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THAILAND'S LONG-TERM GHG MITIGATION AND ECONOMIC IMPACTS TOWARDS 2050

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Highlights

- With more than 90% contribution in the GHG emission reduction in 2050, the energy sector will play a significant role in the total GHG mitigation in the 2-degree scenario.
- The bio-energy power plants with CCS (BECCS) plays a vital role in achieving the 2-degree target in 2050.
- Thailand must prioritize acceleration of its mitigation actions not only in the energy sector but also in the agriculture, IPPU and waste sectors to meet the 1.5-degree target.
- Modal shift, energy efficiency improvement and technology switching are the major mitigation options in the energy sector.

Background

- The Paris climate conference (COP21) in December 2015 led to an international climate agreement, a legally-binding framework for an internationally coordinated effort to tackle climate change, called the "Paris Agreement".
- The main objective of the Agreement is to "limit the global temperature increase well below 2-degree Celsius and pursue efforts to limit the increase even further to 1.5-degree Celsius compared to the pre-industrial levels by 2100".
- Global greenhouse gas (GHG) emissions should reach its peak emissions level as early as possible, and rapidly reduce thereafter to balance between emissions and removal in the second half of 21st century.
- The Paris Agreement requires each Party to prepare, communicate and maintain successive nationally determined contributions (NDCs) that they intend to achieve and pursue mitigation measures in cooperation.
- The Agreement requires all the countries to review their GHG reduction contribution and climate actions and report every 5-year thereafter.
- Furthermore, the Paris Agreement invites countries to formulate and communicate long-term low GHG emission development strategies (LT-LEDS) to the United Nations Framework Convention on Climate Change (UNFCCC).
- A decarbonized future requires a comprehensive long-term pathway.
- Therefore, it becomes necessary for Thailand to establish a national long-term GHG mitigation strategy to inspire the long-term vision.

Objectives

- To analyze the Thailand's long-term GHG mitigation pathways and its economic impacts towards 2050.

Acknowledgement

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Methodology

- The Methodology consists of two main parts (see Figure 1). The first part includes the analysis using the Asia-Pacific Integrated Model/Enduse (AIM/Enduse), a bottom-up long-term energy system model. The second part of the analysis is conducted using a top-down, multi-sector, dynamic recursive computable general equilibrium (AIM/CGE) model to explore the economic impacts of achieving the long-term GHG mitigation goals of Thailand.
- A soft-link is established between the AIM/Enduse and AIM/CGE models of Thailand in terms of the total GHG emissions, technology efficiency improvements and technology penetration rates.

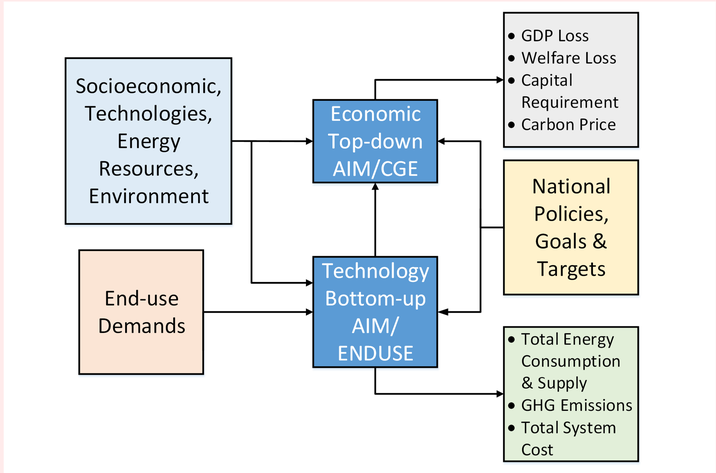

Figure 1 Schematic Diagram of the Research Methodology

Scenarios

1. **Business-As-Usual (BAU) Scenari**o: The energy consumption pattern and the GHG emission trajectory follow the present trend during 2010-2020 in the BAU scenario. The climate policies intervention is excluded in this scenario.
2. **2-degree (2DS) Scenario:** The GHG removal from the LULUCF sector will be 120 MtCO2eq in 2050, called "2DSa" scenario. In the 2DSa, Thailand will reduce net GHG emissions to 200 $MtCO_2eq$ in 2050 or declining by 64% when compared to the BAU scenario in 2050.
3. **1.5-degree (1.5DS) Scenario:** To achieve the 1.5-degree target, Thailand will attain the nationwide net-zero emissions in 2050. The peak GHG emissions will be at 258 $MtCO_2eq$ in 2020 in the 1.5DSa scenario (see Figure 2).

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3. Rajbhandari, S., Limmeechokchai, B., & Masui, T. (2019). The Impact of different GHG Reduction Scenarios on the Economy and Social Welfare of Thailand Using a Computable General Equilibrium (CGE) Model. Energy, Sustainability and Society, 9, (19), https://doi.org/10.1186/s13705-019-0200-9.

Results

- Results show that Thailand's net GHG emissions will increase from 255 $MtCO_2eq$ in 2005 to 561 $MtCO_2eq$ in 2050, increasing at a compound annual growth rate (CAGR) of 1.8%.
- The energy sector will contribute the most in the total GHG emissions, followed by the agriculture, the industrial processes and product use (IPPU), and the waste sectors.
- While the land use, land-use change, and forestry (LULUCF) will play a vital role in the removal of anthropogenic emissions in the BAU scenario

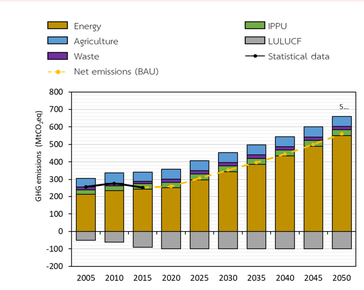

Figure 4 GHG emissions/removals by sector during 2005-2050 in the BAU Scenario

Stringent GHG reduction targets will lead to the distortion of GDP, thus requiring substantial reductions during 2030-2050 in the 2-degree and the 1.5-degree scenarios (see Table 1).

Table 1 GDP Losses in the 2-degree and the 1.5-degree Scenarios

Scenarios	% GDP Loss	
	2DSa	1.5DSa
2030	2.6	9.2
2040	6.6	6.1
2050	18.0	66.5

Table 2 Cumulative Welfare Loss in the 2-degree and the 1.5-degree Scenarios

Scenarios	% Welfare Loss in Cumulative Terms	
	2020-2030	2030-2050
2DSa	5.0	21.3
1.5DSa	14.1	83.0

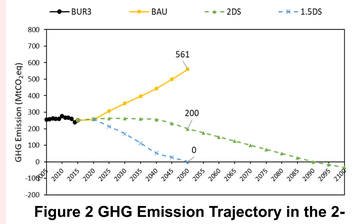

Figure 2 GHG Emission Trajectory in the 2-degree and 1.5-degree Targets

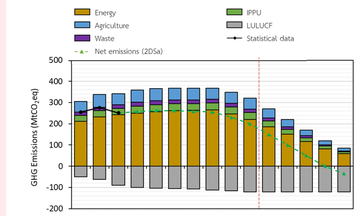

Figure 3 GHG Emissions/Removals by Sector during 2005-2100 in the 2-degree Pathway

- In 2050, the energy sector will play a key role by contributing to about 91.4% in the total GHG reductions in the 2DSa scenario. While the LULUCF sector will contribute 5.6% of the total GHG reductions in 2050 (see Figure 3).
- To achieve the 1.5-degree target, along with the energy sector, ambitious GHG reduction targets will be needed in the agriculture, IPPU and waste sectors as well.

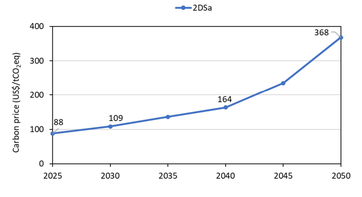

Figure 5 Implications of Achieving the 2-degree Target on Carbon Price

The carbon price will reach 368 US$/$tCO_2eq$ in 2050 to achieve 2-degree target (see Figure 5).

The steep decline in the household consumption to attain net-zero emissions by 2050, will lead to sharp increase in the welfare losses in the 1.5DSa scenario (see Table 2).

Conclusions

Thailand must prioritize acceleration of its new infrastructure and energy systems to meet the 1.5-degree target. Bio-energy with CCS (BECCS), modal shift, energy efficiency improvement and technology switching will be the major mitigation options in the energy sector.