



# ASEAN Power System Transformation and ASEAN-China Way Forward on Low Carbon Energy Transition

New Type of Power System Enabling a highly Efficient, Safe and Low-Carbon Energy Future - Insights from China and ASEAN  
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**One Community  
for Sustainable  
Energy**



# Introduction

Established on 1 January 1999, the ASEAN Centre for Energy (ACE) is an intergovernmental organisation within the Association of Southeast Asian Nations' (ASEAN) structure that represents the 10 ASEAN Member States' (AMS) interests in the energy sector.



ACE shall accelerate the integration of **energy strategies** within ASEAN by providing relevant information and expertise to ensure the necessary energy policies and programmes are in **harmony** with the **economic growth** and the **environmental sustainability** for the region.



## Catalyst

To unify and strengthen ASEAN Energy Cooperation by providing:

- Platform for Sharing
- Policy Advisory
- Best Practices
- Capacity Building



## Knowledge Hub

To provide a knowledge repository for ASEAN Member States (AMS) and services through:

- Data Management
- Publication
- Dissemination



## Think tank

To assist AMS on research and identifying practical & specific solution on:

- Policies
- Legal & Regulatory Frameworks
- Technologies
- Innovative Solutions

# Regional blueprint for the energy cooperation in the ASEAN








## ASEAN Plan of Action for Energy Cooperation (APAEC) 2016-2025 Phase 2: 2021-2025

- Theme: “Enhancing Energy Connectivity and Market Integration in ASEAN to Achieve Energy Security, Accessibility, Affordability and Sustainability for All”.
- Sub-theme: “Accelerating Energy Transition and Strengthening Energy Resilience through Greater Innovation and Cooperation.”

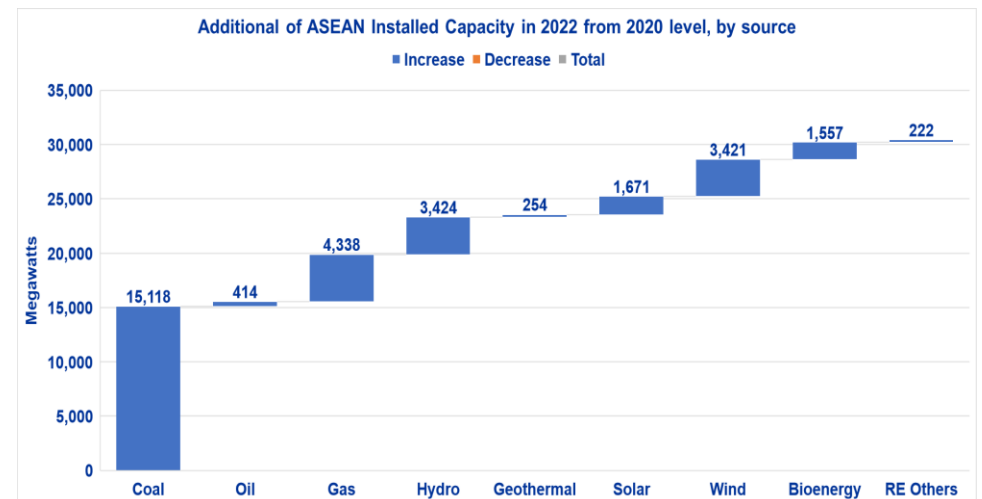
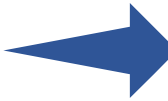
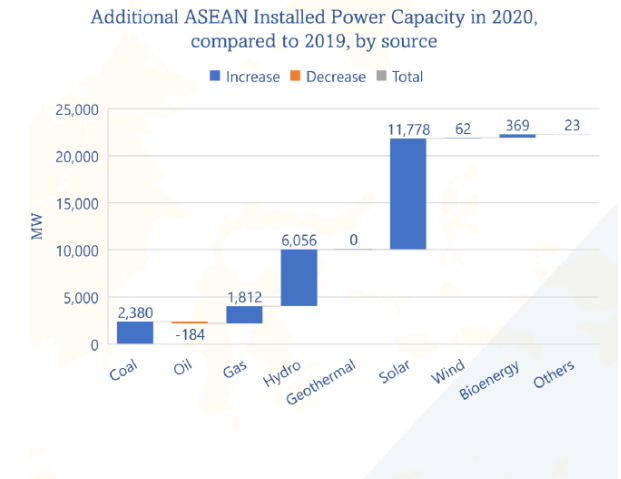
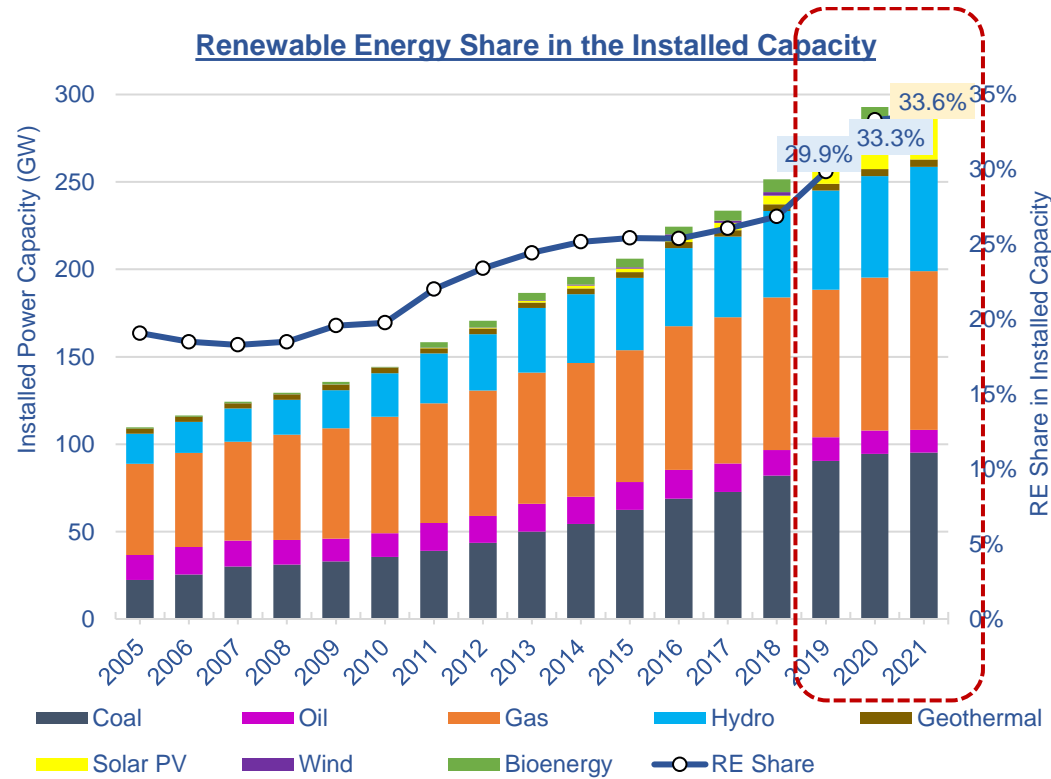


ASEAN PLAN OF ACTION FOR ENERGY COOPERATION (APAEC) 2016-2025 PHASE II: 2021-2025



|   |   |  |   |
|---|---|--|---|
|  <b>ASEAN Power Grid</b>                 | <p>To expand regional multilateral electricity trading, strengthen grid resilience and modernisation, and promote clean and renewable energy integration.</p> |  <b>Energy Efficiency and Conservation</b>    | <p>To reduce energy intensity by 32% in 2025 based on 2005 levels and encourage further energy efficiency and conservation efforts, especially in transport and industry sectors.</p>                                   |
|  <b>Trans-ASEAN Gas Pipeline</b>         | <p>To pursue the development of a common gas market for ASEAN by enhancing gas and LNG connectivity and accessibility.</p>                                    |  <b>Renewable Energy</b>                      | <p>To achieve aspirational target for increasing the component of renewable energy to 23% by 2025 in the ASEAN energy mix, including through increasing the share of RE in installed power capacity to 35% by 2025.</p> |
|  <b>Coal and Clean Coal Technology</b> | <p>To optimise the role of clean coal technology in facilitating the transition towards sustainable and lower emission development.</p>                       |  <b>Regional Energy Policy and Planning</b> | <p>To advance energy policy and planning to accelerate the region’s energy transition and resilience.</p>   |
|   |   |  <b>Civilian Nuclear Energy</b>             | <p>To build human resource capabilities on nuclear science and technology for power generation.</p>   |

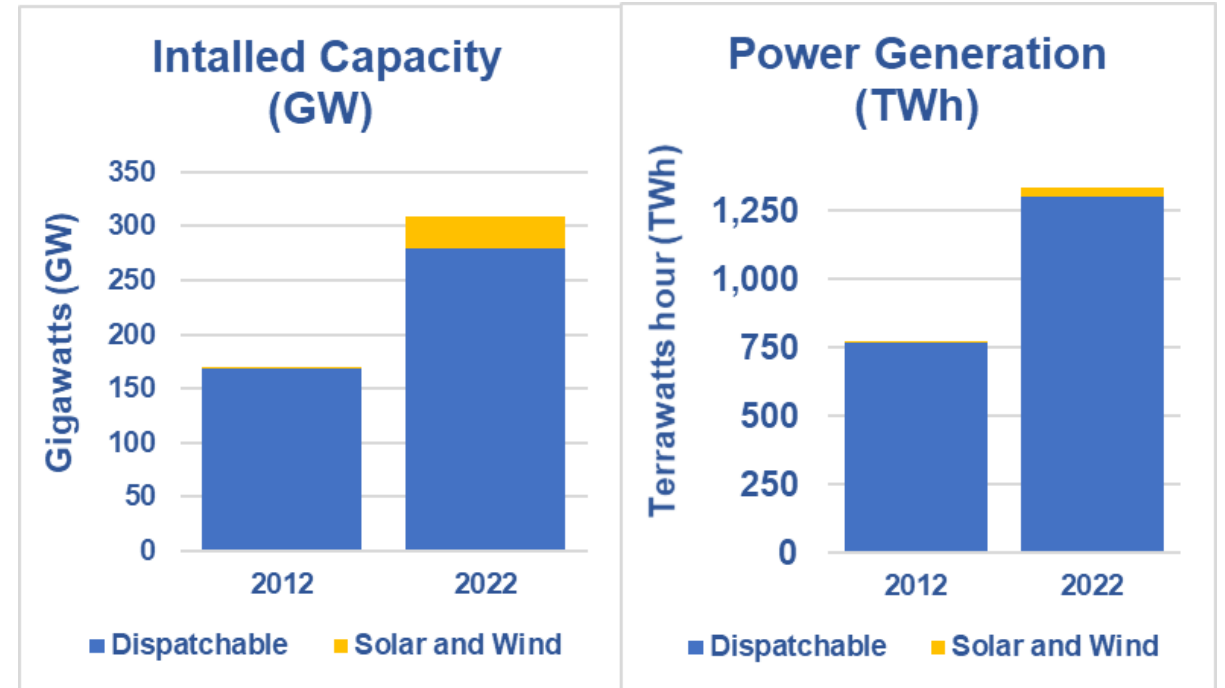
# ASEAN is progressing to add more renewable capacity



On track to go beyond **35% renewable energy in the installed capacity by 2025** but must carefully address the short-term disruption.

# But more is needed to translate capacity into generation

- Even though RE share in installed capacity reached 33.08%, the RE share in power generation was only at 24.71% level
- In 2012 the majority of installed capacity, approximately 99.86% was comprised of energy sources that could be readily dispatched. This dominance also evident in the energy generated with over 99.92%.
- A decade later, solar and wind energy saw massive expansion with their share in installed capacity around 29 GW (almost 125 times to the levels seen in 2012). By 2022, wind and solar energy accounted for roughly 9.76% of the total installed capacity. However, their contribution to the total electricity generation was only 2.4%.



# Smart Grid to improve flexibility of the power system



## Smart Grid in ASEAN: Overview and Opportunities to Support the ASEAN Renewable Energy Aspirational Target



Suvanto, Nadhilah Shani, Jonathan Tjoe, Rika Safrina, Akbar Dwi Wahyono, Beni Suryadi

### Highlights

- Smart grid can help ASEAN integrate more renewable energy, particularly solar and wind, so as to meet the target share of RE in the energy mix.
- Most of the ASEAN Member States have established a smart grid roadmap, with the majority focusing on installing the necessary infrastructures and systems, such as advanced metering infrastructure and energy management systems.
- The implementation of smart grid in ASEAN faces several challenges and barriers, which include the high cost of equipment investment, lack of business and financial mechanisms to generate returns, and cybersecurity.
- The recommendations for ASEAN to accelerate the implementation of smart grids include: (i) identifying needs and priorities of smart grid application, (ii) promoting financial incentives for smart grid projects, (iii) establishing smart grid working groups and forums across AMS, (iv) carrying out further research and development in smart grid technologies, and (v) establishing supportive policies for smart grid integration.

### Introduction

The demand for energy in ASEAN in 2050 is projected to be three times above the 2020 level. Fossil fuels are expected to dominate the energy system, with 27% in the form of coal, which is the most emissions-intensive fuel [1]. To address the adverse effects of using fossil fuels and initiate a transition to cleaner energy, ASEAN has outlined several strategies for achieving its regional aspirational targets, namely a 32% reduction in energy intensity and a 23% share of renewable energy (RE) in the energy mix by 2025 [2].

To achieve the Nationally Determined Contribution (NDC) targets of each ASEAN Member State (AMS), the need to increase the share of RE in the power grid is paramount. Almost all of the AMS have pledged net zero or carbon neutrality by around mid-century, and half have initiated actions to reduce the use of coal. These initiatives have raised the necessity for RE to substitute for fossil fuels, particularly coal, in the power sector. More than 60% of the newly installed capacity up till 2025 will come from renewable sources [3]. This will, in turn, increase the share of RE in

installed power capacity to 37.6% by 2025, above the regional target of 35%.

Among several types of renewable energy sources, variable renewable energy (VRE), particularly wind and solar energy, are becoming the core of RE development. They are to account for 25% and 14%, respectively, of total newly installed capacity between 2021 and 2025 (see Figure 1). According to the ASEAN Interconnection Masterplan Study (AIMS) III Phase I (2021), up to 8,119 GW (12,000 TWh) of solar potential from 42 sites and 342 GW (766 TWh) of wind resources from 20 sites were untapped [4]. In achieving the ASEAN RE Target in 2025, it was estimated that ASEAN would require 20,284 MW of interconnection capacity to provide system flexibility and transmit these power generations to the electricity market.

With the increased interest in grid integration of RE, notably wind and solar energy, traditional power systems are transitioning from centralised systems with few generators to decentralised systems with large numbers of generators. This

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- This evolution has resulted in a higher degree of complexity, especially at the grid level. Moreover, due to variable power output and the typical installation of VRE on the lower voltage level, effective coordination and optimization become crucial, especially considering the high number of units involved.
- Therefore, traditional power grids need to shift to a modernised power grid where intelligent monitoring, control and supply-demand optimisation are possible to efficiently deliver sustainable, economic and secured electricity supplies.



# Opportunity to Support the ASEAN Renewable Energy Target



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No. 10 / October 2023



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# ASEAN-China Cooperation on Low Carbon Energy Transition



ASEAN China Clean Energy Cooperation Center (ACCEC)









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