. 3. Policy Formulation & Supporting Measures: A Sustainable Rice Practice standard is developed based on the Sustainable Rice Platform (SRP) and the project is integrated into the Thai government's work plan and budget at all levels.	AFOLU	2018 – 2023	NAMA Facility, GIZ	€ 14,900,000	X	X	X	X

Table 4-4: Project list of support received for mitigation actions in Thailand (cont'd)

Project name	Project description	Subsector	Project period	Donor agency / Partner agency	Supported amount	Support Type			
						TT	TS	CB	FS
Partnership for Market Readiness (PMR)	The PMR has supported Thailand to: - Create an Energy Performance Certificate scheme (EPC) and Low Carbon City Program (LCC). - Develop a domestic MRV system. The Domestic MRV system will be designed in harmonization with international standards and meet international requirements. - Set up the institutional/legal framework, designing a data collection system, standardizing emission measurement, reporting and verification procedure; and - Build capacity for involved ministries, agencies, and stakeholders	Multi-Sectoral	2016 – 2020	PMR, the World Bank	$ 3,000,000		X	X	
Thailand's Greenhouse Gas Emissions Inventory System (TGEIS)	This is an Australia-Thailand Cooperation on National Greenhouse Gas Inventories by applying the Australian Greenhouse Gas Emissions Information System (AGEIS) and establishing Thailand's Greenhouse Gas Emissions Inventory System. The TGEIS will contribute to a more efficient inventory system to support the Thailand National Communication (NC) and Biennial Update Report (BUR). The 2nd phase expected to achieve on further development of the TGEIS system to be able to support IPPU with F-gases and Land-use, and also be able to report the national GHG inventory according to UNFCCC's form, included establishing Archiving System and Metadata for 6 relevant inventory sectors; energy, transportation, IPPU, agriculture, LULUCF and waste.	Multi-Sectoral	1st phase: 2017 - 2018; 2nd phase: 2019 -2020	GEF, Government of Australia	A$ 29,500 (2nd phase)		X	X	

Remark:

TT: Technology Development & Transfer / TS: Technical Support & Assistance / CB: Capacity Building / FS: Financial Support

Table 4-5: Project List of Support Received for Adaptation Action in Thailand

(Projects reported in SBUR and TNC, while remaining active in the TBUR reporting period, are not listed in the tables below.)

Project name	Project description	Subsector	Project period	Donor agency / Partner agency	Supported amount	Support Type			
						TT	TS	CB	FS
Introduction to the Flood and Drought Management Tools	The project provides a methodology with online tools to facilitate the inclusion of information on floods and droughts, and future scenarios into Integrated Water Resources Management (IWRM) planning and Transboundary Diagnostic Analyses (TDA) and Strategic Action Plans (SAP), and Water Safety Planning (WSP). These approaches are used to support planning from the transboundary basin to local (water utility) level.	Water Management	2014 - 2018	GEF, UNEP	$ 4,000,000		X	X	
Supporting the integration of the agriculture sector into the National Adaptation Plan (NAP) in Thailand	The project aims to integrate agriculture in National Adaptation Plans will support partner countries to identify and integrate climate adaptation measures for the agricultural sector into relevant national planning.	Agriculture	2015 - 2019	Germany, FAO, UNDP	$ 700,000		X	X	
Sixth Operational Phase of the GEF Small Grants Programme in Thailand	The program, by providing financial and technical support to projects that conserve and restore the environment while enhancing people's well-being and livelihoods, demonstrates that community action can maintain the fine balance between human needs and environmental imperatives.	Human settlement	2019 - 2021	GEF, UNDP	$ 2,381,620		X	X	
Increasing resilience to climate change impacts in marine and coastal areas along the Gulf of Thailand	This project focuses on advancing climate change adaptation planning in relation to marine and coastal areas in the Gulf of Thailand. GCF resources will be used to address barriers that hinder information, knowledge, and coordination for adaptation planning; technical capacities for integration of risk informed approaches in planning and budgeting; and lack of options to attract financing for climate change adaptation, particularly from the private sector.	Natural resources	2020 - 2023	GCF, UNDP	$ 3,000,000		X	X	

Table 4-5: Project List of Support Received for Adaptation Action in Thailand (cont'd)

Project name	Project description	Subsector	Project period	Donor agency / Partner agency	Supported amount	Support Type			
						TT	TS	CB	FS
Risk-based National Adaptation Plan project: Risk-NAP Project	The project aims at developing national adaptation plan (NAP) and integrate the priorities of Climate Change Risk Analysis (CCRA) based NAP into sector policies/strategies and subnational planning instruments.	Multi-Sectoral	2015 – 2019	Germany, GIZ	€ 3,950,000		X	X	
Advancing co-design of integrated strategies with Adaptation to climate change in Thailand (ADAP-T)	The project applies observation and forecasting technology to flood risk management trans-disciplinarily, and it aims to contribute to the smooth construction and realization of a climate change adaptation strategy for Thailand by developing the technologies and co-design methods required to develop an integrated adaptation strategy, establishing best practices, and fostering human resources in the field of adaptation.	Multi-Sectoral	2015 – 2020	JICA, University of Tokyo, Kasetsart University	¥ 6,000,000	X	X	X	

Remark:

TT: Technology Development & Transfer / TS: Technical Support & Assistance / CB: Capacity Building / FS: Financial Support

Table 4-6: Project list of support received for enabling environment in Thailand

(Projects reported in SBUR and TNC, while remaining active in the TBUR reporting period, are not listed in the tables below.)

Project name	Project description	Subsector	Project period	Donor agency / Partner agency	Supported amount	Support Type			
						TT	TS	CB	FS
Thailand's Second Biennial Update Report (SBUR) to the UNFCCC)	Objective: To assist Thailand in the preparation of its Second Biennial Update Report (SBUR) for the fulfilment of the obligations under the UNFCCC.	MRV, M&E	2017 - 2018	GEF, UNDP	$ 385,440		X		
Initiative for Climate Action Transparency (ICAT)-MRV systems especially for industry and buildings	With the objective to enhance the efficiency of Thailand's existing Measurement, Reporting and Verification (MRV) System for Climate Change Mitigation, the project aims at identifying the MRV systems for the building and industrial sector. This will provide a solid foundation for Thailand to effectively achieve its GHG reduction target and further contribute to Thailand's Nationally Determined Contributions Roadmap. The government plans to integrate the project results into their newly developed MRV systems.	MRV, M&E	2018 - 2019	GGGI	$ 124,981		X	X	
Thailand's Fourth National Communication and Third Biennial Update Report (NC4-BUR3) to the UNFCCC	Objective: To enable Thailand to prepare its Fourth National Communication (TNC) under decision 17/CP7 and the Third Biennial Update Report (BUR) for the fulfillment of the obligations under the UNFCCC.	MRV, M&E	2019 – 2022	GEF, UNDP	$ 852,000		X		

Table 4-6: Project list of support received for enabling environment in Thailand (cont'd)

Project name	Project description	Subsector	Project period	Donor agency / Partner agency	Supported amount	Support Type			
						TT	TS	CB	FS
Strengthening Thailand's Capacity to Link Climate Policy and Public Finance	The project aims to support Thailand in strengthening its institutional capacity to link a climate change policy with its budgetary allocations, and to report and measure over time the effectiveness of those policies and expenditures. The project strategically focuses on the agriculture and energy sectors as a stepping stone for broader interventions at the national level.	Institutional strengthening	2013 - 2017	UNDP, SIDA	$ 850,275		X	X	
Achieving Low Carbon Growth in Cities through Sustainable Urban Systems Management in Thailand (LCC)	The project aims at promoting sustainable low carbon development in four pilot cities including Nakhon Ratchasima Municipality, Khon Kaen Municipality, Koh Samui Municipality and Chiang Mai Municipality through capacity enhancement as well as integrated framework at the local level	Institutional strengthening	2017 - 2021	GEF, UNDP	$ 3,150,000 (GEF)		X	X	
Strategic Frameworks support for Thailand through GGGI: Advancing Thailand's Access to GCF	The project aims to address a few key challenges preventing Thailand to effectively access to GCF resources, including a) limited technical capacity of NDA in assessing potential GCF projects; b) unidentified priority sector for project pipeline development; and c) the need for private sector engagement in developing the sector investment plan.	Institutional strengthening	2018 – 2019	GCF, GGGI	$ 340,000		X	X	
Scaling up Thailand's climate finance readiness (Strategic Frameworks)	The project aims to scale up the country's climate finance readiness to further increase the Green Climate Fund's engagement and investments in the country. It applies a holistic approach focusing in four key areas: - Acquiring the necessary knowledge and skills to engage with the private sector. - Supporting the accreditation of a direct access entity. - Raising awareness and building capacity of Thai private sector stakeholders on GCF engagement benefits and opportunities. - Identifying GCF project development opportunities along the Thai priorities and mechanisms to facilitate access to finance.	Institutional strengthening	2018 – 2020	GCF, GIZ	$ 555,211		X	X	

Table 4-6: Project list of support received for enabling environment in Thailand (cont'd)

Project name	Project description	Subsector	Project period	Donor agency / Partner agency	Supported amount	Support Type			
						TT	TS	CB	FS
GCF Readiness and Preparatory Support for Thailand (NDA Strengthening)	Objective: - To strengthen the NDA capacity on the GCF procedures, notably on 'no-objection procedures,' coordination mechanisms, and the accreditation processes. - To support the development of stakeholder engagement processes and a country programme which identifies country strategic priorities for engagement with the GCF. - To support the NDA on the dissemination of GCF knowledge and information to relevant stakeholders.	Institutional strengthening	2015 – 2018	GCF, GIZ	$ 258,570		X	X	
NDA strengthening support for Thailand through GIZ: Strengthening the capacities of the Environmental Fund Division to serve as Thailand's key national mechanism for climate finance	The projects intends to support the Environmental Fund Division (EFD) in strengthening its capacities to act as a national climate funding mechanism by providing tailored advice on the integration of climate change in the Environmental Fund Division's portfolio and procedures, delivering trainings for practical knowledge on GCF's operational policies to advance the accreditation request as well as advice the EFD on its public visibility and communication.	Institutional strengthening	2020 – 2021	GCF, GIZ	$ 358,896		X	X	
Nationally Determined Contribution (NDC) Support Project: Delivering Sustainability through Climate Finance Actions in Thailand	The project aims to initiate Thailand's Climate Change Financing Framework (CCFF) to provide the holistic and inclusive approach for climate action needed to ensure the reduction of carbon emission levels and build resilience of communities against increased climate risks such as more frequent flooding, droughts, landslides, and heatwaves.	Mechanisms and Instruments	2019 – 2022	Germany and Sweden, UNDP	$ 481,500		X	X	

Table 4-6: Project list of support received for enabling environment in Thailand (cont'd)

Project name	Project description	Subsector	Project period	Donor agency / Partner agency	Supported amount	Support Type			
						TT	TS	CB	FS
Water and Wastewater Companies on the Way to CO2 Neutrality (WACCLIM)	WaCCliM has piloted mitigation solutions, ranging from energy-efficient pumps to technologies for generating power with wastewater biodigesters, with utilities in Jordan, Mexico, Peru, and Thailand. WaCCliM is also introducing adaptation thinking by helping the pilot utilities develop climate risk plans, advising utility personnel on ways to build water system resilience to the risks identified, reducing water losses, and recycling treated wastewater. The toolbox of both mitigation and adaptation planning measures will be available to utilities everywhere on the knowledge platform Climate Smart Water.	Policy Implementation	2013 – 2022	GIZ	€ 10,500,000 (Selected countries)	X	X	X	
Accelerating Implementation of Thailand's Nationally Determined Contribution	This project builds on GGGI's work in 2015-16, which focused on the development of a practical and implementable Industry GHG Reduction Roadmap for three industrial sectors: palm oil, automotive parts, and frozen seafood. In this project, GGGI will leverage the methodology implemented to formulate the GHG Reduction Roadmap and strong relationship with relevant stakeholders, to develop the NDC Action Plan in 2017-18. Built on the valuable results of the Roadmap, GGGI will move toward the implementation side of the organizational value chain by working to develop bankable projects and providing capacity development on NDC.	Policy Implementation	2017 - Now	GGGI	$ 1,273,000		X	X	

Table 4-6: Project List of Support Received for Cross-cutting Action in Thailand (cont'd)

Project name	Project description	Subsector	Project period	Donor agency / Partner agency	Supported amount	Support Type			
						TT	TS	CB	FS
Thai-German Climate Program (TGCP)	The TGCP follows a cross-sectoral approach and is composed of five integrated components: - climate policy (through the TGCP – Policy) - agriculture (through the TGCP – Agriculture) - energy (through the TGCP – Energy) - waste (through the TGCP – Waste) - water (through the TGCP – Water)	Policy Implementation	2018 – 2021	GIZ	€ 18,477,536		X	X	
Transitioning to Green and Smart City: Case Study of AMATA	The project aims to set an example of green industrial town for Thailand by presenting an assessment of green and smart city model and recommendations ("Green and Smart Industrial Estate Model") for Thailand. As an outcome of the project, "net zero carbon" initiative was adopted and being implemented in Amata City Chonburi starting a floating solar project of which generate energy to be utilized for the city.	Awareness Raising	2018 - 2019	GGGI	$ 68,735		X	X	

BIBLIOGRAPHY

Department of Alternative Energy Development and Efficiency, *Energy Balance of Thailand 2018.*

Department of National Parks, Wildlife and Plant Conservation, *Draft Mid-Term Review of Forest Carbon Partnership Facility (FCPF) REDD+ Readiness Project.*

Intergovernmental Panel on Climate Change, *2006 IPCC Guidelines for National Greenhouse Gas Inventories.*

Ministry of Foreign Affairs, *Thailand's Voluntary National Review on the Implementation of the 2030 Agenda for Sustainable Development 2018.*

Ministry of Energy, *Alternative Energy Development Plan (AEDP) 2015.*

Ministry of Energy, *Energy Efficiency Plan (EEP) 2015.*

Ministry of Energy, *Power Development Plan (PDP) 2015.*

Ministry of Tourism and Sports, *Tourism Satellite Account (TSA) 2018.*

National Statistical Office, *Statistical Yearbook Thailand 2018 and 2019.*

Office of Agricultural Economics, *Agricultural Statistics of Thailand 2018.*

Office of National Water Resources, *The 20-Year Master plan on Water Resources Management 2018-2037.*

Office of Natural Resources and Environmental Policy and Planning, *Thailand's Sixth National Report on the Implementation of the Convention on Biological Diversity.*

Office of Natural Resources and Environmental Policy and Planning, *Thailand's National Adaptation Plan.*

Office of Natural Resources and Environmental Policy and Planning, *Thailand's Nationally Determined Contribution Roadmap on Mitigation 2021-2030.*

Office of the National Economic and Social Development Council, *Human Resource and Social Development Statistics Data.*

Office of the National Economic and Social Development Council, *National Accounts of Thailand 2018.*

Office of the National Economic and Social Development Council, *Report of Studies of the Impact of Changes in Population Structure and Policy Recommendations for National Development from the Population Forecasting of Thailand 2019.*

Office of the National Economic and Social Development Council, *NESDC Economic Report Q4 2017and Q4 2018.*

Office of the National Economic and Social Development Council, *Report of studies of the impact of changes in population structure and policy recommendations for national development from the population forecasting of Thailand 2019.*

Office of the National Economic and Social Development Council, *Thailand Twelfth National Economic and Social Development Plan 2017-2021*.

Pollution Control Department, *Thailand State of Pollution Report 2018.*

Royal Forest Department, *Forestry Statistics Data 2018.*

Thai Meteorological Department, *Thailand's Climate Change Report 2019.*

Thailand Research Fund, *Thailand's Second Assessment Report on Climate Change 2016.*

World Bank Group, *Thailand Economic Monitor 2019.*

THAILAND
THIRD BIENNIAL
UPDATE REPORT

OFFICE OF NATURAL RESOURCES AND ENVIRONMENTAL POLICY AND PLANNING

118/1 Tipco Tower 2, Rama VI Road, Phaya Thai, Bangkok 10400, THAILAND
(Temporary Address)