

Introduction

- The power sector is key to the decarbonization strategy in Thailand, since the sector accounted for 36% of energy sector carbon emissions & 22% of the total emissions by sources in 2019. Further electrification will be essential for reducing emissions from the industries, transport & building sectors.
- Therefore, a fundamental reform & decarbonization of the power sector are imperative for Thailand to successfully realize its commitment to carbon neutrality by 2050 & net-zero GHG emissions by 2065.
- In this context, the purpose of this study is to analyze the economy-wide & emission reduction impacts of decarbonization policies in the Thai power sector.

Methodology

- A multi-sector, recursive dynamic Asia-Pacific Integrated Model/Computable General Equilibrium model, named "AIM/CGE" model of Thailand, has been constructed for the analysis purpose.
- The AIM/CGE model of Thailand is calibrated using the 2015 input-output (I/O) table as its foundation. The original I/O table classifies data into 180 sectors, but it does not specifically segment the electricity industry. This study attempts to disaggregate the electricity sector within the I/O table into eight power generation subsectors, namely coal, natural gas, oil, biomass, hydro, solar, wind & other renewables.
- The disaggregation of electricity supply for each commodity is performed in proportion to the generation share of each power generation technology. The commodities are first disaggregated in the most detailed dataset of 180 sectors. After completion of the disaggregation process, the data in the I/O table is aggregated to match the list of sectors & commodities outlined in Figure 1.

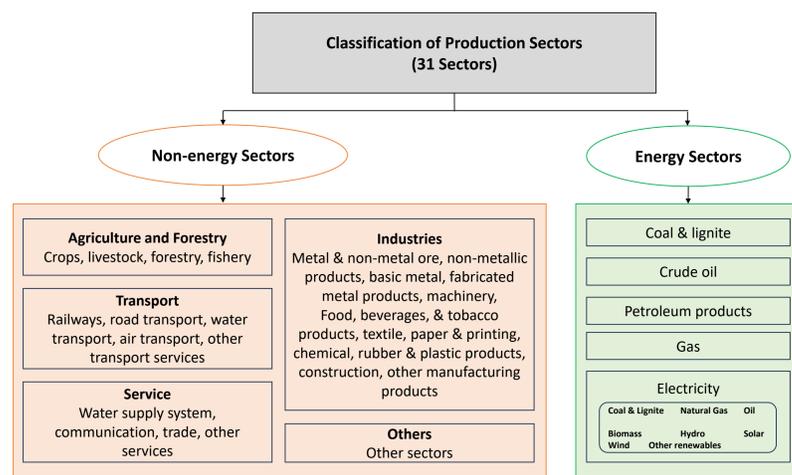


Figure 1. Classification of Production Sectors

Acknowledgements

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Results & Discussions

1. GHG Emissions Trajectories

- This study has formulated two scenarios for the analysis purpose: reference & carbon neutrality scenarios. The reference scenario (referred to REF scenario) aligns with the GHG trajectory projected in Thailand's 2-degree pathway as outlined in the LT-LEDS, in which Thailand will achieve the balance between GHG emissions by sources & removals by sinks in 2090 (Figure 2).
- The carbon neutrality 2050 scenario (referred to CN2050 scenario) aims to achieve carbon neutrality by 2050, balancing GHG emissions with offsets, resulting in no net addition of CO₂ emissions to the atmosphere. Following the IPCC's 1.5-degree pathway, Thailand is projected to achieve net-zero GHG emissions by 2065, balancing the emissions from sources with removals by sinks after 2050. The contribution from the LULUCF sector in carbon removal is assumed to be 120 MtCO₂ during 2040 to 2065, same as in the REF scenario (Figure 3).

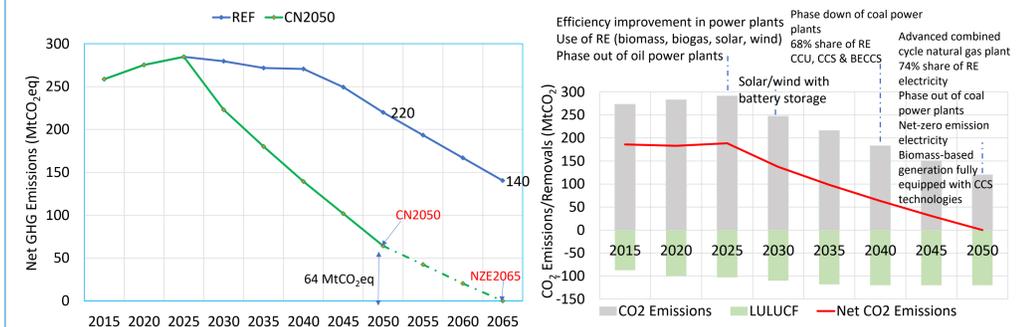


Figure 2. Net GHG Emission Trajectories

Figure 3. Key Mitigation Actions in the Power Sector in the Pathway to Achieve CN2050

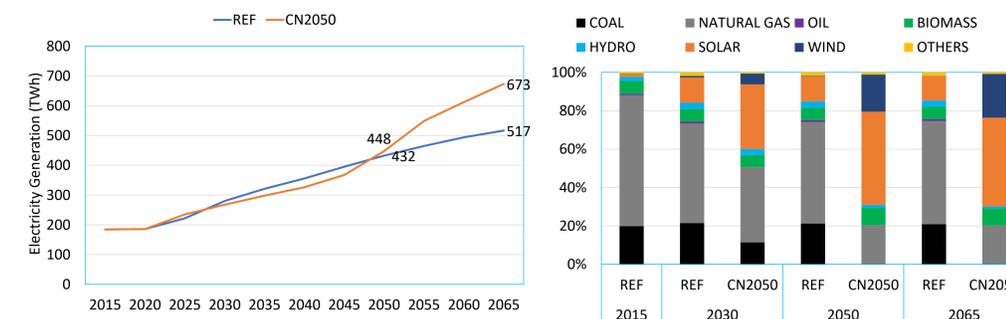


Figure 4. Power Generation during 2015-2065

Figure 5. Power Generation Mix in REF & CN2050 Scenarios

2. Sectoral Output of Power Sector

- The total power generation would increase by 3.6% in 2050 & by 30.3% in 2065 under the CN2050 scenario (Figure 4).
- The share of electricity production from natural gas would remain dominant in the REF scenario. In the CN2050 scenario, the oil power plants & coal power plants are set to phase out in 2025 & 2050, respectively (Figure 5). The natural gas-based CCS power plant & BECCS technology would emerge from 2040 onwards. By 2050, biomass-based power plants are assumed to be fully equipped with CCS technology.
- The transition to renewable energy integration, deployment of negative abatement technologies & energy efficiency measures involve high investment costs resulting in a larger loss in GDP mainly during 2050 to 2065.

3. Macroeconomic Impacts

Impacts on GDP

- The modeling results show that the economy will experience a GDP gain during 2025-2040 in the CN2050 scenario. The economic benefit would be maximum in 2035 at 4.6% due to the integration of advanced energy efficient technologies. While the carbon neutrality scenario will experience a GDP loss beyond 2040. The GDP loss would lie in the range of 1.3% in 2045 to 5.2% in 2065 (Figure 6).

Impacts on Household & Government Consumption

- With the deployment of CCS & BECCS technologies & increased exploitation of renewable energy, the cost of power generation will increase, causing a negative impact on household consumption, leading to GDP loss during 2045 to 2065 in the CN2050 scenario. Household consumption would surge to 67% in 2050 & drop to 26% in 2065 in the CN2050 scenario (Figure 7).
- Results indicate that as GHG emission efforts intensify towards achieving carbon neutrality by 2050 & net-zero emissions by 2065, consumer spending on goods & services declines due to economic downturns. In contrast, government consumption must increase significantly to reach these targets.

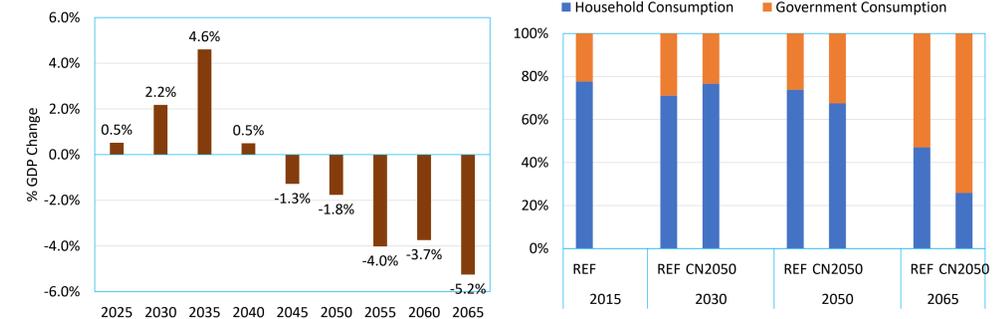


Figure 6. Variations in GDP

Figure 7. Impact on Household & Government Consumption

Conclusion & Future Works

- Simulations indicate that disaggregating electricity production is crucial for accurately quantifying the economic impacts of carbon mitigation.
- The deployment of CCS & BECCS technologies & the increased usage of renewable energy will raise power generation costs, negatively impacting household consumption & leading to GDP loss between 2045 & 2065 in the CN2050 scenario when compared to the REF scenario.
- Future Works: Further updates to the Thailand's AIM/CGE model are necessary to accurately assess the economic impacts of carbon mitigation, particularly in relation to the investment costs of new technologies, & the potential for increased sectoral electrification.

References

- MNRE, "Thailand's long-term low greenhouse gas emission development strategy (revised version)," Office of Natural Resources and Environmental Policy and Planning, Ministry of Natural Resources and Environment, 2022.
- NESDC, "Input-output table of Thailand 2015," Office of the National Economic and Social Development Council, Office of the Prime Minister, Bangkok, 2015.