

# Renewables development for energy transition in ASEAN: Status quo, gaps and the prospect

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## 1. Introduction

Energy demand and carbon emissions are bound to grow significantly in ASEAN as an engine of global economic growth. As so far, nearly all the 10 ASEAN countries have announced to become carbon neutral by around this mid-century except the Philippines. This requires to accelerate the region's energy transition by the upgrading of energy policy and regulatory framework, and much higher levels of investment (IEA, 2022). Focusing on Indonesia, Vietnam, Thailand and the Philippines (with a share of around 75% of the region's total emissions), this study reviews the current status, and identifies the gaps and the prospect to achieve a high penetration of renewables for energy transition in ASEAN.

## 2. Research method

This study was carried out mainly by an overview of literatures with relevance, and the comprehensive and systematic analysis of gathered information from various sources.

## 3. Results

- Status quo of renewables development

ASEAN has some of the best hydropower potential in the world. Solar irradiance across the region is strong. Wind resources are less favorable but have suitable areas in the Philippines, Thailand and Vietnam. Geothermal potential is significant in Indonesia and the Philippines. Bioenergy potential is large across the region (REI, 2019).

Overall, the development of renewables is still at an early stage in ASEAN, especially for solar PV and wind power. In 2020, power generation by fossil fuels made up 78% of the ASEAN electricity mix, hydropower accounted for 16%, the share of other renewables was only 6% (Handayani et al., 2022). By the end of 2021, Vietnam, Thailand and Indonesia were leading the region with an installed renewable capacity of 43 GW, 12 GW and 11 GW, respectively (IRENA, 2022).

As a short-term target, ASEAN aims to expand renewables to account for 23% of its total primary energy supply (TPES) by 2025. In 2021, ASEAN only had a 14.3% share of renewable energy in primary energy, and this share has remained more or less constant for half a decade (ACE, 2022). Some countries also set up medium-term target for renewables, i.e., Thailand aims to increase the share of renewable energy consumption to 30% by 2037.

Indonesia, the Philippines, Thailand and Vietnam are leading renewable policies in this region. Besides the target setting, they have established some key measures like guaranteed purchase of renewable power at set tariffs, economic incentives for project development, financing schemes to support investments, and permitting mechanisms to facilitate grid connection (REI, 2019).

- Gaps with the necessary levels for energy transition

Most scenario studies suggest a high share of and even 100% renewables for energy transition in ASEAN. As the examples, IRENA and ACE (2022) present two ways for the transition of ASEAN power system, one is a 100% renewables system, and the other reaches 90% renewables with some fossil fuel generation remained (mostly from natural gas). Solar PV is a key due to its abundancy across the region. The 100% renewables scenario needs a very large scale of solar PV, up to 2,400 GW, and a similar expansion of battery storage. Handayani et al. (2022) assess ASEAN power sector pathways to net-zero emissions by 2050. Their results indicate that variable renewables and energy storage come to play a central role. As the study cases targeting specific countries, the share of renewable electricity is estimated to be 68% of the total in 2040 and 74% by 2050 in Thailand's Long-term Low Greenhouse Gas Emission Development Strategy. Bioenergy with CCS (BECCS) power plants will be needed to achieve the net-zero CO<sub>2</sub> emission target by 2050 (MONRE, 2022). A transition study on the Philippines confirms that a

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100% fossil free energy system in 2050 is technically possible. Solar PV together with batteries form the backbone for the country's energy system transition (Gulagi et al., 2021). Reyseliani and Purwanto (2021) assess Indonesian power system transition to reach 100% renewables in 2050. Their conclusion is that solar PV will play an essential role up to 70% of total power supply in 2050.

A few other studies propose a moderate share of renewables in future electricity mix of ASEAN while addressing the role of CCS and hydrogen and ammonia-fired power generation. Kimura et al. (2022) conduct an analysis of scenarios for carbon neutrality in ASEAN. In the scenario of CN2050/2060 reflecting nationally declared carbon-neutral targets and considering carbon sinks, renewables will account for 56% in 2060, hydrogen and ammonia-fired power generation accounts for 26%. Under the low carbon scenario compatible with Paris Agreement target (LCCP) developed in Indonesia's Long-Term Strategy for Low Carbon and Climate Resilience 2050, the share of renewables, coal, natural gas and BECCS in electricity mix of 2050 will be individually 43%, 38%, 10% and 8%. Around 76% of the coal power plant are supposed to be equipped with CCS (Indonesia, 2021).

- **Barriers for renewables development**

Investment in renewables is far from the level needed for achieving energy transition in ASEAN. The basic barrier hindering renewables development is the economic order. Renewables are still more expensive than coal power in ASEAN. In spite of the generous feed-in tariffs and exemptions of income tax and land lease payment for the rapid increase of solar PV and wind power in Vietnam, high policy uncertainty appears as a key barrier recently (Do et al., 2021). Financial access is the most important for capital-intensive renewables projects. ASEAN countries (i.e., Indonesia and Vietnam) are lack of expertise for the risk assessment of renewables investment.

Another critical obstacle is the bureaucracy in power sector of ASEAN. Competition varies among countries for power generation. Independent Power Producers (IPPs) play a key role but the market is dominated by national utilities in Indonesia and Vietnam (REI, 2019). The state power company (i.e., PLN of Indonesia) monopolizes power transmission and distribution and dominates the local power generation market. This inhibits the interest of potential investors for renewables development (The ASEAN Post Team, 2019).

Major non-economics obstacles include grid problems, infrastructure, regulation and administrative deficiency, and often occur in ASEAN (Erdiwansyah et al., 2019). A lack of policies to regulate the proper land use and the environmental impact is a growing concern for large-scale renewable projects. Geographical and technical conditions may also bring challenges for renewables development, i.e., the fragmented power grids of Indonesia and the Philippines as archipelagic countries. Lack of exploration techniques, extended permission time as long as 7 to 10 years and lack of public acceptance are specified as barriers for geothermal in ASEAN (ACE, 2022).

- **The prospect for renewables development**

Many opportunities remain for ASEAN to expand renewables by establishing a level playing field (REI, 2019). Short-term affordability perspective in energy planning should be avoided. Energy transition should be recognized as a business chance with a focus on leapfrogging by building renewables infrastructure. Meanwhile, phase out of fossil fuel power should be promoted. The development of local micro-grid and off-grid facilities, and the acceleration of regional power connectivity enable renewables development in ASEAN (Overland et al., 2021).

#### **4. Conclusions**

This study clarifies the current status, gaps and the prospect of renewables development in ASEAN. The future research seeks the measures to overcome the existing barriers, analyze the effects of optional policies and propose effective mechanisms driving renewables development for energy transition in ASEAN.

#### **Acknowledgement**

This study was funded by the Environment Research and Technology Development Fund (ERTDF) of Environmental Restoration and Conservation Agency (ERCA) of Japan (Project No.: 1CN-2206). The author wishes to express great thanks to this financial support.

#### **References**

Omitted due to the limitation of abstract length.