

ENERGY STATUS AND ALTERNATIVE ENERGY PLANS OF MAJOR ENERGY CONSUMERS IN SOUTHEAST ASIA : INDONESIA AND THAILAND

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ABSTRACT

Southeast Asia comprises an extraordinarily diverse set of countries with vast differences in the scale and patterns of energy use and energy resources endowments. Indonesia and Thailand have been selected to be compared because they are the two largest consumers in energy sector in the region and both countries still similarly rely on energy imports such as oil. They have been facing challenges in energy policy reformation distorting energy markets. The combined energy status of Indonesia and Thailand not only aims at providing policy makers with an understanding of the energy trends and challenges being faced by the countries up to the next two decades, but also at confidently convincing them the future energy pathways to unlocking energy efficiency potential and investment. This work contains data and information on pattern of energy use in the past, present, and future, some economic and political factors that may be affecting energy demand and supply of Indonesia and Thailand. Key energy issues that need to be considered are introduced. The potential future energy pathways are included and compared between the countries. Investment opportunities in each country are also identified.

This paper highlights:

- *Trends in domestic energy use prospects*
- *Economic and political factors influencing energy demand and supply*
- *The future potential energy pathways*
- *Key Energy Issues and energy-related CO₂ emission*

KEYWORDS

alternative energy, energy issues, energy policy, Indonesia, Thailand

1. TRENDS IN DOMESTIC ENERGY USE PROSPECTS

The association of Southeast Asian Nations (ASEAN) is a political and economic organization of ten Southeast Asian countries formed in 1967 (Clean Technica, 2016). Primary energy mix in

ASEAN region dominated by fossil fuels, which includes oil, natural gas and coal making up more than three-quarters of demand. Coal used in ASEAN has been taking part in the share of energy mix by 16% since 1990. Modern forms of renewable energy are given increasing interest in deployment, which currently account for 12% of the primary energy mix (IEA, 2015). As the economies of the region continuously grows, the energy security and sustainable development need to be maintained via strong measures and strengthen policies (Summary, 2015). By 2025, a target of the share of renewable energy in the regional fuel mix decided by the Energy ministers of the Association of Southeast Asian Nations (ASEAN) is 23% (Clean Technica, 2016 and IEEJ, 2015).

ASEAN has high interest in expanding renewable-based electricity because of the multiple energy security and environmental benefits on offer, such as better diversity in the power mix, slower growth in energy imports and decreased local air pollution. Thailand is one of a member states among 9 other countries comprising Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, and Vietnam. It has financial support measures such as feed-in tariffs (FiT) and tax exemptions to accelerate renewable deployment (Clean Technica, 2015).

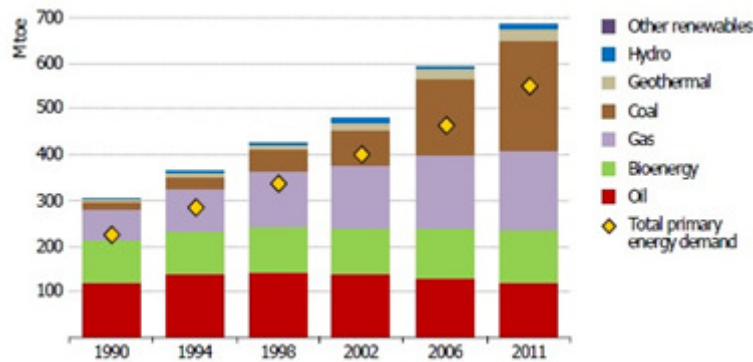


Fig. 1: Total energy production in ASEAN by source (International Energy Agency, 2013; Matsuo, Yanagisawa, & Yamashita, 2013)

*Bioenergy refers to the energy content in solid, liquid and gaseous products derived from biomass feedstock and biogas. This includes biofuels for transport and products (e.g. wood chips, pellets, black liquor) to produce electricity and heat. Municipal solid waste and industrial waste are also included.

2. THAILAND'S ENERGY USE : PAST, PRESENT, POTENTIAL FUTURE

In the past, Thailand national energy plan was established in accordance with the increasing of imported oil. The past goals differed from the current energy plan's as they were focusing mainly on the development of the country's conventional energy reserves such as natural gas, lignite, oil shale, and some radioactive ores. However, the similarities of the previous to the current and the future plans are that the development of alternative energy resources was supported, and the energy efficiency and conservation were much needed to improve (Issue, 2016). Thailand still depends on gas (44%) and coal (35%) for 55GW added over the period to 2035, while expected to start generating electricity from nuclear power plants before 2030 (INTERNATIONAL ENERGY AGENCY, 2013; "RENEWABLE ENERGY IN ASEAN _ HEINRICH-BÖLL-STIFTUNG SOUTH EAST ASIA," N.D.)

Recently, Ministry of Energy (MoE), Thailand, has established the integrated national energy plan (Ministry of Energy, 2016) under 5 categories including: Power Development Plan of Thailand : PDP2015 (EPPO, 2558)); Energy Efficiency Plan: (EEP2015) (EPPO, 2015a); Alternative Energy Development Plan: (AEDP2015) (DEDE (Department of Alternative Energy Development and Efficiency), 2015); Natural Gas Supplying Plan: (Gas Plan 2015) (EPPO, 2015b); Oil Management Plan: (Oil Plan 2015) (Department of Energy Business, 2015).

According to Energy Efficiency Plan 2015 (EEP2015) of Thailand governmental Policy (Issue, 2016), the predicted final energy demand in 2036 will be approximately 131,0000 ktoe if the country succeeds in achieving energy intensity reduction by 30%. All the plans set for improving Thai Energy situation in the future are defined for goals in ramping up the ratio of renewable energy usage and renewable resource's potential consideration in terms of electrical, thermal, and bio-energy, which account for 30% of the final energy consumption in 2036. Accordingly, in order to strengthen the energy security of Thailand, another plan, namely Alternative Energy Development Plan 2015 (AEDP 2015), has been developed to support renewable energy production industry, to support research in renewable energy development, and to promote Thai national renewable technology to be able to compete with international market.

Renewable energy and alternative energy are aimed to be a part of power generation for 30% from 2015-2036. The main technologies include solar energy, biomass, wind energy, municipal solid waste (MSW), energy crop, bio-gas, and hydro energy (Issue, 2016). Renewable energy development in Thailand has been strategically planned using six approaches, as follows:

- 1) In a large scale, corporative community in production and utilization of renewable energy will be promoted.
- 2) Private sector's investment will be motivated and incentivized.
- 3) Laws and legislations that do not support the development of renewable energy will be amended.
- 4) Necessary infrastructures such as transmission-line systems, distribution line and smart-grid system will be improved or expanded.
- 5) Public relation and education for correct understanding of energy efficiency will be supported.
- 6) Research for driving the development of renewable energy will be encouraged.

3. ECONOMIC AND POLITICAL FACTORS INFLUENCING ENERGY DEMAND AND SUPPLY

Policies are primarily focusing on voluntary measures, support for model projects and enhancing awareness. Mandatory measures and incentives for widespread deployment and implementation have played a lessen role. Considering the range of adopted policies and measures, such as regulations, market-based and financial instruments, and information and awareness measures, all countries in Southeast Asia have performed actions in order to improve energy efficiency (International Energy Agency, 2013).

In transport sector, Thailand is developing mandatory standards that will reduce the purchase of cars with low fuel economy and with average fuel consumption of no lower than 20 km/litre, and also meeting at least euro 4 emissions standards.

Thailand's energy policy is formulated based on three crucial aspects including security, economy and ecology. The policy focuses firstly on securely supply of energy which is growing according to the growths of economy and population as well as urbanization. Fuel mix in power generation becomes important. Secondly, reformation of energy prices that support the development of economy and society in a long term is supported. Thirdly, energy production from renewable energy sources and the use of high-efficiency technologies are one of the major goals to reduce pollution and conserve ecology.

Since the risk of using specific types of fuels in power generation is concerned, the policy on fuel diversification is implemented. This leads to the promotion of using renewable energy technologies in power sector, the use of clean-coal technology, and the reduction of the dependence on natural gas to be lower than 40% by 2036. The peak demand forecast and the energy demand forecast are needed for planning in investment of power plants, transmission lines, and distribution systems, and for preparation of the fuel supply to be used in power generation in Thailand, respectively (Issue, 2016).

The PDP2015 aims at enhancing stability of the system, reducing dependency on natural gas, increasing the proportion of electricity from clean-coal technology and increasing the amount of power purchase from neighboring countries as well as increasing the proportion of electricity from renewable energy. Thailand has set plans to develop power transmission and distribution system to support the development of renewable energy and to be ready for the expansion of ASEAN community.

In fig. 2, it can be seen that coal consumption is currently at 10-15% and will be increasing to 17% in 2036. The expected growth of renewable energy consumption will increase to 15-20%. However, in PDP2015, primary energy production is somehow the main source for Thailand power sector. Purchasing electricity from neighboring countries such as Myanmar and Cambodia still remains but the use of natural gas will be expected to gradually decline.

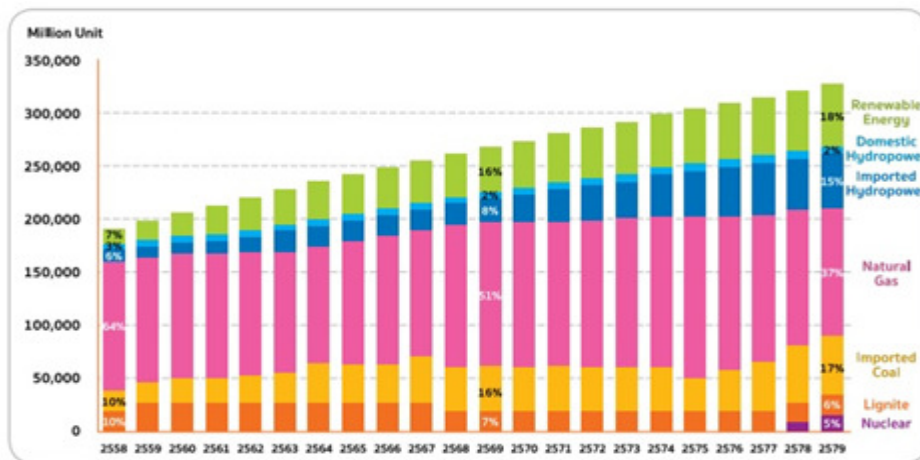


Fig. 2: The proportion of fuels used for power generation in PDP2015 (Issue, 2016).

In EEP2015 (Issue, 2016), Thailand uses enforcement and regulations and measures, as well as promotion and support for selected governmental organization, public and private sectors that have availability in resources and expertise in order to raise awareness of the public and improve energy efficiency. Several measures are applied in order to change the behavior of energy consumers, entrepreneurs, and the direction of the energy market. Moreover, innovative campaign such as the promotion of linking energy conservation with environmental protection and global warming reduction are supported. Using professional energy Management Company such as ESCO in Thailand to obtain sound advices and proper energy conservation measures has been convinced. The major goal is to reduce energy intensity by 30% in 2036 in comparison with 2010 mainly aiming at transportation sector (30,213 ktoe in 2036) and industry sector (14,516 ktoe in 2036). This will result in the CO₂ reduction of 177 million tons in 2036. Additionally, the use of high-efficiency building, appliances and vehicles are also promoted.

One of the government policies set to drive energy conservation in Thailand uses three strategies, ten measures in different four economic sectors. The policy relating to energy conservation will affect the people in every sector and social-level in terms of motivation and awareness in consuming energy more efficiently. Three strategies in energy efficiency plan comprise: 1. Compulsory program, 2. Voluntary program, and 3. Complementary program (Federal Ministry for Economic Affairs and Energy, 2017). The government provides support for domestic and industrial sectors through the Provincial Energy in their areas. Some of their duties are to:

- Provoke energy efficiency in local areas
- Give advice and suggestions to make people comply with the laws
- Promote information, news of each measure to public
- Cooperate with the demand of target groups
- Investigate/collect data of equipment in governmental buildings

4. THE FUTURE POTENTIAL ENERGY PATHWAYS

Many countries in ASEAN members seek to diversify their energy supply due to energy security and economic concerns as well as their rising in dependency on imported oil and in some cases natural gas (Kanchana & Unesaki, 2014). Most countries adopted both medium- and long-term targets for renewable (ASEAN BRIEFING, 2015). Thailand falls into the ambitious one, targeting an increasing in the share of new and renewable energy in primary supply for 20% and 23% by 2036 and 2025, respectively.

5. KEY ENERGY ISSUES AND ENERGY RELATED CO₂ EMISSION

One of the most pressing issues for Thailand is installing sufficient additional power generation capacity. Due to a number of economic and energy-related challenges such as providing sufficient energy services, improving industrial productivity and minimising poverty, as well as adapting to global warming, Thailand is increasingly turning to renewable energy. Increasing use of fossil fuels continuously raises energy-related carbon-dioxide (CO₂) emissions almost double, from 1.2 gigatonnes (Gt) in 2011 to 2.3 Gt in 2035 (see fig. 1.3) (INTERNATIONAL ENERGY

AGENCY, 2013). Power sector and transport sector produce biggest emissions. But their carbon intensity of GDP improves considerably due to the rapid growth in the size of the region's economy coupled with efficiency improvements in power generation and appliances, and the recurrence of improved technologies (Supply, Consumption, Electricity, & Efficiency, 2013).

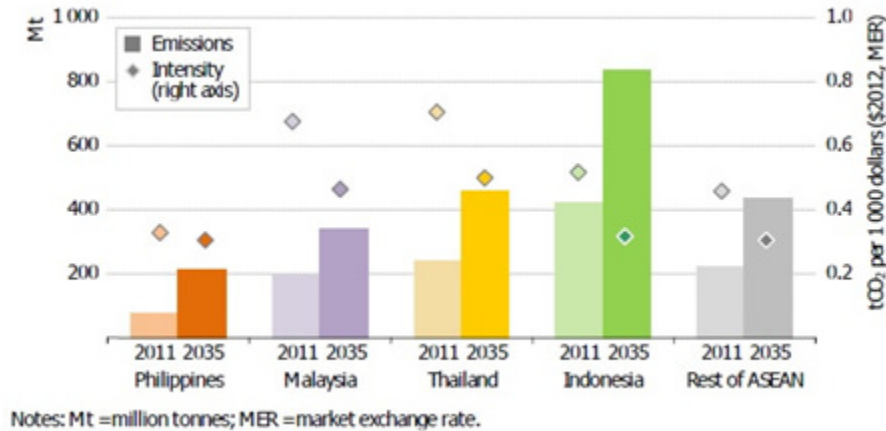


Fig. 3: CO₂ emissions and energy intensity, 2011 and 2035 (International Energy Agency, 2013).

Even though Thailand is currently one of the most CO₂ producers in the ASEAN region, looking forward to 2035, carbon intensity will improve considerably due to rapid growth in the size of its economy coupled with efficiency improvements in power generation and appliances, and supporting policies. Somehow, Thailand does not have specific legal frameworks for energy efficiency, and, in many cases, responsibility for enforcement of related policies is divided among various authorities, resulting in modest level of implementation.

6. CONCLUSIONS, AND SUGGESTION ON POTENTIAL RENEWABLE ENERGY MARKETS

It can be recognized that it is considerably diverse with vast differences in the scale and patterns of energy use and energy resource endowment. Indonesia consumes 66% more energy than Thailand, the second-largest user. To summarize Indonesia's and Thailand's energy situation and opportunity related to potential future cooperation among countries, there are several points of views being offered as follows:

- ✓ Indonesia exports steam coal, which is the world's largest, and LPG. It is also an increasing importer of oil.
- ✓ Thailand depends strongly on energy import owing to limited energy resources. It is aiming at diversifying electricity generation.
- ✓ There are several engaging factors affecting Indonesia's and Thailand's energy future including demographics, economics, pricing, technology, environmental concerns and policy.

- ✓ Energy policy in both Indonesia and Thailand varies substantially reflecting differences in economic development, political direction and natural resource endowments. They have common grounds in terms of enhancing *energy security, ensuring energy affordability and improving energy efficiency and CO₂ reduction.*
- ✓ As the Indonesian government has high hopes for geothermal energy, for additional generating capacity, an improvement for infrastructure for geothermal energy, and investments in geothermal power exploration will rapidly grow.
- ✓ The development of smart grid network will cause direct impact to the economic and industrial sectors in terms of increasing investment, higher employment rate which will lead to the growth of economic and industrial sectors of Thailand.
- ✓ As Thailand's natural-gas reserves are observed to expire within a decade, it has been motivated to become solar energy leader in the region. By the end of 2050, Thailand was expected to have more than solar power capacity than the rest of Southeast Asia combined. Solar capacity in Thailand is projected to increase to up to 2800 MW which is equivalent to six times higher than that in 2014. Therefore, incentives for supporting the investment in Thailand for Solar energy will be significantly crucial.

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REFERENCES

- [1] ASEAN BRIEFING. (2015). RE and Investment in ASEAN. Retrieved from <http://www.aseanbriefing.com/news/2015/11/04/renewable-energy-and-investment-in-asean.html>
- [2] Clean Technica. (2015). ASEAN Adopt RE Target. Retrieved from <https://cleantechnica.com/2015/10/09/asean-countries-adopt-renewable-energy-target/>
- [3] Clean Technica. (2016). ASEAN REMarkets. Retrieved from <https://cleantechnica.com/2016/09/21/look-asean-promising-renewable-energy-markets/>
- [4] DEDE (Department of Alternative Energy Development and Efficiency). (2015). Alternative Energy Development Plan : AEDP2015, 2579, 22. Retrieved from http://www.dede.go.th/download/files/AEDP2015_Final_version.pdf.
- [5] Department of Energy Business. (2015). Oil Plan 2015, ๒๕๖๕, 0–14.
- [6] EPPO, M. of E. (2015a). (Energy Efficiency Plan ; EEP 2015), 2579.
- [7] EPPO, M. of E. (2015b). Gas Plan 2015, 2579.
- [8] EPPO, M. of E. (2558). PDP2015, 2579.
- [9] Federal Ministry for Economic Affairs and Energy. (2017). Thailand Solar PV Policy Update 01/2017, 1–6.

- [10] IEA. (2015). Southeast Asia Energy Outlook. World Energy Outlook Special Report, 131. <https://doi.org/10.1787/weo-2013-en>
- [11] IEEJ. (2015). Asia/ World energy outlook 2015: Analyses of oil pricing and climate change measures under new circumstances.
- [12] International Energy Agency. (2013). Southeast Asia Energy Outlook - WEO Special Report.
- [13] Issue, S. (2016). Eppo journal.
- [14] Kanchana, K., & Unesaki, H. (2014). ASEAN energy security: An indicator-based assessment. *Energy Procedia*, 56(C), 163–171. <https://doi.org/10.1016/j.egypro.2014.07.145>
- [15] Matsuo, Y., Yanagisawa, A., & Yamashita, Y. (2013). A global energy outlook to 2035 with strategic considerations for Asia and Middle East energy supply and demand interdependencies. *Energy Strategy Reviews*, 2(1), 79–91. <https://doi.org/10.1016/j.esr.2013.04.002>
- [16] Ministry of Energy. (2016). Thailand Integrated Energy Blueprint. Retrieved May 15, 2016, from <http://www.eppo.go.th/index.php/th/plan-policy/tieb>
- [17] Renewable Energy in ASEAN _ Heinrich-Böll-Stiftung South East Asia. (n.d.).
- [18] Summary, E. (2015). The 4th ASEAN Energy Outlook.
- [19] Supply, P. E., Consumption, F. E., Electricity, G., & Efficiency, E. (2013). Energy Intensity in Thailand 2013.