

Development of ASEAN Power Grid and Factors Affecting Regional Power Market Integration

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SYNOPSIS

The ASEAN Power Grid has reached a milestone by implementing the first multilateral power trades from Lao PDR to Singapore and is preparing to move to a higher level of integration. The successful implementation of an integrated power market can increase overall economic benefits. It can also help meet climate goals by introducing low-carbon energy into the regional power system. On the other hand, there are also economic, regulatory, infrastructural and institutional challenges to successfully implementing electricity infrastructure and market integration. The integration process requires active cross-boundary coordination, and the regional governing bodies and their frameworks facilitate economic, institutional, regulatory, and technical cooperation.

KEY POINTS

- The successful implementation of the integrated market will create larger markets and increase the utilisation rate of infrastructure and traded volume.
- Integrated markets will enable buyers to take advantage of lower power prices through access to cheaper electricity from other countries and increased supplier competition. Sellers can expand markets by reaching a wider range of customers beyond domestic buyers and increasing sales revenue.
- Sufficient reserve power generation capacity in exporting countries will ensure that the price of exporting countries will not increase and avoid supply disruption, prompting the low volume of electricity trade.
- Experiences in Central America and the EU demonstrate that regional governing bodies play essential roles in market integration and operation, and in the governance system for consensus gathering and transboundary coordination.

INTRODUCTION

The storage and transport of energy commodities such as electricity and natural gas are difficult and require the construction of designated infrastructure and significant capital investment. Nationwide infrastructure provides opportunities to easily transport large quantities of energy commodities and create integrated energy markets beyond the national borders. In general, larger market size, diversified supply sources, and increased infrastructure utilisation enable economies of scale, more effective resource sharing, and enhanced supply security. These factors increase economic benefits to both consumers and sellers. However, as much as the advantages it brings, the road to integrating

energy infrastructures and markets poses many challenges and requires a lengthy and complicated process.

This policy brief identifies the importance of the ASEAN Power Grid (APG) and its development process, [complementing the ESI Policy Brief No. 70 on the technical challenges of the APG](#). It also discusses the opportunities and challenges surrounding regional power grid integrations based on examining the experience of other regions.

ANALYSIS

Development of APG: A Step Towards a Regional Integrated Power Market

APG has been progressing under a common goal to improve the integration of economies of ASEAN member states (AMS), and its strategies and plans have been developed under various documents. In the *ASEAN Vision 2020* unveiled in 1997, AMS declared that it would transform the ASEAN region into a stable, prosperous, and highly competitive economy. The ASEAN Economic Community (AEC), established in 2015, is a realisation of these goals. It aims to deepen and broaden economic regional integration with clear timelines. APG is also one of the physical energy infrastructure projects included in the ASEAN regions' critical projects under the ASEAN Plan of Action for Energy Cooperation (APAEC). The APG is included and identified by the first APAEC, APAEC 1999-2004. Since then, the objectives of APG have been revised and updated in every APAEC, APAEC 2004-2009, APAEC 2010-2015 and APAEC 2016-2025, demonstrating the importance of the project for the AEC. Heads of ASEAN Power Utilities/Authorities (HAPUA) is a subsidiary body of the programme on APG. It provides recommendations and advice for the ASEAN Ministers on Energy Meeting and the Senior Officials Meeting on Energy and pursues regional cooperation.

Operational bilateral transmission capacity in the ASEAN region is over 7 gigawatts (GW). The ASEAN power connection is initially based on cross-boundary bilateral agreements and expands to multilateral power trading within sub-regions, increasing the potential to create an integrated power market. The APG marked the progress towards a regional market with the launch of the multilateral power trades involving Lao PDR, Thailand, Malaysia and Singapore. Through cross-border electricity trade, the APG would benefit member states by improving their access to energy services within the region. The ASEAN region can exploit its rich clean energy potential and improve overall benefits through resource sharing. [As a result, it can enhance economic integration towards a common market.](#)

Singapore aims to reach peak emissions before 2030 and net zero by 2050 by decarbonising the economy. Reducing emissions in the power sector is especially important to achieve the goals because it accounts for around 40% of the country's total carbon dioxide (CO₂)

emissions, and over 90% of electricity is generated from natural gas annually. In this sense, improving power grid connections with neighbouring countries and importing clean electricity can be central to progressing towards the net zero goal. Singapore intends to import clean electricity from overseas to decarbonise the power sector, purchasing up to 4 GW of low-carbon electricity by 2035, around 30% of the country's projected power supply. Efforts are underway to ensure a more volume of clean energy supply from neighbouring economies to Singapore. Many bilateral electricity trade projects involve Singapore and other countries in the region, such as Malaysia, Indonesia, Vietnam, and Cambodia. [A total of 4.2 GW of power import projects has already been granted conditional approval by EMA.](#)

Opportunities for the Integrated Regional Power Market

The successful integration of regional power markets can create many opportunities and economic benefits. Importers can take advantage of lower power prices by accessing cheaper electricity from other countries and through increased supplier competition. They can also enhance energy security by diversifying the supply of sources. Sellers will have opportunities to expand markets, reaching customers beyond domestic buyers and increasing sales revenue. Integrated power markets can also enable more companies to participate in electricity trading. As a result, they create larger power markets through the physical connection of infrastructures and achieve economies of scale. Functioning integrated markets will drive international energy exchanges through demand/supply balance and price differentials between countries. All these factors lead to overall economic benefits.

In addition to the economic benefits, [IEA's report, *Integrating Power Systems across Borders*](#), published in 2019, identifies regional electricity market integration and multilateral trades contribute to improving the flexibility of power systems and facilitating the introduction of variable renewable energies. A regional electricity grid could increase electricity system security and stability by supporting intermittent renewable energy

generation and sharing renewable energy sources.

From an international relations perspective, multilateral power trades and increased economic interdependence enhance regional security and mitigate cross-border conflicts due to shared economic interests and energy security. Therefore, a multilateral power trade regime in the ASEAN region could unite states to pursue a common economic and climate goal. Collaboration through the APG projects would optimise the region's rich clean energy resources and enhance national and regional security.

Because of the potential advantages of successful integration of infrastructure and markets, there have been many attempts to improve regional infrastructural connectivity around the world or to move beyond infrastructural connections and create integrated markets.

Challenges Involving Regional Power Market Integration: Power Generation and Transmission Capacity, and Market Structure

Interconnecting infrastructures and creating common markets of different countries is a lengthy process, and the road to a regional integrated market involves a series of challenges. Some experiences of other regions show such plans face economic, regulatory, and political hurdles to overcome. One of the significant issues is the power generation capacity of exporting countries. Lack of excess power generation capacity in exporting states often leads to supply disruptions. Sufficient reserve capacity will not influence the price of domestic markets arising from power exports and avoid supply disruption. In the case of the Eight Country Grid Integration (EIJLLPST), which interconnects the eight Middle East countries' electricity grids, insufficient generation capacity among the participating states is one of the critical reasons for the low volumes of electricity trade in the region. The member countries' generation capacities have yet to increase sufficiently to meet the increased demand for electricity, and electricity is presently traded on an emergency basis.

A heterogeneous market structure among participating countries can increase regulatory burdens. Regulatory and economic difficulties can arise from different pricing mechanisms and market structures when creating integrated regional power markets and complicate the calculation of the price of traded electricity. The network capacity and integrated market should be able to support the energy exchanges driven by demand dynamics and price differentials. These factors can encourage more diverse players and participants to voluntarily join power market integration projects.

Institutional Challenges and Role of Governance: Examples of Central America and the European Union (EU)

Physical integration of large-scale infrastructure and creation of highly integrated common energy markets connecting different countries are works of giant scale and require coordination of a wide range of regulations and legislations of each country. This process involves active communications among various counterparts and regulators covering every economic sector. Regional governing bodies and the presence of regional governance and institutional frameworks can play an essential role by facilitating inter-governmental communications, negotiations, and consensus-gathering processes,

The Central American Electrical Interconnection System (SIEPAC), comprising seven countries in Central America (Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and Panama), initially operated based on a series of bilateral interconnections. The Central American Integration System (SICA) Framework Treaty created regional regulatory bodies and organisations, such as the Council of Ministers of Energy, Regional Operations Entity (EPR), Regional Operating Entity (EOR) and Regional Commission for Electrical Interconnections (CRIE). The CRIE is the independent regional regulatory agency that regulates commercial relations and sets rates. It has statutory powers to ensure the regional power market remains non-discriminatory and competitive. Consequently, the number of electricity exchanges between the participating states has increased significantly.

The EU has a higher regional energy market integration level than SIEPAC. In SIEPAC, trade occurs between jurisdictions with different market structures, whereas in Europe's Internal Energy Market, market structure and related regulations are harmonised and coordinated by regional governing bodies. [In both cases, regional institutions support market integration.](#) To a certain degree, the European Parliament mandated market reforms through a series of legislative acts at various levels to its member countries after gathering consensus through institutions in the bloc, such as the European Commission and the European Council. The EU harmonises a regulatory framework and transmission system through the legislative acts included in the Energy Packages. The EU liberalised and integrated the gas and power market through the Energy Packages. The Third Energy Package set up the European Union Agency for the Cooperation of Energy Regulators (ACER), the European Network for Transmission System Operators for Electricity (ENTSO-E), and the European Network for Transmission System Operators for Gas (ENTSO-G). ACER is a regional independent regulatory agency coordinating the bloc's national regulators. It facilitates cooperation among the regulators across member countries and assists the operation of the regional energy market. ENTSO-E and ENTSO-G are responsible for effectively functioning EU-wide networks and cross-border transmission. Efficient coordination with national transmission system operators ensures adequate electricity and natural gas transportation through the power and natural gas infrastructure. These organisations harmonise standards to guarantee the stable transportation of power and natural gas across borders via the transmission systems of each member country.

Every region has a different situation, and the process in ASEAN may differ from those in Central America and the EU. However, the experience of other countries shows that regional frameworks, governance, regulatory bodies, and consensus-gathering processes have been proven essential and developed in line with the infrastructural and market integration processes. They facilitate cross-border cooperation and the operation of infrastructure and market systems. They also can help with the integration process and save

time for each project to avoid a separate, lengthy negotiation and agreement process.

CONCLUSION

APG is progressing towards a higher level of integration. Interconnection of the power grid provides economic benefits to participating countries and can accelerate economic integration through the improved connectivity of infrastructure, harmonised market structure, and regulatory framework. On the other hand, it poses a series of economic, infrastructural, and institutional challenges requiring coordination among participating countries. They include insufficient capacity of power generation, transmission and network, and different pricing mechanisms and market structures. The examples of different regions show that a high level of coordination through regional bodies is necessary to achieve the common goal.

WHAT TO LOOK OUT FOR

- Future bilateral agreements/deals of electricity trade between ASEAN countries
- Development of another multilateral project (BIMP PIP)
- National commitment to decarbonise of ASEAN countries

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