

Development of CCUS Project in Thailand: Initiation and Collaboration of Parties

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Abstract—The economy of Thailand has been growing leading to an increase in energy consumption and carbon emission to the atmosphere. To handle this issue, Thai Government, industries and other sectors have various policies and initiative programs to mitigate carbon problem and to encourage the sustainable development to meet carbon-neutrality by 2050 and net-zero target by 2065. Recently, the energy related companies like PTT Exploration and Production Public Company Limited (PTTEP) is applying Carbon capture and storage (CCS) technology in the business by injecting carbon dioxide (CO₂) to store carbon in the depleted production fields. The first pilot project is Arthit gas field in the Gulf of Thailand. It is expected to have more projects in many areas. Also, Electricity Generating Authority of Thailand (EGAT), the main power generator in Thailand and the Shell Company of Thailand (Shell) have the collaboration to work on CCS especially for power generation. Many alternative sources are studied to use them as future sources of energy such as hydrogen, ammonia, solar cell, biomass and so on. The intention to reduce the use of fossil fuel and mitigate CO₂ released to the atmosphere. However, this CCS technology requires more knowledge and experience. More collaboration and operation will become a good solution to achieve this goal for low carbon society.

Keywords— CCUS Project, carbon capture, storage, Arthit field.

I. INTRODUCTION

Thailand, has a growing economy leading to an increase in energy consumption. This causes an increase in carbon emission to the atmosphere. To tackle this problem, Thai Government has many policies and initiative programs aimed to reduce the carbon footprint and to promote the sustainable development. As part of the Paris Agreement and the 26th annual session of the COP26 in 2021, Thailand committed to meet carbon-neutrality by 2050 and become net-zero emission by 2065. Carbon capture, utilization and storage (CCUS) becomes one of the policies to help committing a low-carbon agenda and to meet net zero emission within 2065 [1].

Furthermore, the government has approved the establishment on climate change policy and the greenhouse gas reduction committee which initiated the CCUS technology for

the first carbon capture, utilization and storage. Also, the committee has the mission to set the actions for reducing the climate impacts through the CCUS technology from many industry sectors, such as petroleum exploration and production (E&P) industry. This policy will allow the country to meet the target on net-zero emission in 2050 whereas the challenges of climate change and energy transition can be faced. The previous projects such as the use of electric vehicles (EVs), the use of the biodiesel mixed with fossil fuel for trucks and heavy vehicles as an alternative selection, as well as less energy consumption for commercial and residential use with alternative energies like biomass and solar energy are the policies to reduce the carbon emission [2]. Therefore, this work is aimed to summarize some projects and collaboration started to implement the mitigation of carbon in Thailand.

II. IMPLICATIONS OF CCUS TECHNOLOGY IN THAILAND

The adoption of CCUS technology is important in addressing the rapidly increasing energy demand and carbon emissions. CCUS is referred to as one of the technologies to drive lower emission in operations, especially in the petroleum business. Supported by the government initiative on CCUS technology under the energy policy, the national energy-producing company, Petroleum Authority of Thailand (PTT) and PTT Exploration and Production Public Company Limited (PTTEP) are applying CCUS technology in their business such using CCS in carbon dioxide (CO₂) producing fields. They aim to capture and store more CO₂ emission and apply other technologies to use and convert CO₂ into other valuable products for onshore processing and petrochemical plants [3].

Under Long-term Low Greenhouse Gas Emission Development strategy (LT-LEDs) of Thailand [4], the main actions to low carbon emission and energy transition are defined relying on the availability of the technologies and preparation of the industries [1]. Under carbon emission policy in 2022, for Thailand, the National Energy Policy (NEP) includes the part of CCUS technology as a main decarbonization technique to issue the increasing energy requirement and carbon emissions.

There are two main factors in applying CCUS technologies: ample policy movement and incentives, and the financial support. Thailand is setting a 5-year plan from year 2022 to 2027 aiming to CCUS application and development in petroleum and petrochemical industries. The government supervises the participation of the energy-related companies,

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such as oil and gas companies, facility companies and other sectors to develop a CCUS Roadmap. Various CCUS pilot projects are prepared including CCUS unit in the existing fossil-fired power plants and CO₂ injection in the depleted oil and gas fields.

III. CO₂ STORAGE PROJECT IN THAILAND

It is estimated that Thailand has potential for CO₂ storage capacity of 2.69 GtCO₂. With CCS technology application, Thailand can reduce carbon emission by 55% in 2065 [5]. Currently, most of CCUS projects and initiatives are in the pilot stage. There are five pilot projects are under consideration and study. These are the Arthit Pilot Project (PTT), the Phu Horn Pilot Project, the Kra Basin Pilot Project, the Sirikit or S1 Pilot

Project (including the project for more oil recovery. It is under study for the agreement with EGAT on future collaboration). The last one is BLCP Pilot Project which is under the starting phase for Thai and Japanese government collaborating together to enhance the production of methane. Furthermore, there are five feasible areas which have potential to do carbon capture. These places are (1) Kra Basin, (2) West Kra Basin, (3) North Malay Basin, (4) Namphong and Sinphuhorm areas, and (5) S1 or Phitsanulok Basin. From the study of CCS in Thailand [6], Figure 1a) presents CO₂ sources for emission from various types of energy sources and b) illustrates the potential storage sites in Thailand for both onshore and offshore areas and the example of the estimation for CO₂ potential storage sites for both aquifer and depleted oil and gas fields in Thailand are listed in Table 1.

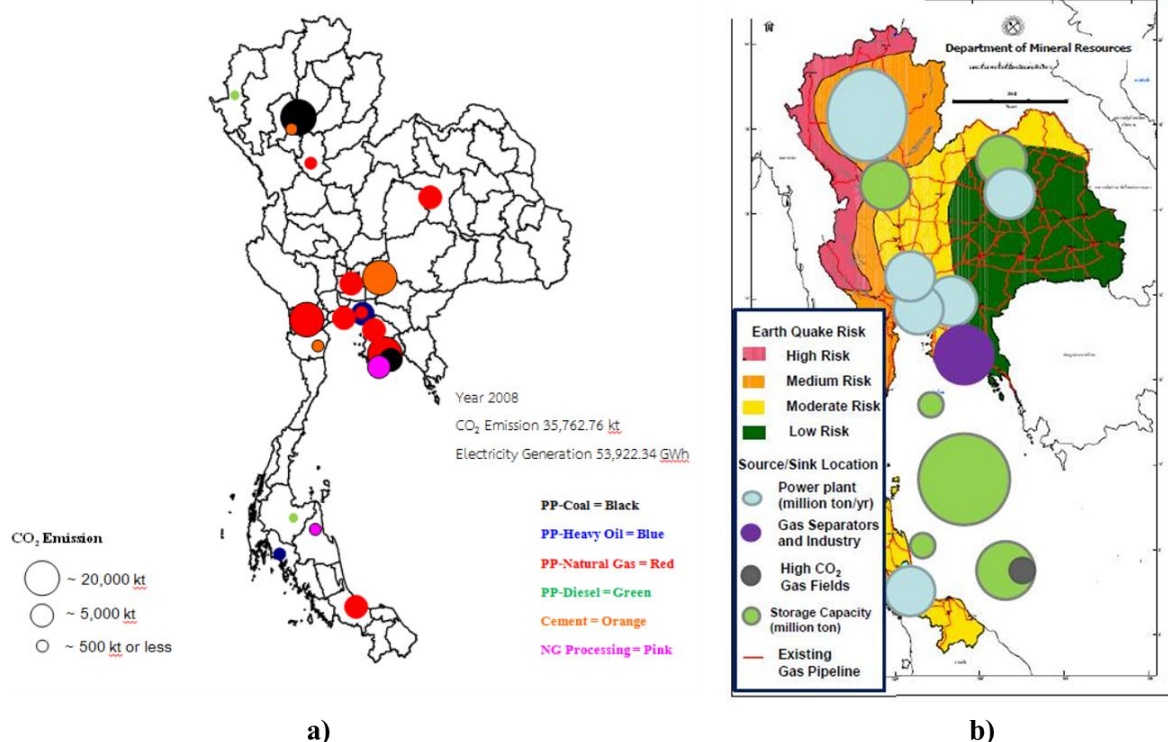


Fig. 1: a) CO₂ sources and b) potential storage sites in Thailand [6].

Table 1: Examples of CO₂ storage potential sites in Thailand and estimated storage capacity

References	Capacity in aquifer (Mt)	Capacity in depleted reservoir (Mt)	Remark
ASIAN Development Bank [7]	8,900	1400	Referring to 10 geological basins both onshore and offshore
Li et al. [8]	5,764	1,404	Conservative Estimation
Zhang et al. [9]	77,582	1,715 (Gas Field) 49 (Oil Field)	P50 values

A. Arthit project

In June 2022, PTTEP is initiated to develop the first carbon capture and storage (CCS) project at Arthit offshore gas field in Thailand, preparing for the company to meet net zero emissions target and has also launched the feasibility studies for CCS in other parts of Thailand to support Thailand commitment for reducing carbon emissions into the atmosphere. One of PTTEP's main strategies to reduce CO₂ released from the oil and gas production system is the application of CCS technology to effectively mitigate carbon emissions at high level.

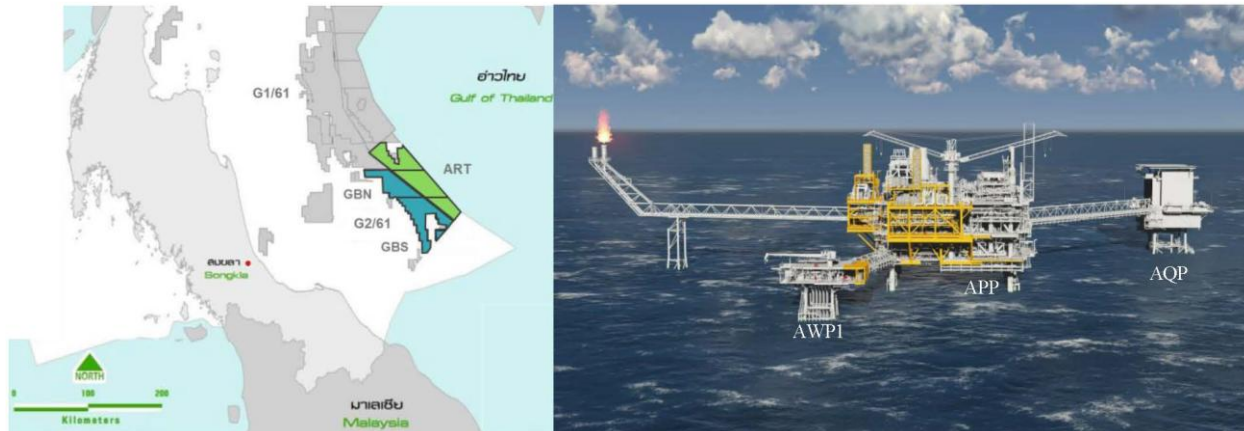


Fig. 2: CCS pilot project in Arthit field [5].

The knowledge in geoscience and petroleum engineering can be applied to attain the advantageous bedrock for CCS technology, leading to CO₂ reduction target. Other than this first CCS project at the Arthit field, PTTEP has worked with other sectors with more experience in CCS technology to evaluate the CO₂ potential storage sites in many areas in Thailand. This can lead to the collaboration and support from many industries in various sectors especially domestic companies for decarbonization projects. These ongoing projects are expected to be the roadmap and the ways to meet the carbon net-zero goal.

However, various important factors including policy and laws, financial support, investment, as well as the knowledge and understanding in technology are required for the successful implementation of the CCS project in Thailand. These will need the support from government section and relevant parties to drive and promote CCS knowledge and technology transfer in Thailand to ensure that the carbon reduction mission can be achieved.

IV. POWER GENERATION SECTION

Electricity Generating Authority of Thailand (EGAT), the main power generator in Thailand intends to work with the Shell Company of Thailand (Shell) on joint feasibility studies on knowledge and technology transfer and a study of development for renewable energy program to reduce carbon emissions and move Thailand to net-zero emission by year 2065. The decarbonization effort would be attained primarily through a collaborative study of clean energy technologies such

Recently, the feasibility study of carbon injection project at Arthit field has finished. The study includes several aspects of the preliminary assessment of carbon storage capacity of selected geological storage formations and to the development plan. At this moment, the project is in the stage of preliminary front-end engineering and design (Pre-FEED) study [5] and is expected to start the carbon injection by year 2026. It is also expected that the injected carbon will be controlled and monitored in the proper way for safety. The example of CCS project in Arthit field is presented in Figure 2

as CCS, CCUS, and power generation from alternative sources, applying both organizations by technical expertise and resources. Both EGAT and Shell have signed a memorandum of understanding (MOU) to strengthen collaboration in driving innovative solutions toward decarbonization, making it a pioneer in supporting Thailand's target.

In addition, EGAT has implemented Triple S strategy [10].

This strategy can be referred based on the EGAT and Shell collaboration as follows:

1. Source transformation: enhance renewable energy portion in the power generation and apply new technologies to promote renewable utilization;
2. Sink co-creation: apply nature-based result to recover land and plants from deforestation in 1 million units of land and provide more knowledge of CCUS; and
3. Support measures mechanism: increase public collaboration in GHG mitigation through program called Energy-Saving Label No.5 (label of the highest energy saving equipment) and Green Classroom Project as well as promote EV deployment.

With this collaboration, the CCUS, hydrogen, ammonia and clean energy as the future alternative sources of electricity generation are studies for the future application. These various technologies and knowledge can help reduce CO₂ problem. However, Thailand will still depend on power generation from fossil fuel to meet the energy security and demand

V. CONCLUSION

Thai economy is growing with an increase in energy consumption leading to more carbon emission to the atmosphere. Thai Government, industries and other sectors

have more policies and programs to mitigate carbon problem and to encourage the sustainable development to meet net-zero emission by 2065. CCUS technology can be one of the solutions to solve the problem. CCS project in Arthit gas field is the first pilot project for CO₂ injection in the Gulf of Thailand. More projects in many areas are studied. Other projects like clean energy utilization for power generation are studied by EGAT and Shell Thailand.

However, for now, Thailand does not have any enforced policies or regulations on CCUS technology that can be achieved for the whole aspects. Nevertheless, the government, industries and other sectors will support any initiatives that can reduce carbon emission to become low carbon society and meet the carbon-neutrality in 2050. Also, Thailand is expecting to gain as much as possible knowledge in this technology even CCUS is still new in Thailand. Both domestic and international collaboration and operation will become a good solution to learn from each other

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