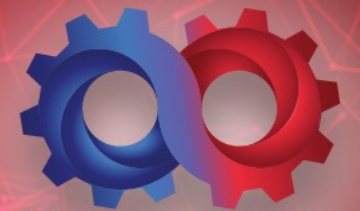


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A Survey on Opportunities of Carbon Capture Utilization and Storage (CCUS) in Thailand's Oil & Gas, Energy and Chemical Industry

Final Report



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Outline

- Introduction
- Role of the Government Agencies and Public Organizations
- Current Plan and Policy of Private Sector in Thailand
- Conclusion

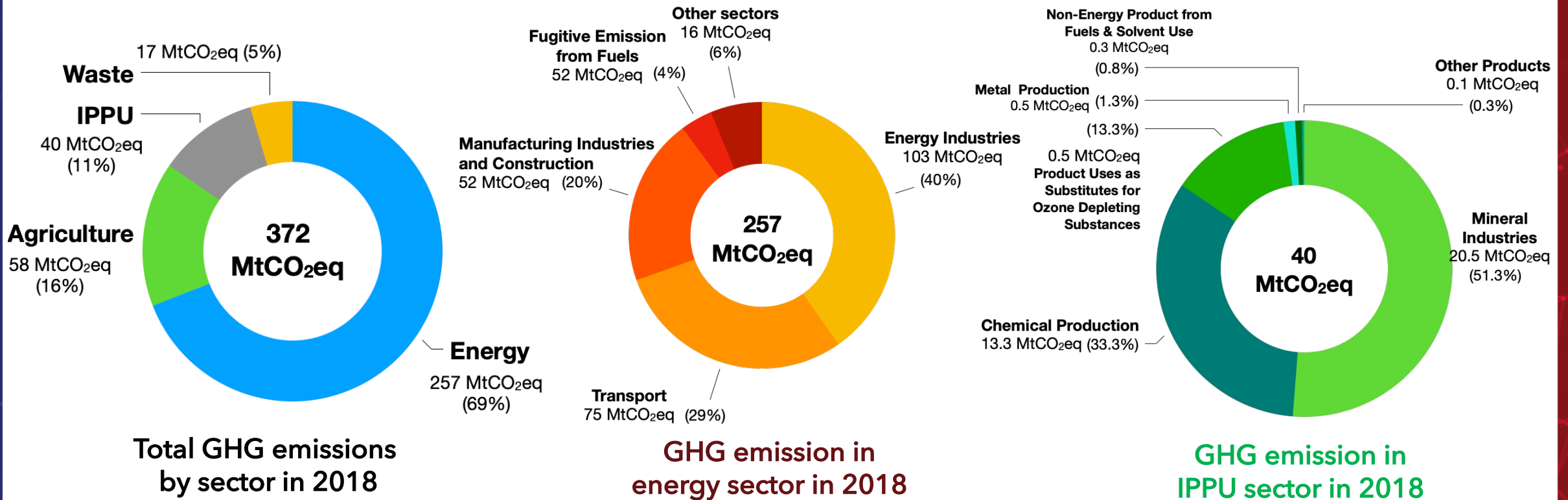
A Survey on Opportunities of Carbon Capture Utilization and Storage (CCUS)
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Introduction



Introduction

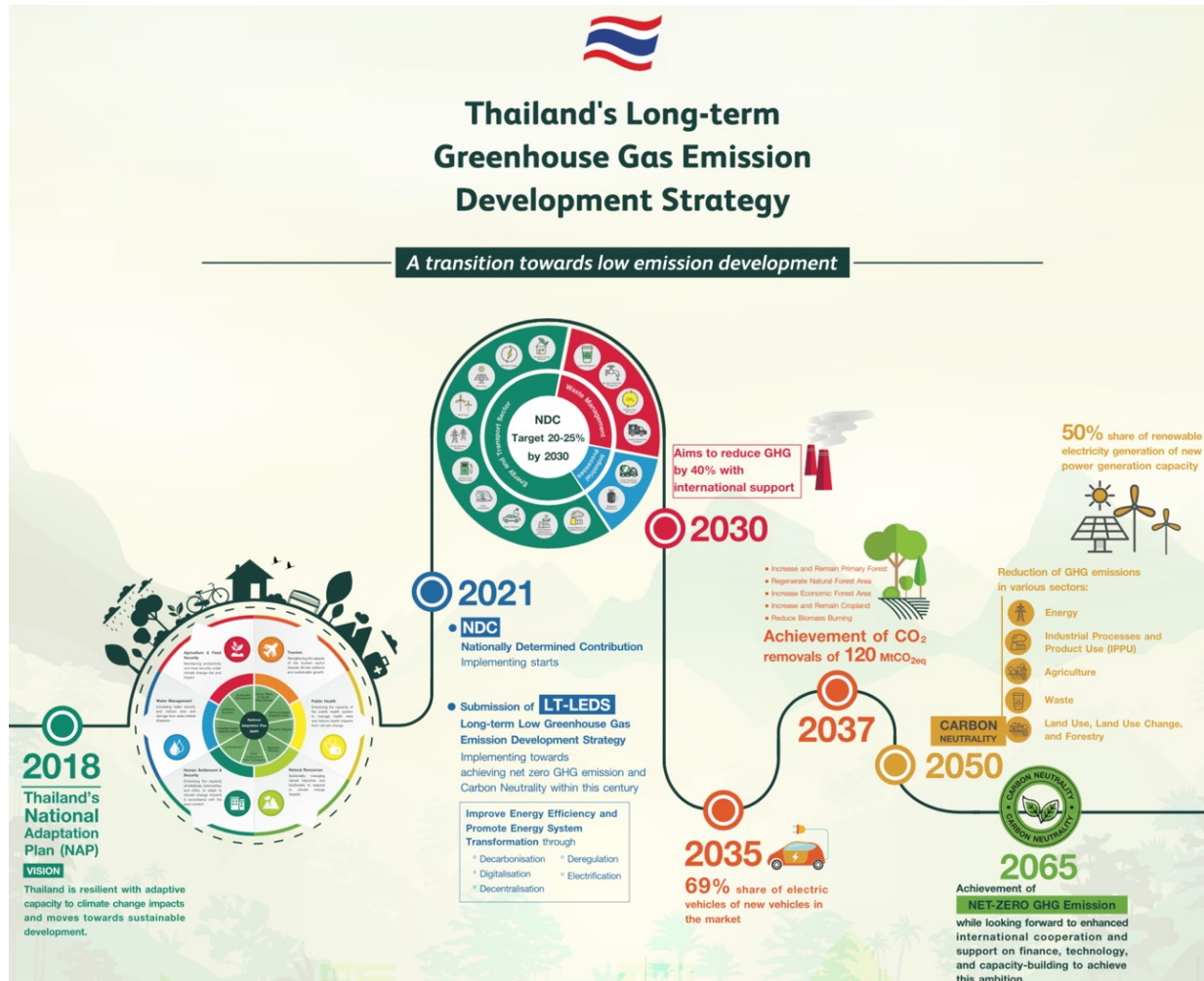
Thailand's GHG emissions



Key challenges: the energy sector is the main source of GHG emissions.

Source: Thailand's Fourth National Communication, 2022

Introduction



- At COP21, Paris agreement globally aims to keep temperature rise this century below 1.5 °C.
 - Reducing Global CO₂ for 45% by 2030
 - Net Zero Global Emission by 2050
- Thailand's PM announces Long-term Greenhouse Gas Emission Development Strategy at COP26
 - Reducing GHG emission by 20% compared BAU in 2030
 - Carbon Neutrality by 2050
 - Net Zero GHG before 2065
- **Key challenges:** Carbon Capture Utilization and Storage (CCUS) Technology

Source: Global Compact Network Thailand



Overview of the Project

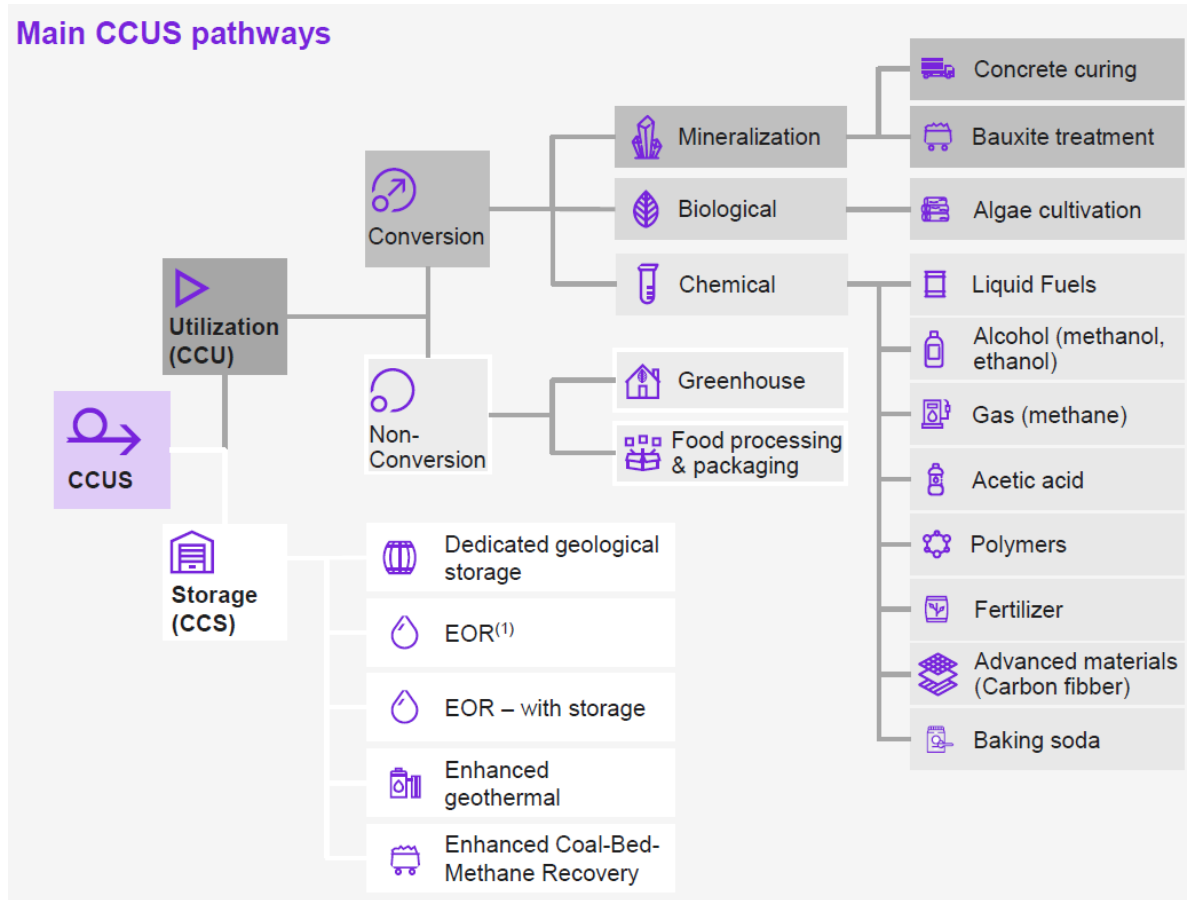


Diagram of main CCUS pathways

Source: Kearney Energy Transition Institute

What is status of CCUS technology and supporting measures in Thailand ?

Objectives of this research

1. To survey the current status of CCUS projects and the readiness of such technologies in Thailand's oil & gas, energy and chemical industries.
2. To study the progress of research and development on CCUS technology in Thailand.
3. To comprehend the government's policies, supporting schemes, related law and regulations on CCUS.

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Role of the Government Agencies and Public Organizations

Thailand's Institutional Mechanisms for Climate Change

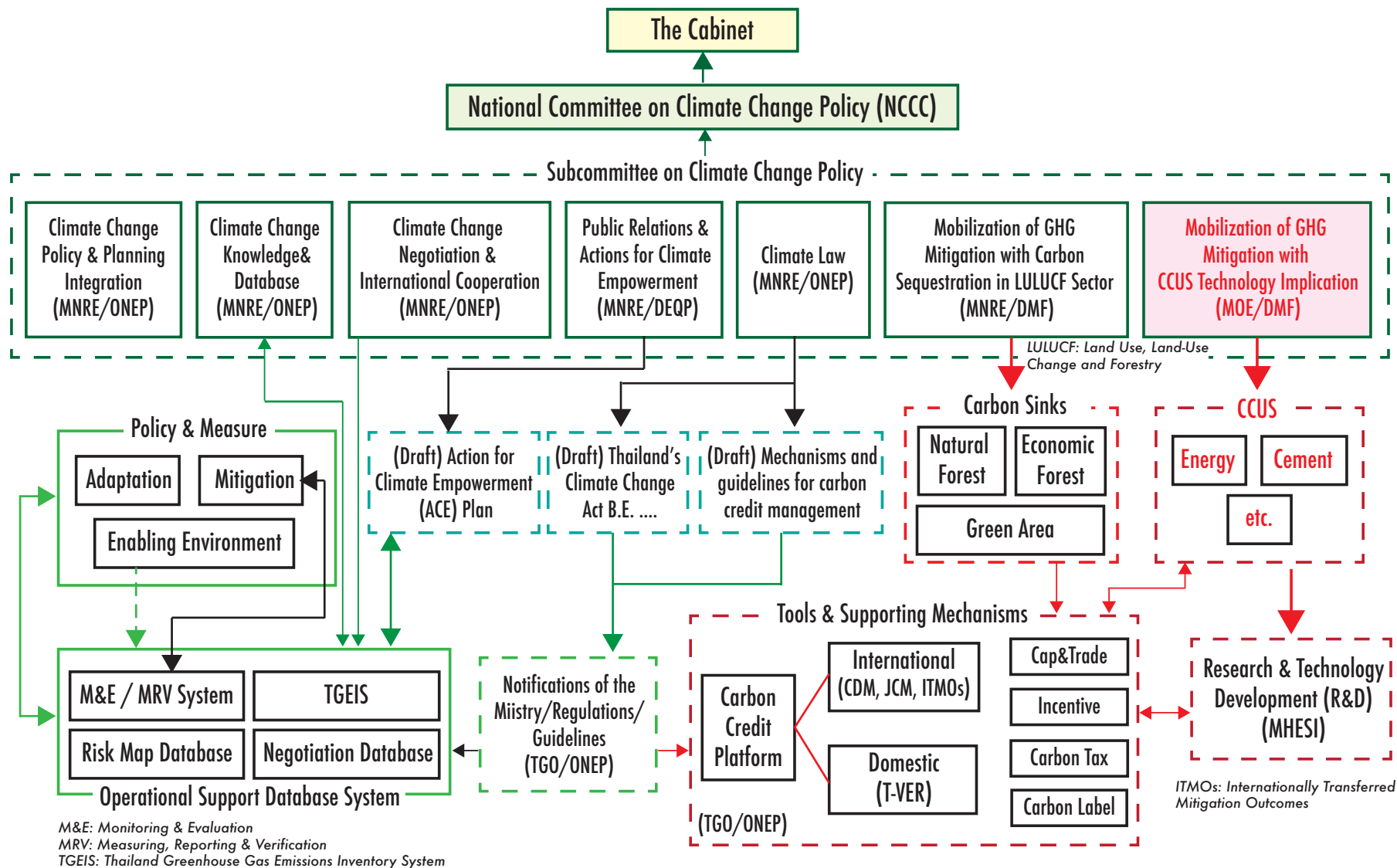
- Thailand established the National Committee on Climate Change Policy (NCCC), which chaired by the PM.
- The NCCC is composed of 7 subcommittees:
 - 1) Climate Change Policy and Planning Integration
 - 2) Climate Change Knowledge and Database
 - 3) Climate Change Negotiation and International Cooperation
 - 4) Public Relations and Actions for Climate Empowerment
 - 5) Climate Law
 - 6) Mobilization of GHG Mitigation with Carbon Sequestration in LULUCF Sector
 - 7) Mobilization of GHG Mitigation with CCUS Technology Implication

Thailand's Institutional Mechanisms for Climate Change

The Subcommittee on the Mobilization of GHG Mitigation with CCUS Technology Implication is responsible for

- Providing suggestions and recommendations on GHG mitigating capacity of Carbon Capture and Storage technology and the carbon storage and utilization.
- Suggesting mechanisms or measures (e.g., legal, economic, and other related measures) for incentivizing, developing, and applying such technology.

Thailand's Institutional Mechanisms for Climate Change



Source: คุณจิรวัดณ์ ระติสุนทร การประชุมเชิงปฏิบัติการ “Innovation Roadmap for Industrial Decarbonization” วันที่ 29 มิถุนายน 2565 ณ อาคารเอนกประสงค์ บริษัท ปูนซิเมนต์ไทย จำกัด (มหาชน)



Thailand's Institutional Mechanisms for Climate Change

Critical Changes in 2023

- **Department of Climate Change and Environment**

Thailand is setting up a new department under the Ministry of Natural Resources and Environment, named the [Department of Climate Change and Environment](#), to respond for proposing and developing strategies, plans, and programs on climate change and GHG reduction.

- **Thailand's Climate Change Act**

Ministry of Natural Resources and Environment is responsible for developing first [Thailand's Climate Change Act](#), which will feature mandatory regulations, carbon-credit management, financial mechanisms, and targets.

Thailand's Climate Change Policy

Thailand has integrated climate change policies, strategies, and plans into its national, sectoral, and municipal plans to address the climate change problem systematically and effectively.

National Plan

National Strategy (2018-2037), [National Economic and Social Development Plan](#), Climate Change Master Plan, Nationally Appropriate Mitigation Action (NAMA), Thailand's Nationally Determined Contribution (NDC), and [Long-Term Low Greenhouse Gas Emission Development Strategy \(LT-LEDS\)](#).

The 13th National Economic and Social Development Plan includes development strategies to promote CCUS technology under the 10th milestone (Thailand has a circular economy and low-carbon society):

- The promotion of CCUS technology in energy and industrial sectors, investment support in CCUS's research and development
- Increase financial and fiscal incentives to attract investment from the private sector and infrastructure development for transportation of carbon storage

Thailand's Climate Change Policy

Long-Term Low Greenhouse Gas Emission Development Strategy (LT-LEDS)

To achieve the NDC and LT-LEDS targets, GHG mitigation measures implemented in the energy sector are classified into three main measures: energy efficiency improvement/technology switching, implementation of renewable energy, and carbon capture and storage (CCS).

- The energy efficiency improvement and the deployment of natural gas with CCS and coal with CCS power plants are expected to increase to 43% in 2050 compared to the current technology.
- The share of renewable electricity is expected to increase to 33% of the total electricity generation in 2050.
- Bioenergy with a CCS power plant is needed to achieve the target in 2050.
- In manufacturing industries, the deployment of CCS in industries will play an important role in the chemical and the non-metallic sub-industries. The estimated captured CO₂ will be 18 MtCO₂eq in 2050

Thailand's Climate Change Policy

Sectoral Plan

- **Energy Sector Plan:** MOE is developing details in the National Energy Plan 2022 Framework, consisting of 5 plans: [Power Development Plan 2018-2037 \(PDP\)](#), Alternative Energy Development Plan 2018-2037 (AEDP), Energy Efficiency Plan 2018-2037 (EEP), Gas Plan 2018-2037, and Oil Plan 2018-2037.
- **Transport Sector Plan:** Thailand's Transport Infrastructure Development Plan 2015-2022
- **Industrial Sector Plan:** National Industrial Development Master Plan 2012-2031, Thailand's Industrial Development Strategy 4.0 (2017-2036), Thailand's Green Industry Initiative.
- **Waste Sector Plan:** Draft National Waste Management Action Plan 2022-2027, Thailand's Roadmap on Plastic Waste Management 2018 – 2030).

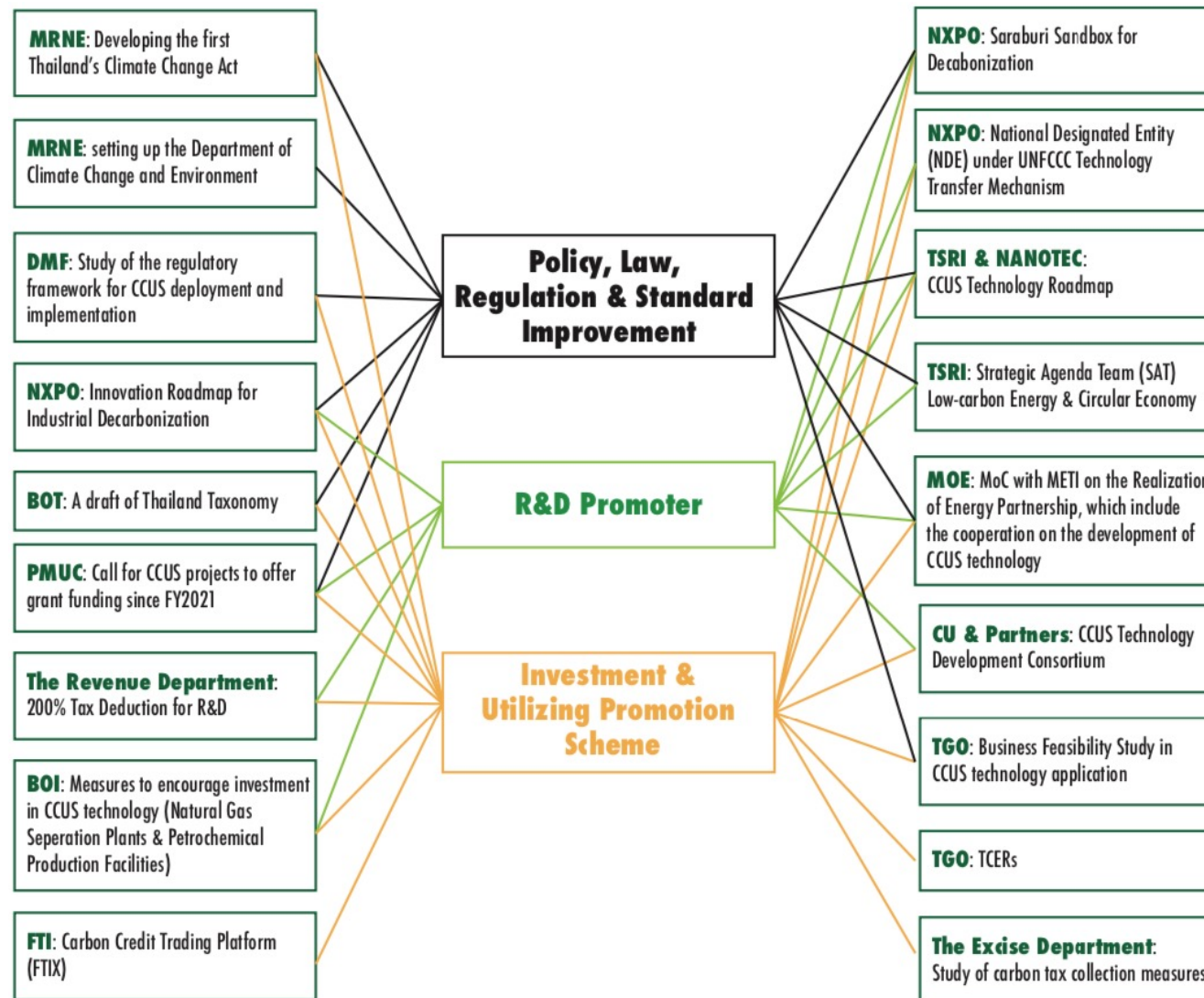
- Enhancing the potential use of CCUS technology in power generation is included in the Power Development Plan 2018-2037.
- In a mid-term period, Thailand needs support to enhance the potential use of CCS and CCUS technologies in industries and power plants, and bioenergy with CCS.

Thailand's Climate Change Policy

Municipality Plan

- The draft Bangkok Master Plan on Climate Change 2021-2030, sponsored by Japan International Cooperation Agency (JICA).
 - To reduce GHG emissions by 19% compared to the BAU from the base year of 2018 by 2030 and continually reduce GHG emissions toward a "net-zero emission city" by 2050.
 - The mitigation measures of GHG emissions under this master plan cover 4 sectors: transport, energy, waste and wastewater, and green urban planning.
 - The main sectors for GHG emissions reduction in this plan are energy and transportation (94% of the total)
-
- **Saraburi, Mae Moh and Rayong Models:** A sandbox will be launched in Saraburi and Rayong to become a model for net zero GHG emissions, whereas Mae Moh will be a model for livable eco-friendly city by rehabilitating brownfield and building three low-carbon economic zones.

Key Parties and Their Supporting Roles in CCUS



Challenges and Suggestions

- A technology roadmap and business feasibility study in CCUS technology are necessary to determine the R&D direction, funding policy, and incentive measures for CCUS technology.
- The regulations related to CCS should be clarified.
- Lack of mechanisms for integrating cooperation and management from the policy level to the operational level.

Challenges and Suggestions

- The new incentive measures should be proposed to motivate the private sector to invest and apply new technologies and innovations with high risk and high cost.
- Domestic and international financial support is needed to enhance the potential use of CCS and CCUS technologies in industries and power plants and Bioenergy with CCS.
- Government should invest in the development of infrastructure to transfer technology to industrial sectors.

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Current Status of CCUS Implementation by Private Sectors

Current Status of CCUS Implementation by Private Sectors

We categorized the interviewed companies into three fields:

- I. Petroleum (Oil&Gas) and Petrochemical Industries
- II. Energy and Utilities Industry
- III. Other Energy Intensive Industries

I. Petroleum (Oil&Gas) and Petrochemical Industries

Current Plan

CCS

- Focus on feasibility study of CCS implementation.
- Companies having an access to carbon storage sites prefers CCS to CCU, and vice versa for companies having no access.
- PTTEP is the spearhead of CCS implementation in Thailand, and the Arthit's pilot project is supposed to be the 1st CCS in the country.
- From initial assessment, aquifers in the Gulf of Thailand has a carbon storage capacity of about 7,000 M ton, which could support carbon emission for about 20 years.
- CCS technologies are mature, but still too costly. Laws and regulations are not ready.
- CCS current cost (mainly the capture cost) is about 50 - 100 \$/ton of CO₂, capture cost shares the major cost.

I. Petroleum (Oil&Gas) and Petrochemical Industries

Current Plan

CCU

- CCU is more attractive than CCS to petrochemical industries.
- **Focus on research in lab scale to create value-added product from CO₂.**
- **For example, CO₂ is converted into acetone for producing perfume concentrate and food coloring agents.**
- For post-combustion, need a carbon concentrating unit to increase from 9% after burner.
- For pre-combustion, plan to use H₂ as a fuel.
- Chemical plant area utilization is optimized, and the area is limited. Difficult to install new capture units.

Key Findings

CCS

- CCS technology is ready, Laws are not. Public awareness is also very important.
- Clear and concrete laws and regulations are in urgent need. Must be effective by 2025 to meet CCS plan in 2030.
- The government should support on the investment cost of initial infrastructure; main pipelines.

CCU • 110 Euro per ton of CO₂ is the benchmark for wide-scale CCS implementation in 2030.

- More attractive for no CO₂-storage companies as it can produce value-added products in long term (to be implemented after 2035).
- Limitation of plant area and diversity of feedstock of each plant are key barriers.
- Carbon capture is the most expensive process.
- Some companies are very good at finding foreign research fund. Could share lesson-learnt.
- Government should use policy driven strategy. CBAM also helps; Carbon tax; Carbon measuring standards; Laws and regulations; penalty and incentives.

II. Energy and Utilities Industry

Current Plan

- Plan to be carbon neutral in 2050, and net-zero in 2060.
- Companies having an access to carbon storage sites prefers CCS technologies.
- Plan to store carbon in aquifers or empty mines.
- **Feasibility is extremely expensive.** Need funds. sign MOU with many Japanese tech-providers.
- Otherwise, they focuses on pre-combustion technologies.
- Some consider the use of **H2** in gas-combined power plants and **NH3** in the coal-fired.
- Others focus on energy efficiency improvement, especially RE based powerplant.
- **CCU is still far** from being fully implemented.

Key Findings

- Need subsidy from Thai government and METI through collaboration with Japanese firm.
- **Large Japanese enterprises have an access to Thai companies** and source of fund. No concern about reliability of the enterprises.
- Through JCM program, some Thai companies mentioned that they have **concerns on reliability of Japanese SMEs** and the program should be allow more versatility in selecting partners and technologies.
- Investment in CCUS technology depends on technology, carbon pricing mechanism, a clear and firm government policy and regulation, tax benefit, funding, etc.
- Need government support such as measuring instruments, measurement methods, measurement standards for food industry.

III. Other Energy Intensive Industries

Current Plan

- Study in CCUS technology to match the company's production processes. Most industries think that CCU is more cost-effective by converting carbon to more value-added products.
- Collaborate CCUS network with Thai and Foreign sectors to research and exchange information to achieve carbon neutrality and net zero emission.
- Reduce CO₂ emission by improvement of energy efficiency in production process or use of biofuel, biomass, oxyfuel, H₂ instead of fossil fuels.
- Use carbon credit and carbon footprint to help company in the global market.

Key finding

- Improve energy efficiency in production process.
- Use biofuel, biomass, oxyfuel to reduce CO₂ emission.
- Need funding and technical support.

Challenges and Suggestions

- Investment in CCUS technologies depends on many factors, for example,
 - government policies and regulations, investment promotion policies,
 - availability of technology, human resources,
 - economic consideration, funding sources,
 - carbon price, carbon taxes.
- All parties should collaborate in the CCUS technology network to develop clear and comprehensive policies and regulation to support carbon neutrality and net zero mission.
- Further development of the CCUS technology and supportive funding model is required to enhance the CCUS pilot project, innovation, readiness, and global market competitiveness of the domestic industry.

Challenges and Suggestions

- Implementation of CCUS on existing plants is very challenging due to limitation of plant area and diversity of feedstocks of each plant.
- Carbon footprint should be certified at the international level by government authorities.
- Japanese organization should help Thai and ASEAN industries to provide training and development opportunities to study a good learning experience of successful implementation of CCUS technologies in Japan.

Conclusion

- Thailand established National Committee on Climate Change Policy with seven subcommittees including “Mobilization of GHG Mitigation with CCUS Technology Implication”.
- Thailand government agencies currently develop the technology roadmap and supporting measures for implementing CCUS technology to reach the net zero emission goal.
- Thailand researchers accompany with big players in Oil & Gas and Cement industry to develop CCUS technology.

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Thank you very much
ご静聴ありがとうございました。

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