

Annex B: BACKGROUND FOR THE ASEAN POWER GRID PROGRAM

1. ASEAN has long pursued the realization of the ASEAN Power Grid (APG) to promote regional power interconnection and trade and increase the transmission capacity of interconnections in Southeast Asia. The initiative was harnessed in the 1986 agreement on ASEAN Energy Cooperation (AEC) to build a more competitive, inclusive, and cohesive ASEAN. While initiated prior to the global efforts to stem greenhouse gas (GHG) emissions through energy transition, through interconnectivity the growing demand in the Region for energy could be addressed to enhance confidence in RE and reduce the need for fossil fuel-based solutions. Advancing multilateral power trade is a key focus of the APG to achieve the goal of AEC 2025 to enhance connectivity, energy security, accessibility, affordability, and sustainability for all through the energy connectivity and market integration, including the renewable energy target of ASEAN in the TPES (Total Power Energy Supply).
2. The ASEAN Power Grid Program (APGP) is a multilateral effort to bring the APG to fruition by moving it systematically from the current study stage to implementation of a multilateral power trading mechanism that paves the way for additional renewable energy to the ASEAN region. ETP and its Aligned Program, the Clean Affordable and Secure Energy (CASE), and the United Nations Economic and Social Commissions of Asia and the Pacific (ESCAP) are combining resources to collaborate with the ASEAN Center for Energy (ACE) to reinforce the APG to foster progress from the study stage to implementation. APGP is a multi-pronged initiative that enables involvement of development partners and developers throughout its stages to support the initiative and to play key roles in ensuring that the decision-making progresses smoothly toward a functioning multi-country energy market. The first undertaking in the context of the APGP is to develop a roadmap for the APGP to take the APG to its fruition through progressive steps. The roadmap will provide a background analysis on the benefits of increased renewable energy, electricity exchanges, resulting from electricity market integration, identify investments, processes and procedures to enable sustainable electricity trade between the signatories, and formulate the electricity trading roadmap implementation pathway. The work identified in the roadmap will include studies to analyze the economic, financial, legal/regulatory, security, technical, environmental, social, market and implementation topics relevant to the electricity trading roadmap preparation and where these are pending. The roadmap will establish pending work and decisions, as well as identify the financing needs for these steps to be successfully executed with the objective to ensure that the APG becomes a multilateral reality. The actions identified in the roadmap will subsequently be approved and implemented with multiple funding sources with support of public and private funders.
3. APG has confronted various challenges, including ensuring rationale and benefits for all involved countries, socio-economic benefits for the consumers in terms of lower prices, and consequently greater affordability and accessibility for various consumer groups. This calls for dynamic market and electricity pricing mechanisms, as well as fair division of the investment burden; and finally, clarity regarding measures to ensure that renewable energy serves APG, including, carbon pricing, among other relevant targets.

4. Projections and the region's plans forecast an increase in regional programs for natural gas among other fossil fuel investments to meet the growing energy and electricity demand. APGP captures an opportunity to demonstrate that APG will bring the confluence of the effects of digital technologies, renewable energy potential and energy storage as a credible energy solution for the region. To enhance progressive implementation of APG and to capture coordination benefits, the Project will develop a roadmap with financing requirements, as well as provide funding for the analytical work that is crucial for pursuing concerted and systematic implementation of APG. The roadmap and its financing framework will set direction and enable leadership of the pertinent regional institutions to pursue a systematic issue resolution through coordinated and structured decision-making and achieve progress to move the APG from planning stage to technical feasibility and implementation stages as defined in the political ambitions of the region's energy leadership to move to a Renewable Energy dominated, integrated energy system.
5. **Economic Growth:** Southeast Asia depends on fossil fuels to sustain economic growth. Carbon-based energy supply is estimated at 77% share of the region's overall energy generation mix.¹ These countries still have plans to further expand coal-fired generation with some 20GW of new generating capacity in the pipeline. In the case of the Philippines, the Department of Energy announced in October 2020 a moratorium on the construction of new coal-fired power plants. Indonesia dovetailed this announcement in May 2021, while the existing programs still indicate plans for new coal power production capacity.
1. **Energy Demand:** Southeast Asia has a significant opportunity to meet the rapidly growing energy demand, while reducing the GHG emissions by directly moving to renewable energy. In pursuit of low carbon futures, the economies in the region have published their climate goals in the context of the UNFCCC and energy goals in the national energy policies.
2. **ASEAN:** The members countries of the Southeast Asian Nations (ASEAN)² have collectively agreed in the APAEC³ to a target of 23% share of renewable energy in their total primary energy supply (TPES) and 35% renewable energy in the region's installed power capacity by 2025. With the relevant capacity factors, this entails 35 GW to 40 GW of renewable energy capacity⁴. However, as of 2017, the renewable energy (RE) share remained at only 13.7%.
3. **APG:** ASEAN has long pursued the realization of the ASEAN Power Grid (APG) to promote power interconnection, trade and increasing the transmission capacity of interconnections in the Region. The initiative was harnessed in the 1986 agreement on ASEAN Energy Cooperation (AEC). While initiated prior to the global efforts to stem greenhouse gas (GHG) emissions

¹ Summarized from: (2021-2025) ASEAN Plan of Action for Energy Cooperation (APAEC) 2016-2025 Phase II.

<https://aseanenergy.org/asean-plan-of-action-and-energy-cooperation-apaec-phase-ii-2021-2025/>; Electricity Market Report (2020), p. 69-74.

https://iea.blob.core.windows.net/assets/a695ae98-cec1-43ce-9cab-c37bb0143a05/Electricity_Market_Report_December_2020.pdf<https://aseanenergy.org/asean-plan-of-action-and-energy-cooperation-apaec-phase-ii-2021-2025/>; Establishing Multilateral Power Trade in ASEAN (2019).

https://iea.blob.core.windows.net/assets/37a2b2f0-bab0-47e0-a618-1a0259926b26/Establishing_Multilateral_Power_Trade_in_ASEAN.pdf

² Association of Southeast Asian Nations (ASEAN), is a political and economic union of 10 member states in Southeast Asia, which promotes intergovernmental cooperation and facilitates economic, political, security, military, educational, and sociocultural integration between its members and other countries in Asia. The 10 member states include Indonesia, Malaysia, Philippines, Singapore, Thailand, Brunei Darussalam, Vietnam, Laos, Myanmar and Cambodia.

³ ASEAN Plan of Action for Energy Cooperation (APAEC) is the regional blueprint for the energy sector in the framework of the ASEAN Economic Community (AEC) implementation.

⁴ McLaren, 2021.

through energy transition, through interconnectivity the growing demand in the Region for energy could be addressed to enhance confidence in RE and reduce the need for fossil fuel-based solutions. Advancing multilateral power trade is a key focus of the APG to achieve the goal of AEC 2025 to enhance connectivity, energy security, accessibility, affordability, and sustainability for all through the energy connectivity and market integration, including the renewable energy target of ASEAN in the TPES.

4. **ASEAN Interconnection Masterplan Study.** AIMS was first initiated at the 17th ASEAN Energy Ministerial Meeting in 1999. The Heads of Power Utilities Association (HAPUA) is a Specialized Energy Body (SEB) of the ASEAN and drives the APG to ensure regional energy security in collaboration with ASEAN energy bodies including the ASEAN Energy Regulators Network (AERN), which consists of energy regulators from AMS and the ASEAN Power Grid Consultative Committee (APGCC). HAPUA established APG with AIMS as the foundation of its development in 2000. A roadmap and the AIMS were approved by the 20th Senior Officials Meeting on Energy-ASEAN Ministers on Energy Meeting in 2002. AIMS-I, completed in 2003, pioneered the APG's electrical power transmission network. In 2010, AIMS-II prepared a plan for the interconnections of the Region's countries to promote more efficient, economical and secure power systems through the harmonious development of national electricity networks across the region. In 2017, AIMS III focused on inter-country cooperation to increase RE integration (as part of the ASEAN's target 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 through greater interconnections).
5. **Progressive Analysis:** Several studies on regional power integration and multilateral power trade in the APG were completed, including the Feasibility Study on Multilateral Power Trade (IEA, 2019, Establishing multilateral power trade in ASEAN) and the ASEAN Renewable Integration Analysis Study on integrating renewable energy into cross-border power trade in 2019. Additionally, *a Study on Taxation on Cross Border Power Transaction* was conducted in 2017. During this period, HAPUA also began the ASEAN Interconnection Masterplan Study (AIMS III) to set out the interconnection infrastructure needed to enable expanded power trade as well as integrate higher shares of renewables into the APG. The Region's countries are cognisant that increasing energy investment is a priority to advance the connectivity goals of the APG, which needs clear policy guidelines and best practices, and investment-friendly conditions. Along this direction, HAPUA has completed studies to identify areas where indigenous resources can be utilized to benefit the region.⁵
6. **AIMS III** will be the basis to promote cross-border power exchange and the development of the APG with a cleaner energy solution to achieve ASEAN's RE target of 23% in the regional energy mix in 2025 (including through increasing the share of RE in installed power capacity to 35% by 2025) under three main objectives:
 - a. To provide a new and updated master plan of the APG as the reference for AIMS in pursuing regional cooperation in the power and VRE sector.
 - b. To evaluate the techno-economic viability of the potential cross-border interconnections and optimal generation capacity and VRE expansion that could be used as a reference for implementing VRE pilot projects to promote multilateral power trading with high utilization of RE.
 - c. To enhance energy connectivity and market integration in ASEAN to achieve energy security, accessibility, affordability, and sustainability for all.

⁵ ASEAN Center for Energy. 2020. (2021-2025) ASEAN Plan of Action for Energy Cooperation (APAEC) 2016-2025 Phase II.

<https://aseanenergy.org/asean-plan-of-action-and-energy-cooperation-apaec-phase-ii-2021-2025/>

7. **Recent Decisions:** The 38th ASEAN Ministers of Energy Meeting, where ETP was officially launched, held in November 2020 in Vietnam endorsed the APAEC 2016-2025 Phase II: 2021-2025, retaining the theme of “*Enhancing Energy Connectivity and Market Integration in ASEAN to Achieve Energy Security, Accessibility, Affordability and Sustainability for All*”. It sets out ambitious targets and initiatives to enhance energy security and sustainability in support of the United Nations Sustainable Development Goal 7 (UN SDG7). The completion of the AIMS III Phases 1 and 2 were noted at the 39th ASEAN Ministers on Energy Meeting in September 2021. AIMS III Phases 1 and 2 has identified 18 potential cross-border lines worth up to 33 GW of electricity interconnections until 2040, from the existing 7,650 MW interconnections (2020). AIMS III also identified 62 potential renewable sites (42 sites for solar and 20 for wind) from the 8,119 GW technical gross capacity of solar and 342 GW of wind. Based on the AIMS III Phase 1 and 2 findings, APG was acknowledged to support better utilization of RE resources, advancing clean energy and climate protection goals in ASEAN since power system connectivity increases flexibility through effective utilization of resource sharing across geographical locations for common regional benefit. Power system connectivity can also provide economic benefits by allowing cost-effective generating units within the interconnected area to be dispatched and enabling power trade between the systems. This is vital as power system connectivity among APG will smooth the variability and reduce wind and solar generation uncertainty.
8. **Operationalizing APG:** A major initiative of the APG in APAEC Phase I was the operationalisation of the first multilateral power trade pilot project, namely the Lao PDR-Thailand-Malaysia-Singapore Power Integration Project (LTMS-PIP). Initiated in 2014, the LTMS-PIP was a path finder for cross-border power trade of up to 100 MW of hydro electricity from Lao PDR to Singapore using existing interconnections. The first multilateral electricity trading started following the signing of the Energy Purchase and Wheeling Agreement (EPWA) by Lao PDR, Thailand, and Malaysia in 2017. A total of 30.2 GWh of electricity traded under LTMS-PIP Phase I and LTM-PIP Phase I and II, as of August 2020. A Supplementary Agreement to the EPWA was signed by the utility companies from the three countries to increase the committed energy capacity trading from 100 MW to 300 MW for a 2-year period from January 2020 to December 2021. Lao PDR, Thailand, Malaysia, and Singapore are discussing expansion of electricity trading as part of the next phase of the LTMS-PIP.⁶
9. **Expansion of multilateral power trade:** HAPUA plans to explore expanding multilateral power trade to another sub-region of the ASEAN Power Grid following the success of the LTMS-PIP. This will be guided by the key findings and recommendations of the APG studies such as (i) Study on the Formation of APG Institutions, which consists of the ASEAN Power Grid Generation and Transmission System Planning Institutions (AGTP) and ASEAN Power Grid Transmission System Operator (ATSO), (ii) Feasibility Study for ASEAN Multilateral Power Trade, and (iii) ASEAN Interconnection Master Plan Study (AIMS) III. The AIMS III will provide the new and updated plan of the APG to be used as the main reference for the region to pursue the development of a high-level plan for the realization of multilateral power trading, including the comprehensive feasibility study on the design and implementation in delivering a fully operable bilateral and multilateral power trading. AIMS III comprises three phases: Phases 1 and 2 set out the transmission infrastructure needed to support multilateral power trade in ASEAN and renewable energy integration into the ASEAN Power Grid. Phase 3 focuses on further developing minimum requirements for multilateral market development, regulatory framework, and grid code and technical standards.

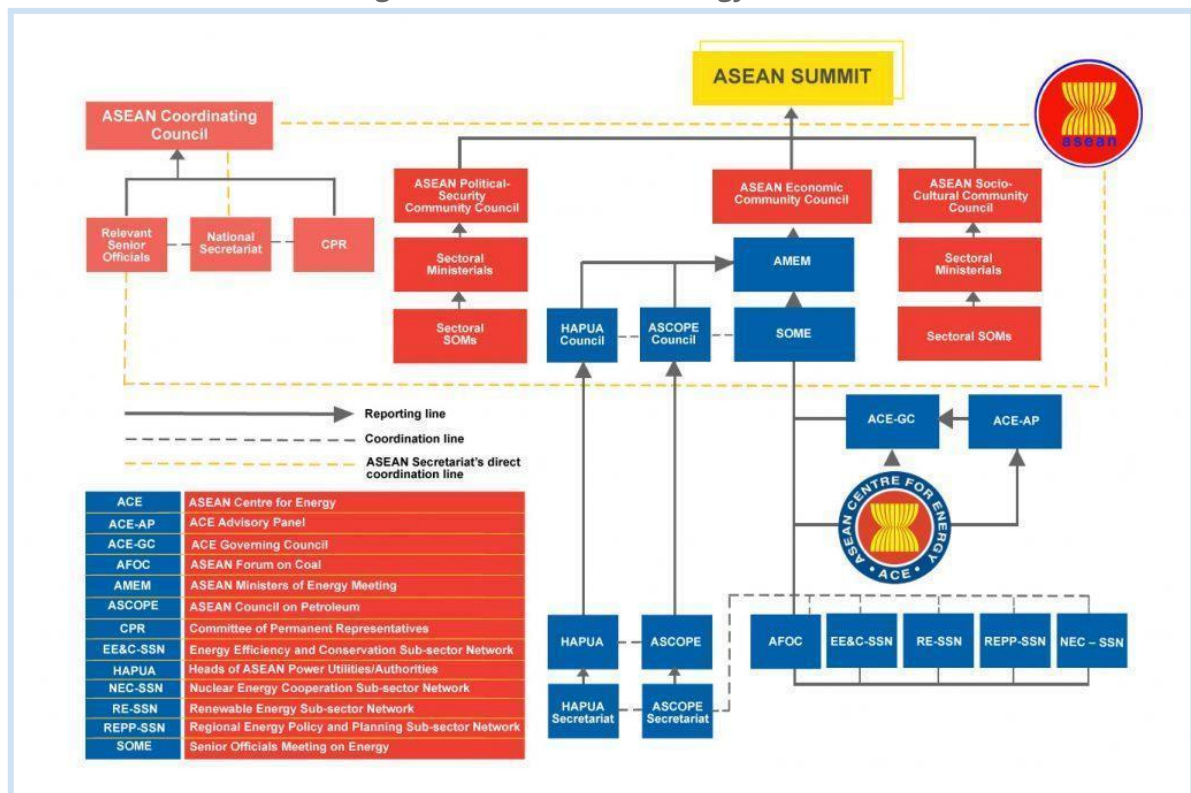
A. APG and Stakeholder Institutions

⁶ https://www.ema.gov.sg/media_release.aspx?news_sid=20220623UjiFDR2aZUxy

10. **External Assistance:** Overtime, APG has received significant support from various stakeholders, including development partners and donors. This support has helped ASEAN and the relevant agencies make progress to the current study stage. Partnerships and alliances will be essential in moving the program to execution and to realize its benefits within the envisaged timeframe by 2025. Stakeholders in the APG involve the consumers in the region that seek to enhance their access to secure, resilient, affordable and sustainable energy and electricity sources to fuel economic growth, the governments and its agencies, the regional forums involved in energy sector and the region's electricity utilities and regulators, who will drive the implementation the program.
11. **ASEAN and the ASEAN Secretariat (ASEC)** was set up in February 1976 by the Foreign Ministers of ASEAN. Its basic function mission is to initiate, facilitate and coordinate ASEAN stakeholder collaboration in realising the purposes and principles of ASEAN as reflected in the ASEAN Charter. This is primarily done through providing for greater efficiency in coordination of AMS and ASEAN institutions and for more effective implementation of ASEAN projects and activities. The ASEC's Energy and Minerals Division sits under the Sectoral Development Directorate that reports to ASEAN Economic Community Department, which in turn reports directly to the Secretary-General. The Division also acts as the secretariat to a number of relevant regional bodies and forums, including the ASEAN Energy Regulators Network (AERN).
12. **ASEAN Centre for Energy (ACE)** is an intergovernmental organization within ASEAN structure that represents the 10 ASEAN Member States' interests in the energy sector. ACE assumes a central role in the ASEAN energy sector. It works closely with energy authorities and ministries in the 10 ASEAN Member States as well as with the ASEAN Secretariat. Together, ACE and ASEAN Secretary implement the APAEC, which serves as a blueprint for better cooperation towards enhancing energy cooperation. ACE serves as a *catalyst* to unify and strengthen ASEAN Energy Cooperation by providing a platform for sharing, policy advisory, best practices, and capacity building; as a *knowledge hub* to provide a knowledge repository for ASEAN Member States and services through data management, publication, and dissemination; and as a *think tank* to assist the Region on research and identifying practical and specific solutions on policies, legal and regulatory frameworks, technologies, and innovative solutions.
13. **Heads of ASEAN Power Utilities/Authorities (HAPUA)** is the official ASEAN Specialized Energy Body (SEB) to implement the ASEAN Power Grid (APG) under the ASEAN Plan of Action for Energy Cooperation (APAEC). Its members includes the Department of Electrical Services of Brunei Darussalam, the Electricité du Cambodge of Cambodia (EDC), PT PLN (Persero) of Indonesia, the Electricité du Laos (EDL) of Lao PDR, the Tenaga Nasional Berhad of Malaysia, the Department of Electric Power of Myanmar, the National Power Corporation of Philippines, the Singapore Power Limited of Singapore, the Electricity Generating Authority of Thailand (EGAT), and the Electricity of Vietnam (EVN). Its objective is to promote cooperation among its members to strengthen regional energy security through interconnection development, enhancing private sector participation, encouraging the standardization of equipment, promoting joint project development, cooperation in human resources, research & development, and enhancing quality & reliability of the electricity supply system. As per HAPUA Secretariat's directives established on 2 March 2022, HAPUA's work is organized by working groups, with the relevant ones being:
 - a. HAPUA Working Group 4 operating as a Project Advisory Committee for the development of AIMS III Phase 3, led by Manila Electric Company (Meralco) of the Philippines;
 - b. HAPUA Working Group 2 with a focus on Transmissions / ASEAN Power Grid (APG) and led by the Electricity Generating Authority of Thailand (EGAT); and

- c. ASEAN Power Grid Consultative Committee (APGCC) as a Project Advisory Committee for the development of AIMS III Phase 3 in alignment with APGCC's functions under a new Terms of Reference of APGCC in 2022, endorsed during the Senior Officials Meeting on Energy (SOME) Meeting on 26-27 January 2022.
14. **Role of HAPUA in APG:** HAPUA aims to accommodate a higher penetration rate of renewable energy in the APG and to increase initiatives on energy transition and sustainable development goals through RE. In close coordination with Renewable Energy Sub-Sector Network (RE-SSN) and Regional Energy Policy and Planning Sub-Sector Network (REPP-SSN), the key actions of HAPUA are:
- assess the potential of RE investment opportunities and contribution to the ASEAN Power Grid, including the initiation of the RE Integration pilot projects;
 - analyze the expansion of APG considering other flexible resources and emerging technologies as well as demand side management; and
 - conduct at least one activity on smart grid and Cyber Security technologies and policies for power grids in ASEAN.
15. As per the endorsement of the ASEAN Ministers on Energy Meeting, HAPUA appointed ACE as the Implementing Agency to lead the work on AIMS III, and to support the implementation of APG under APAEC Outcome-Based Strategies and its annual priorities.

Figure 1. ACE in ASEAN Energy Sector



Source: ACE

16. **The ASEAN Energy Regulators Network (AERN)**, established in 2012, was formed to forge closer cooperation among ASEAN energy regulators in order to promote sustainability and economic development in the region. In particular, the AERN has been tasked to;

- a. collaborate on regulatory issues related to ASEAN flagship integrated energy projects such as the APG and the Trans ASEAN Gas Pipeline.
 - b. Promote consistency in energy regulation in the region through information exchange and dialogue.
 - c. Develop a channel for communications among ASEAN energy regulators to promote mutual understanding and mutual benefit to energy regulation and regional economic development.
 - d. Promote knowledge sharing and capacity building among ASEAN energy regulators on regulatory issues and best practices.
17. To support this work, the AERN has two working groups devoted to, respectively, technical and regulatory harmonization (AERN Technical Working Group 1) and another focused on establishing a database of legal and regulatory documents (AERN Technical Working Group 2).
18. The United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) is one of five UN regional commissions. It serves as the most inclusive intergovernmental platform in the Asia-Pacific region, promoting cooperation on a range of economic and social issues among its 53 member States (including all ten ASEAN member States) and 9 associate members. ESCAP supports inclusive, resilient, and sustainable development in the region through analytical work and knowledge development, technical assistance and capacity building, development of regional agreements, and implementation of the 2030 Agenda for Sustainable Development.
19. ESCAP's Energy Division works with member States on achieving Sustainable Development Goal 7 (SDG7), ensuring access to affordable, reliable, sustainable and modern energy for all, and on increasing power system connectivity in support of sustainable development. ESCAP's work on energy connectivity is guided by the "Regional road map on power system connectivity: promoting cross-border electricity connectivity for sustainable development",⁷ which was endorsed by ESCAP member States at the 77th Commission Session in 2021. The Road Map contains a vision, a set of principles, and nine strategies (with associated milestones) to enable increased cross-border power system connectivity in the region, linked to sustainable development.
20. In South East Asia, ESCAP work to support increased power system connectivity includes analytical work,⁸ capacity building, and stakeholder convening. ESCAP also organizes, as the secretariat, the Expert Working Group on Energy Connectivity (EWG-EC), and leads the Green Grids Initiative - One Sun, One World, One Grid (GGI-OSOWOG) Asia-Pacific Working Group.

⁷ https://www.unescap.org/sites/default/d8files/event-documents/CE_2021_4.pdf

⁸ <https://www.unescap.org/resources/energy-interconnection-asean-sustainable-and-resilient-societies-accelerating-energy>