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NET ZERO EMISSIONS 2050

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Bundit Limmeechokchai

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Activities

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01

The revision and update of Thailand's Long-Term Low Greenhouse Gas Emission Development Strategy (LT-LEDS) and Thailand's National Determined Contribution (NDC)

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The revision and update of Thailand's Long-Term Low Greenhouse Gas Emission Development Strategy (LT-LEDS) and Thailand's National Determined Contribution (NDC)

02

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Energy, Sustainability and Society

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Thailand's mid-century greenhouse gas emission pathways to achieve the 2 degrees Celsius target

Achiraya Chaichaloempreecha[1], Puttipong Chunark[1], Tatsuya Hanaoka[2] and Bundit Limmeechokchai[3*]

Abstract

Background: The Paris Agreement aims at minimizing threats of climate change by keeping global temperature rise well below 2 degrees Celsius above the pre-industrial level and to pursue efforts to limit the rise to 1.5 degrees Celsius. The Representative Concentration Pathways (RCPs) are developed to investigate GHG emission pathways. RCP2.6 focuses on limiting the global temperature rise to less than 2 degrees Celsius. This paper assesses the impacts of carbon price and CCS on energy and GHG emissions in Thailand. The no carbon price (T0) and the carbon price pathways are compared. In addition, the net-zero emissions and year are discussed.

Results: The decarbonized energy system with low-carbon power generation and increased electricity usage in the final energy consumption is the main pillar of GHG mitigation. Imposing carbon prices; increasing solar, wind, and biomass electricity generation; energy efficiency improvements in power generation; and energy savings in the industry and the building sectors, will be the key options for clean power generation in the carbon prices (CT) scenarios. Renewable electricity, coal and natural gas, coupled with CCS and bio-energy with CCS (BECCS) will be utilized significantly to curb GHG emissions. The increase of renewable energy and the electrification of end-use plays a key role in reducing GHG emissions. Fuel switching from diesel to biodiesel, energy efficiency improvement and electric pick-ups and trucks will help reducing GHG emissions in the transport sector.

Conclusions: There are three major policy implications to meet Thailand's 2 degrees Celsius target. First, carbon prices will be the mechanism to accelerate the transformation in the energy sector. Wind and solar electricity will be key pillars of clean electricity in 2050. Policy-makers should update the renewable electricity plans to meet Thailand's 2 degrees Celsius target in 2050. Second, coal- and gas-fired plants, and BECCS will become important options in reducing CO_2 emissions. The policy-makers should investigate the application of CCS in the power sector and the storage location. Third, a major transformation in the transport sector is critically needed. Liquid biofuel and electrification in pick-ups, sedans, and trucks will help reduce GHG emissions.

Keywords: GHG mitigation, 2 Degrees Celsius target, AIM/Enduse, Carbon prices, Carbon capture and storage, Shared socio-economic pathways, Thailand

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Energy system transformation for attainability of net zero emissions in Thailand

Bijay Bahadur Pradhan, Achiraya Chaichaloempreecha, Puttipong Chunark, Salony Rajbhandari, Piti Pita and Bundit Limmeechokchai*

Sirindhorn International Institute of Technology, Thammasat University, Khlong Luang, Pathumthani 12120, Thailand

ABSTRACT

Thailand has a commitment to achieve net zero emissions. The roles of energy service demand reduction and hydrogen in the energy transition have not been sufficiently evaluated. This study analyzed energy and technological implications in the energy sector to attain net zero emissions in Thailand by 2050. This study used the AIM/Enduse model, a bottom-up type energy system model, as an analytical tool. A business-as-usual and a net zero emission scenario are analyzed. Unlike other studies, this paper explored the energy transition in the absence of carbon, capture and sequestration (CCS) technology with a focus on energy service demand reduction and green hydrogen-based technologies. Decarbonization of the energy sector and transition towards net zero emission by 2050 in Thailand would require rapid deployment of renewable energy sources like solar, wind and biomass. In the net zero scenario, installed capacity of solar PV and wind for power generation in 2050 would reach 64 GW and 40 GW, respectively. In addition, green hydrogen will have a crucial role in achieving net zero emission target. The high carbon removals from LULUCF sector in Thailand will aid in reaching net zero emission without CCS technology in the energy sector.

Keywords

AIM/Enduse;
CCS;
Decarbonization;
Net zero emission;
Renewable energy;
Thailand

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Role of Asia towards a Decarbonized World: Road Map of Asian Countries

Analysis of CO_2 emission pathways of Thailand to achieve carbon neutrality 2050 using AIM model

Salony Rajbhandari, Achiraya Chaichaloempreecha and Bundit Limmeechokchai*

Sirindhorn International Institute of Technology, Thammasat University, 99 Moo 18, Km. 41 on Paholyothin Highway, Khlong Luang, Pathum Thani 12120, Thailand

**email: bundit@siit.tu.ac.th, bundit.lim@gmail.com*

Abstract

The rising trend of greenhouse gas (GHG) emissions in Thailand is a matter of concern and demands a need of ambitious mitigation efforts beyond 2030 or even before to contribute towards meeting the long-term goal of the Paris Agreement of staying within 1.5°C. The carbon dioxide (CO_2) emissions come from the major part in the total GHG emissions in Thailand. This study aims at exploring the energy, environmental and macroeconomic impacts of limiting the CO_2 emissions during 2010-2050 under the underlying target of achieving carbon neutrality by 2050. The study has developed a recursive dynamic Asia-Pacific Integrated Model/computable general equilibrium (AIM/CGE) model for Thailand which is soft-linked with the AIM/Enduse model. Besides the business-as-usual (BAU) scenario, the study has formulated two different CO_2 mitigation scenarios, each indicating the carbon neutrality pathway towards 2050. Results indicate that Thailand should put more effort in mitigation actions to achieve carbon neutrality by 2050. Expansion of renewable energy-based technologies, improvement of end-use energy efficiency, fuel-switching and deployment of carbon capture and storage (CCS) technologies both in the power and industrial sectors are identified to be important mitigation measures for Thailand in curbing out the CO_2 emissions by 2050. Results indicate that the introduction of such mitigation measures provide CO_2 emission reduction benefits however at the expense of economic losses. The prices of CO_2 mitigation were found varying from 220 to 332 US$ per tCO_2 in 2050 in the two carbon neutrality scenarios.

Keywords: AIM/CGE, AIM/Enduse, Energy efficiency, Net zero emissions, Renewable energy, Thailand

05 Low carbon scenarios to be analyzed by GCAM

Scenario	Policy Components	Description
Mandatory National Energy Policies	Mandatory national energy policies	Scenario integrating existing national energy development plans & enforced mandatory energy regulation measures
Extended National Energy Policies	All national energy policies	Scenario including additional planned power development and energy efficiency and decarbonization policies along with the plans and regulations above.
Bangkok Smart Energy Policies	All national energy policies + MEA grid digitalization & modernization plans	Scenario integrating MEA's plans for Bangkok grid modernization and digitalization along with all national energy policies.
Net Zero Thailand	All national policies + CO2 emissions constraint	Scenario using most efficient pathway to net zero national CO2 emissions by 2060

Expected outcomes:

* Bangkok's Grid Modernization and Digitalization
* Thailand's Carbon Neutrality 2050

06

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Transition to Deep Decarbonized Energy Systems in Nepal: The Macroeconomic Perspectives

Salony Rajbhandari* and Bundit Limmeechokchai*,1

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ABSTRACT

This study analyzed the macroeconomic impacts of the Nationally Determined Contribution (NDC) and the deep decarbonization pathways aligning with the 2°C and 1.5°C scenarios in Nepal using the computable general equilibrium (CGE) model. The analysis shows that the NDC, the 2°C and the 1.5°C scenarios would be achievable at the expense of national economic loss in Nepal. Results show that extending the NDC targets beyond 2030 without strengthening them would result in a greenhouse gas (GHG) emission reduction of 9.9% by 2050, which is far behind the level of reductions compared to that which could be required under the ideal mitigation pathways needed to confine the temperature rise to 2°C and 1.5°C compared to the pre-industrial levels. Results indicate that the NDC scenario of Nepal could be achievable at a carbon price of US$ 4.0 per tCO_2eq in 2050. However, the results of the CGE modelling analysis of Nepal showed that a much higher carbon price of US$ 21 per tCO_2eq and US$ 245 per tCO_2eq would be needed by 2050 to achieve the 2°C and the 1.5°C scenarios respectively.

Results

Thailand's mid-century greenhouse gas emission pathways to achieve the 2 degrees Celsius target

Table 1 Thailand's 2 degrees Celsius scenarios

Scenario		Low carbon technology		Carbon prices in 2050 (2005 US$/ton CO_2)
		RE	CCS	
BAU		✓*	×	0
CT	T0	✓	×	0
	AIMC	✓	×	70.1
	GCAM	✓	×	185.5
	IMAGE	✓	×	925.4
	WITCH	✓	×	464.8
CT_CCS	T0_CCS	✓	✓	0
	AIMC_CCS	✓	✓	70.1
	GCAM_CCS	✓	✓	185.5
	IMAGE_CCS	✓	✓	925.4
	WITCH_CCS	✓	✓	464.8

Note: * The shares of RE and technology follow the historical patterns from 2005 to 2050.

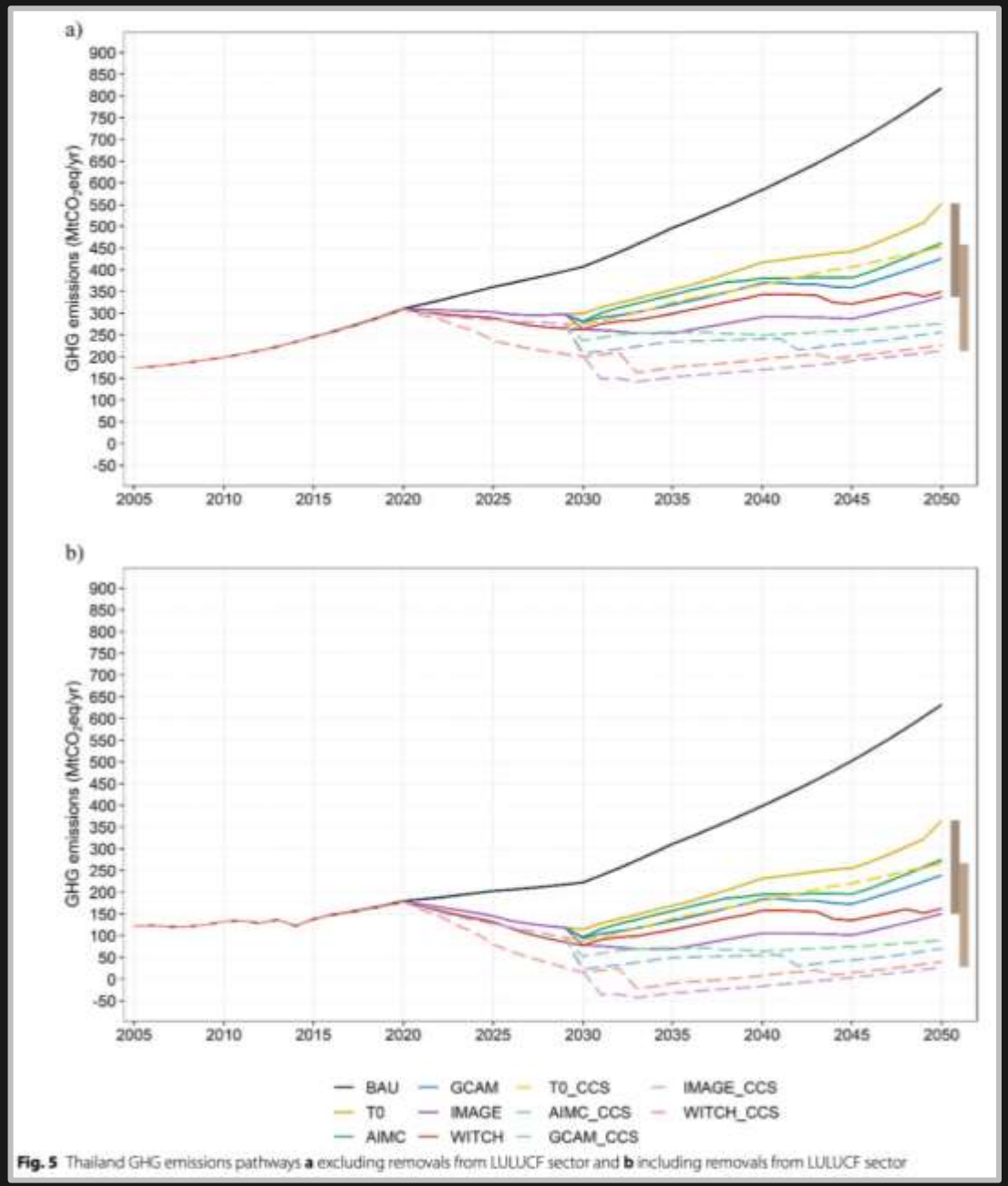
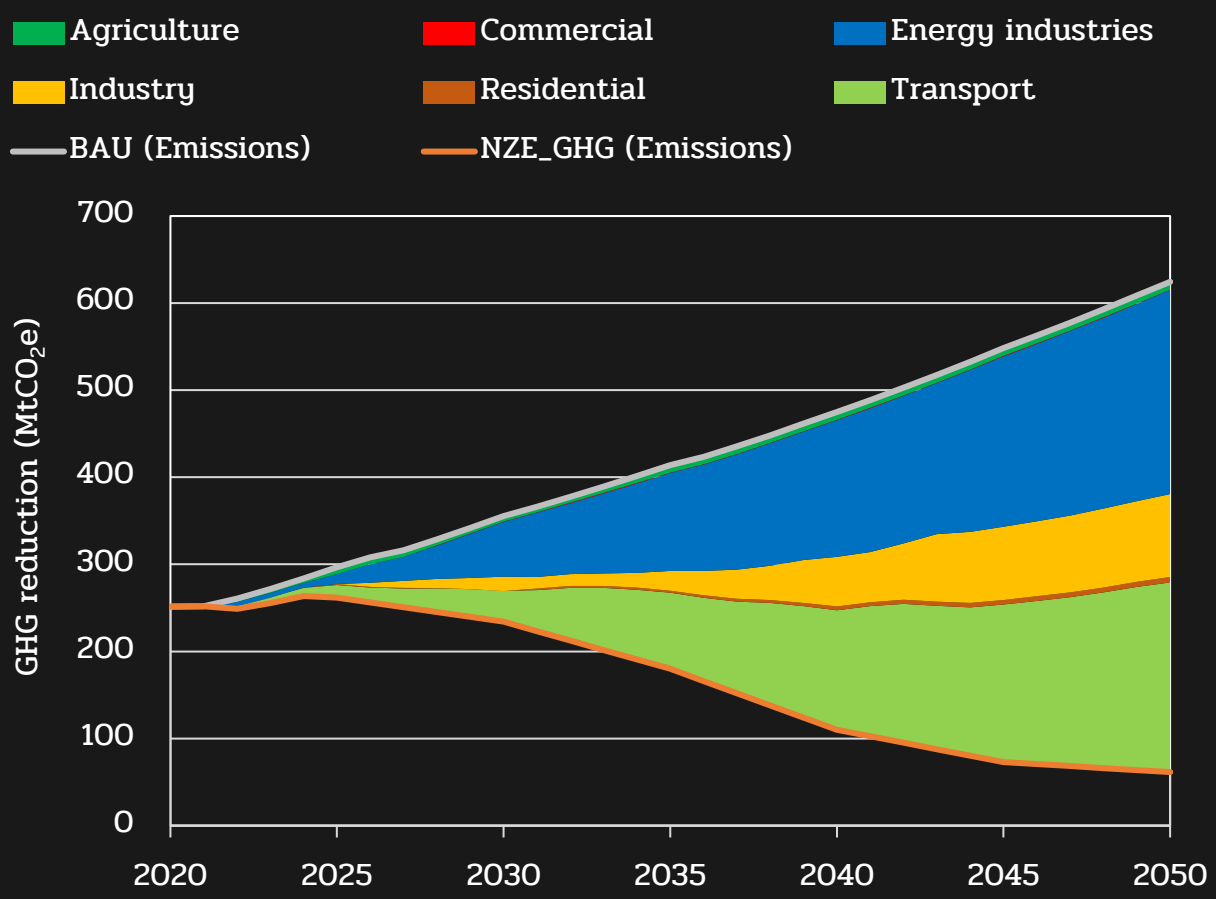
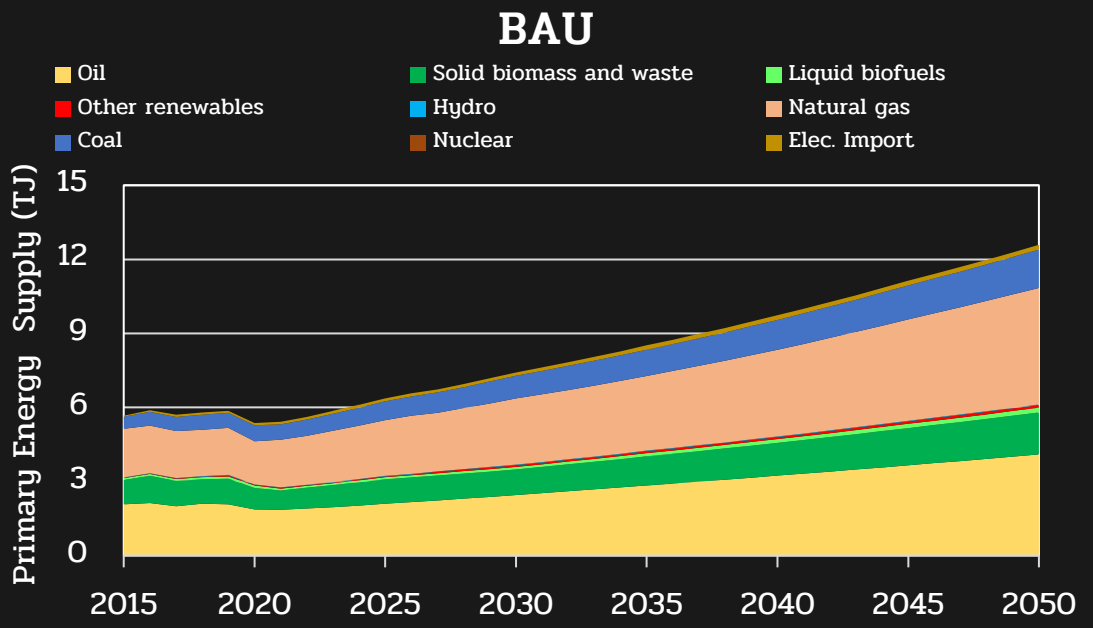
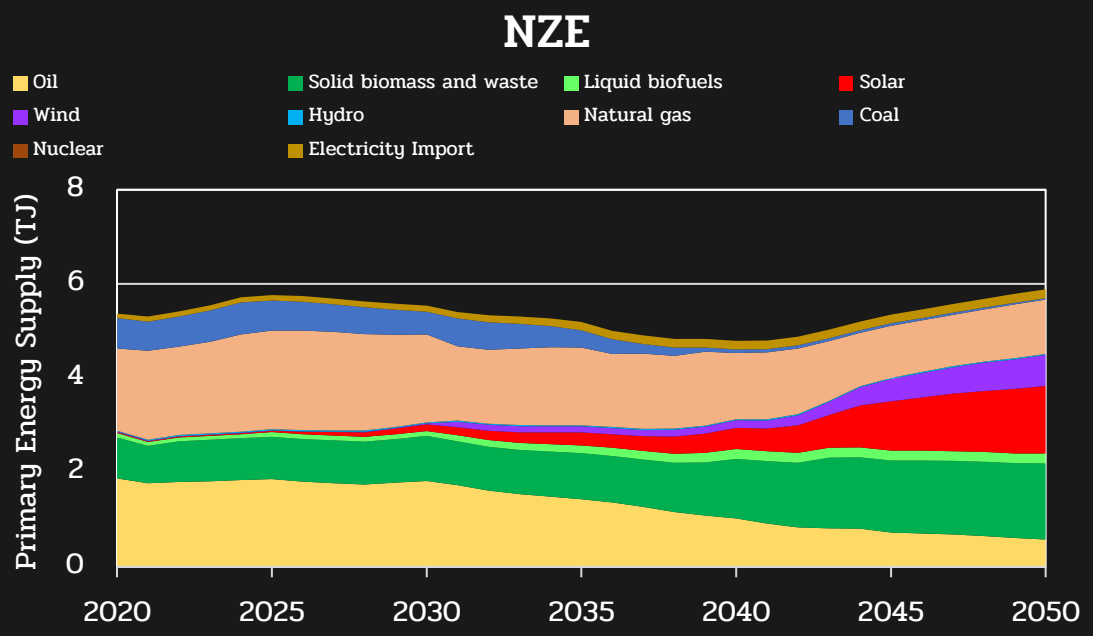


Fig. 5 Thailand GHG emissions pathways **a** excluding removals from LULUCF sector and **b** including removals from LULUCF sector

Energy system transformation for attainability of net zero emissions in Thailand







Process of updated Thailand's LTS

Cabinet

National Committee on Climate Change Policy (NCCC)

Subcommittee on Climate Change Policy & Planning Integration

National Working Group on Integration of GHG Mitigation Policy & Planning

ONEP

UNFCCC

START

Working Group on Thailand's Long-term Low GHG Emissions Development Strategy

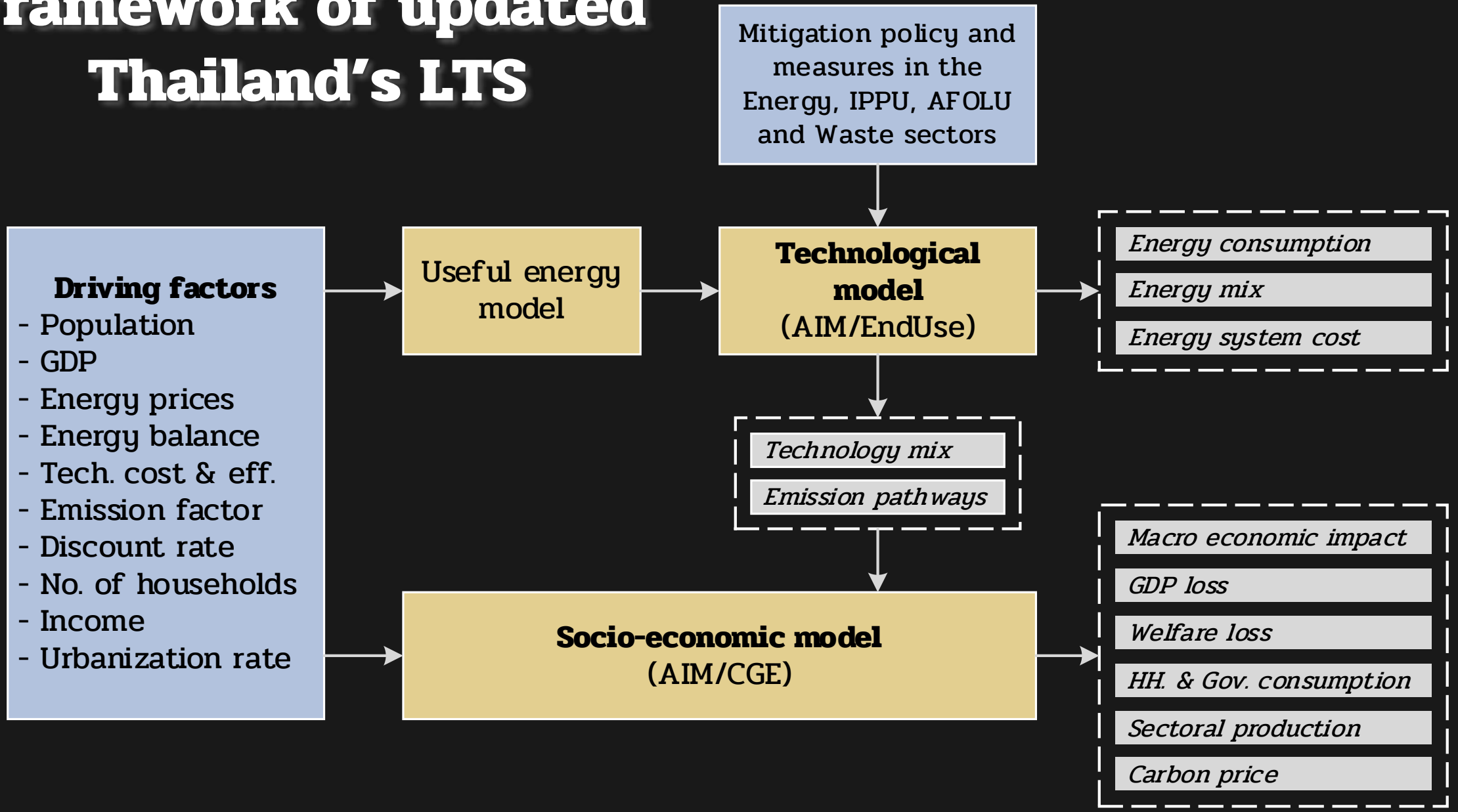
Energy	Transport	Waste	Socio-economy
IPPU	Agriculture	LULUCF	

National Consultation

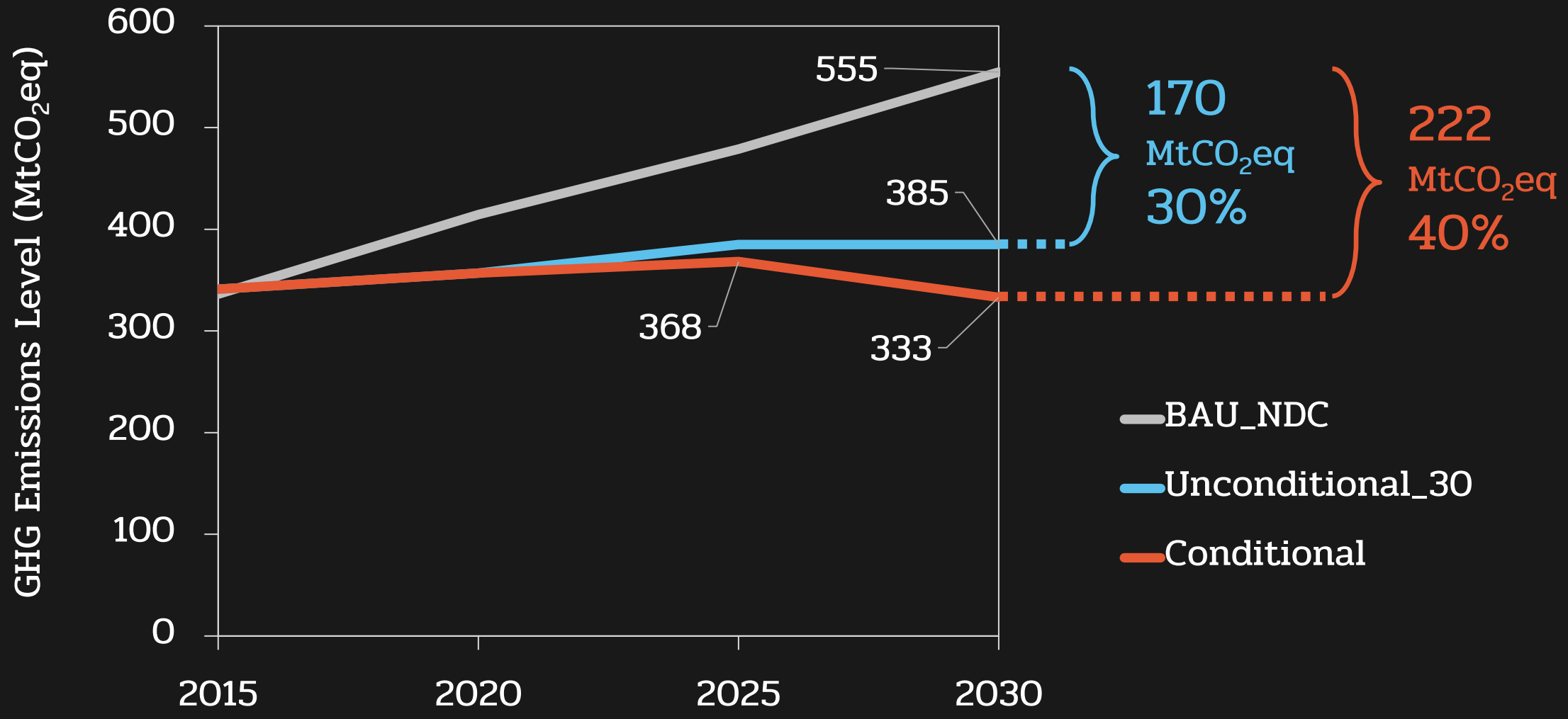
Relevant Stakeholders:

- Government agencies
- Civil society
- Experts
- Private Sector
- Academia
- Public Sector

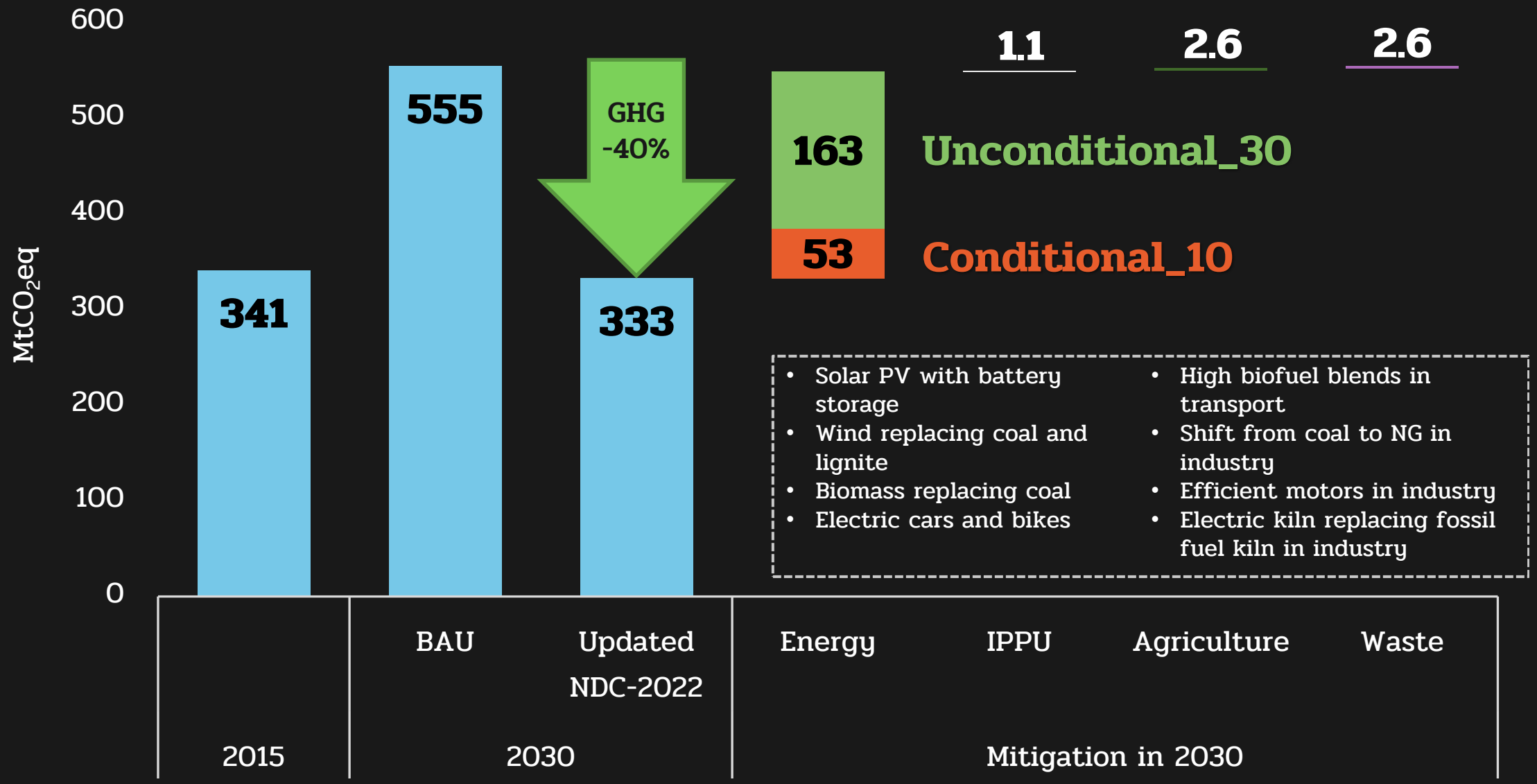
Framework of updated Thailand's LTS



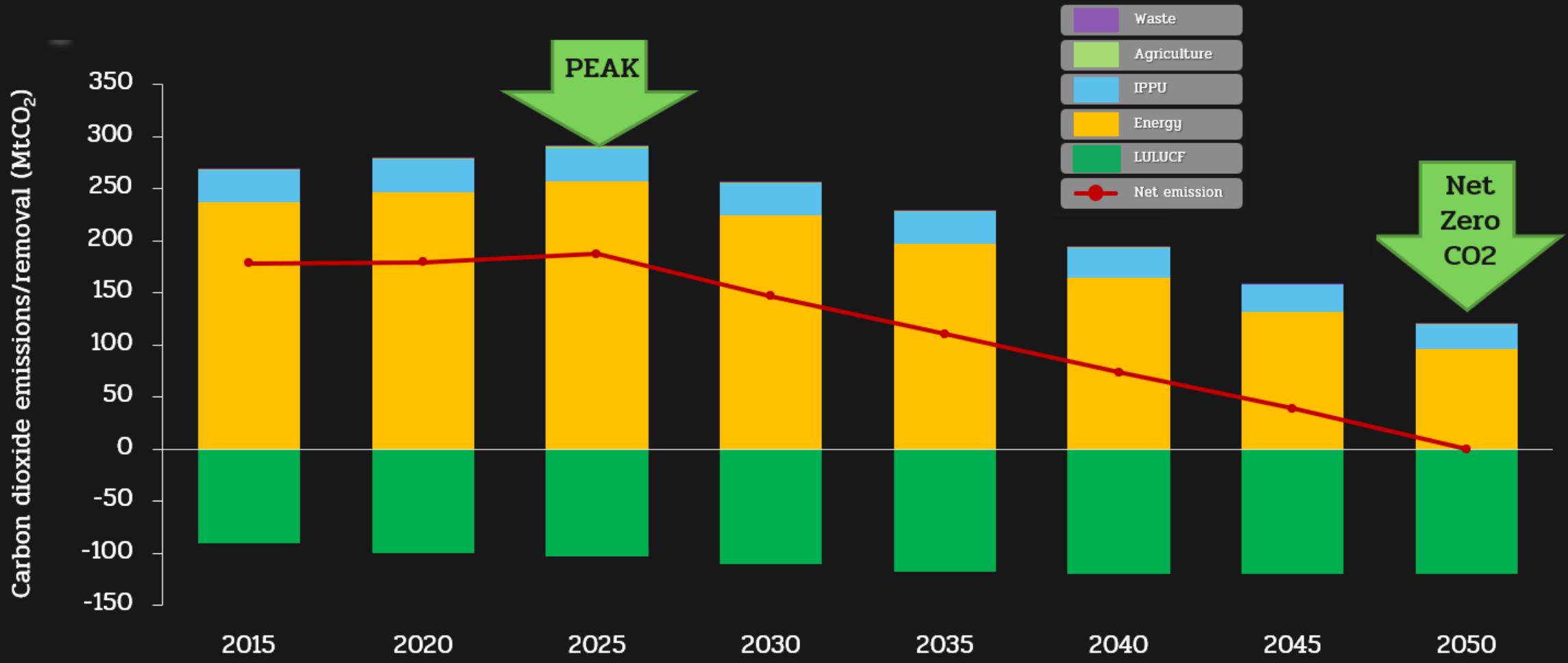
Updated Thailand's NDC 2030 using AIM/Enduse



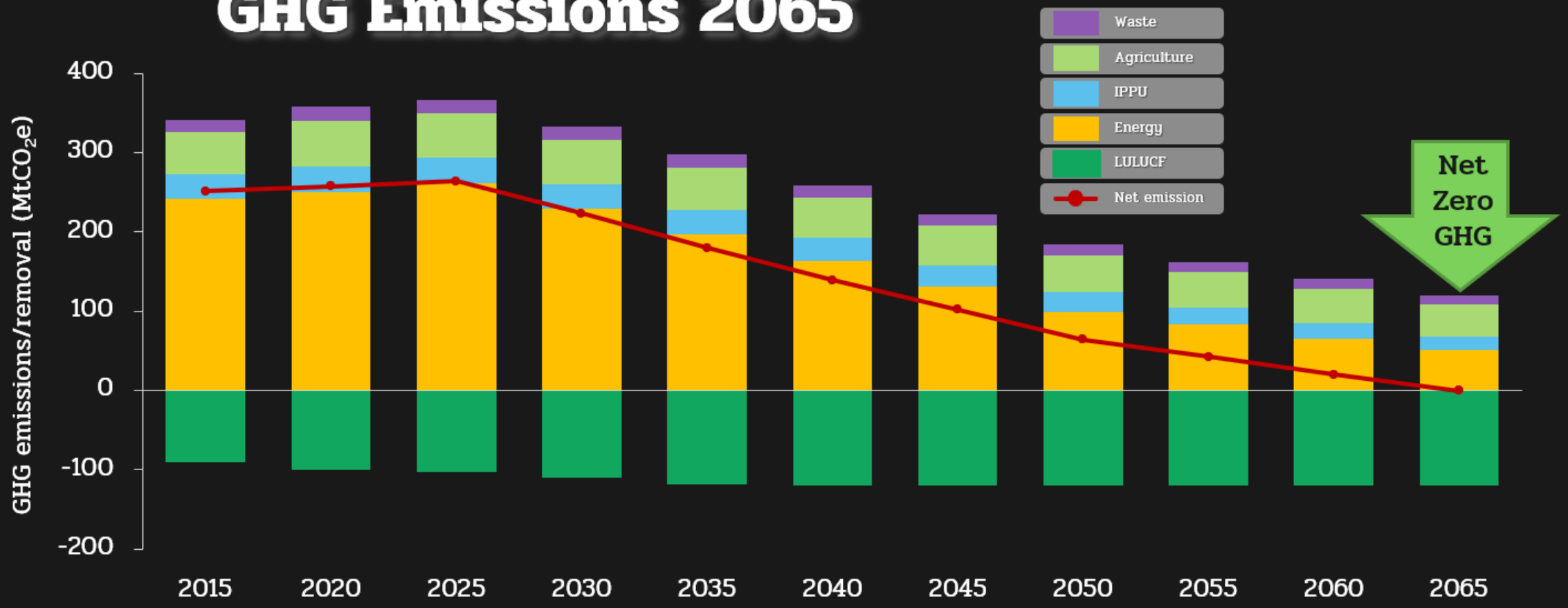
Updated Thailand's NDC 2030 using AIM/Enduse



Updated Thailand's LTS: Carbon Neutrality 2050



Updated Thailand's LTS: Net Zero GHG Emissions 2065



Timeline of Thailand's Net Zero GHG Emissions 2065

"Green Power Sector"

- Efficiency improvement in power plants
- Use of renewable energy (biomass, biogas, solar, wind)
- Phase out of oil power plants

- Phase down of coal power plants
- 68% share of RE electricity

Thailand net zero CO_2

Thailand net zero GHG

2025 | **2030** | **2035** | **2040** | **2045** | **2050** | **2055** | **2060** | **2065**

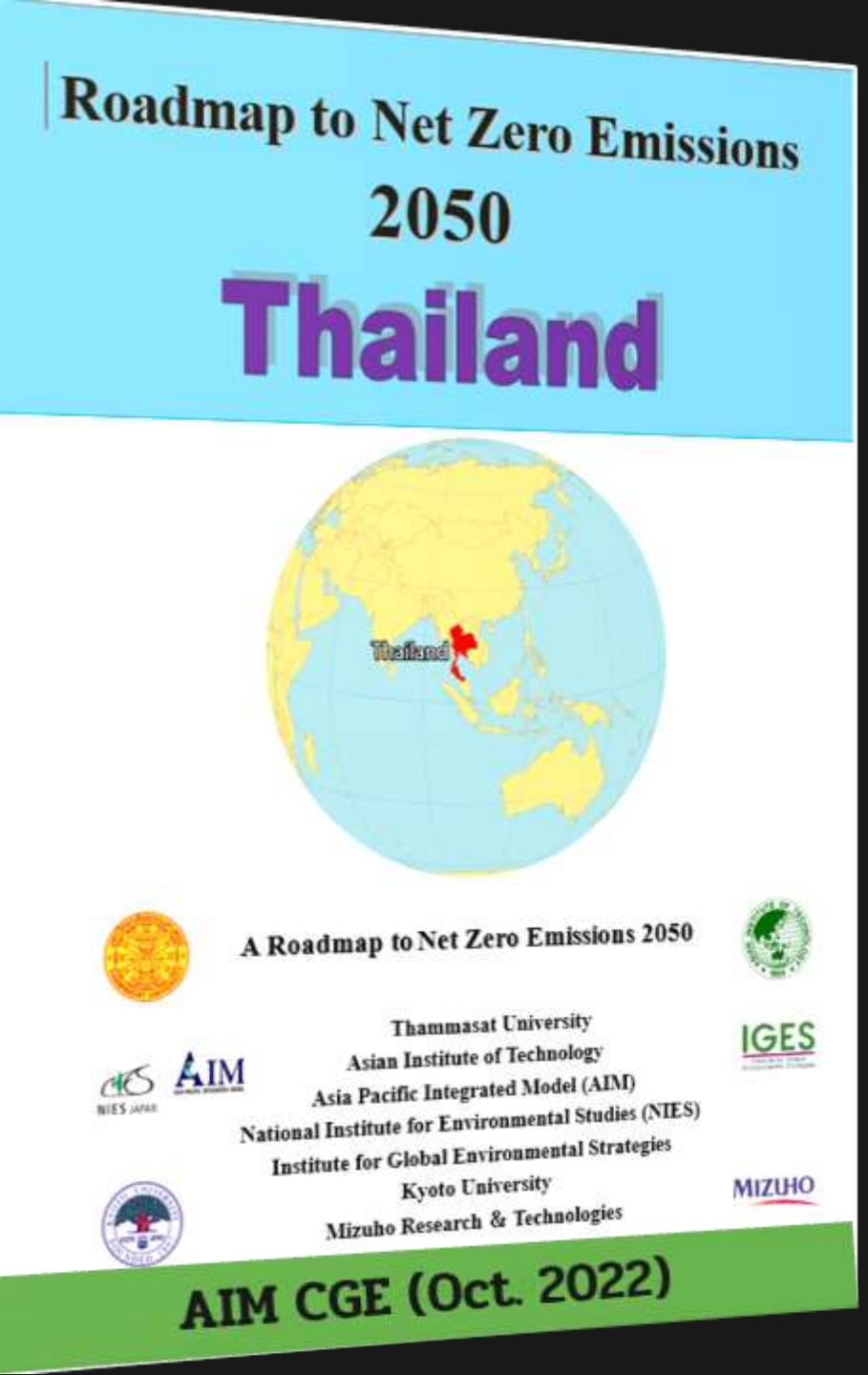
- Solar/wind with battery storage

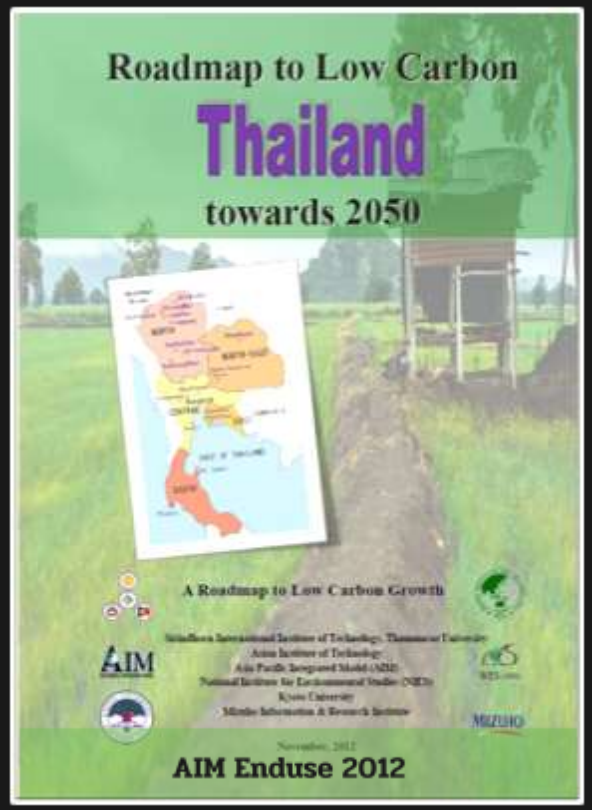
- CCS, CCU & BECCS

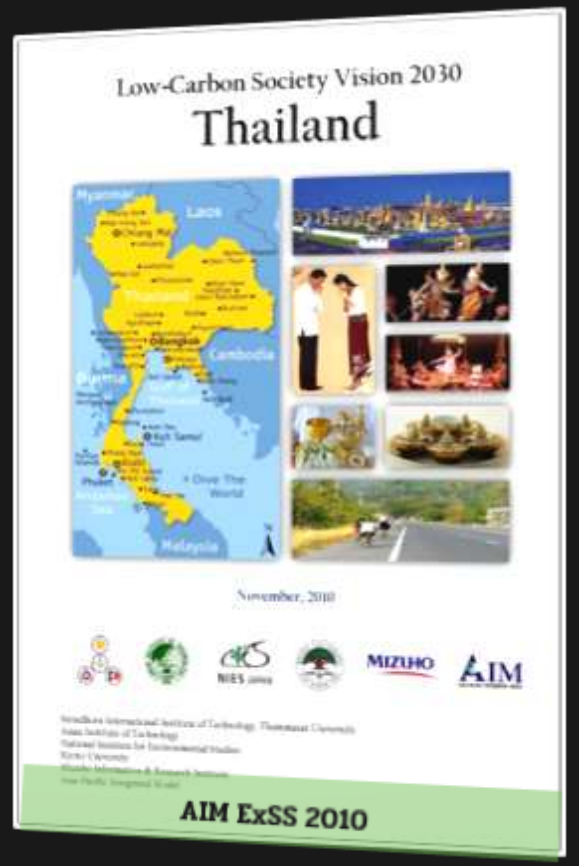
- Combined cycle natural gas used best in class
- 74% share of RE electricity
- Phase out coal power plants
- Net zero emission electricity
- Biomass-based generation fully equipped with CCS technologies

Future Work in 2022

Thailand AIM Brochure

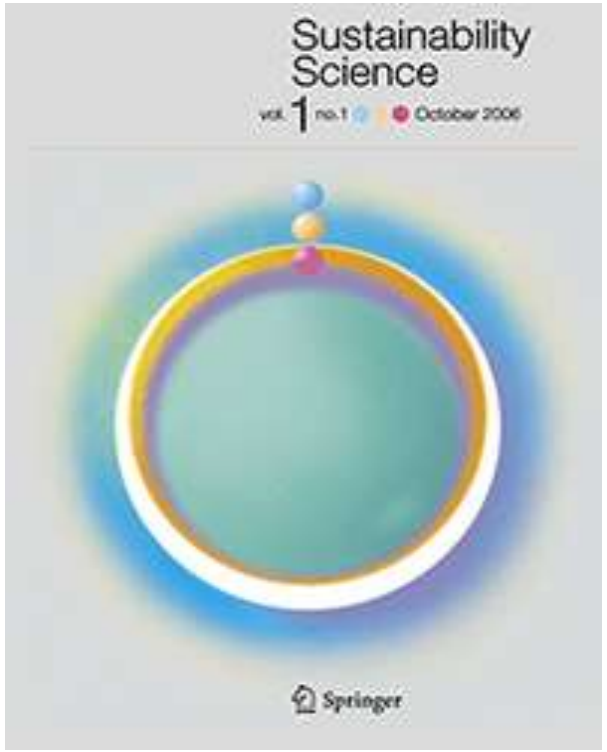






Draft paper to “Special Feature with Sustainability Science” by Dec 2022

Sustainability Science



Economy-wide impacts of net-zero emission 2050 pathways in Thailand

Salony Rajbhandari, Bundit Limmeechokchai, Bijay Bahadur Pradhan, Achiraya Chaichaloempreecha

Sirindhorn International Institute of Technology, Thammasat University, Pathumthani 12120, Thailand

Abstract

This paper aims at exploring the macroeconomic impacts of limiting GHG emissions between 2010 and 2050 under the underlying target of achieving Thailand’s GHG emission pathways aimed at limiting the temperature rise to well below 2°C by 2050. The study has developed a recursive dynamic computable general equilibrium (CGE) model for this purpose. Besides the business-as-usual (BAU) scenario, the study has formulated eight different GHG emission trajectories, four each indicating the 2°C and the 1.5°C pathways. Results indicate that Thailand should put more effort in mitigation actions to achieve emissions peak by 2025 to 2030. Lowering the activity level of energy-intensive industries, improving end-use energy efficiency, fuel switching, deploying CCS technologies in the power and industrial sectors, and expanding renewable energy-based technologies are identified to be important mitigation measures for Thailand in attaining such an emissions peak. The price of GHG mitigation varies from USD 348 to 628 per tCO_2eq in 2050 among the four 2°C scenarios. Conversely, the values would be much higher, lying in the range of USD 1,207 to 1,423 per tCO_2eq across the four 1.5°C scenarios.

Keywords Computable general equilibrium model, Greenhouse gas emissions, Thailand

THANK YOU