ASIA CLEAN ENERGY FORUM 2025, MANILA

How AZEC Can Fuel ASEAN Power Grid Development?

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May 2025

Development Stages of APG, MPT and Related Markets

1

AMS Domestic Market

- Single buyer model
- Competitive wholesale market model

2

Bilateral Power Trade

Initial stage involving direct electricity trade between two countries.

3

Multilateral Power Trade

Expansion to trade within smaller regional groups of countries.

Basic Markets

4

Auxiliary Service Markets

Integration of ancillary services to enhance grid stability.

5

Fully Integrated Regional Grid

- Organized markets
- From seasonal to short-term energy markets (e.g. day-ahead and hourly trading)
- Seamless power flow across ASEAN.

Advanced Markets

6

Renewable Energy Certificate Market

Common standards and procedures for the issuance and cross-border transfers of RECs

7

Financial Derivative Markets

Establishment of markets for financial risk management tools.

8

Interconnected Carbon Markets

Carbon credits from the power sector of AMS become tradable

Derived Markets

Key Challenges in APG Development

Policy / Regulatory Fragmentation

Domestic priorities often overshadow regional cooperation efforts.

Divergent Political Will

Varied commitment levels hinder cohesive progress.

Market Structure Differences

Inconsistent pricing mechanisms and market structures complicate integration.

Technical / Economic Barriers

- TSO coordination required
- Information sharing and data communication to be streamlined
- Third party access (TPA)

Harmonization Needs

- Diverse technical standards, grid code and operation procedures require alignment
- Dispute settlement mechanisms

Transmission Capacity Calculation and Allocation

Consistent methodologies for determining transmission capacity availability to be developed

Wheeling Charges

Absence of common cross-border transmission capacity compensation mechanisms complicates trade.

Benefits of APG and Successful Cases in ASEAN

Enhanced Energy Security

Interconnections reduce reliance on single sources, ensuring stable supply.

Cost-Competitive Pathways

Enables access to cheaper electricity, lowering energy costs for consumers.

Renewable Energy Optimization

Utilizes regional resources efficiently, promoting sustainable energy practices.

Case: West Kalimantan–Sarawak Interconnection

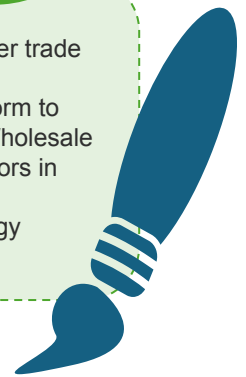
A successful bilateral model which showcases how effective cooperation and substantial economic benefits enabled multilateral financing.

Case*Laos-Thailand Interconnections

- Dedicated cross-border transmission for new power plant
- PPAs stipulated fixed tariffs and "take-or-pay" mechanisms
- PPP structure: Build-Own-Operate-transfer (BOOT)
- Multilateral consortium for both debt and equity financing

Case: The LTMS Multilateral Project

- Pathfinder project for feasible multilateral power trade model in ASAEAN
- Developed a web-based communication platform to coordinate market clearance in Singapore's Wholesale Electricity Market (SWEM) with system operators in Laos, Thailand, and Malaysia.
- Wheeling charge addressed through the Energy Purchase and Wheeling Agreement based on negotiation.



A Roadmap for APG and MPT

- This roadmap presents a general overview on what should be prioritised and finalised chronologically within the ATSO / AGTP development process and what can be left for future enhancement. Based on this, it could be expected that a functioning regional market should be established within 6 years. However, this is not definitive as the ASEAN's transition towards self-sustainability depends on the establishment and trading volumes in the market.

- The roadmap is built on four key high-level milestones:

1. Intergovernmental Agreement
To establish the ATSO and AGTP functions as regional functions, the APG MoU successor agreement and its protocols 8, 9 and 10 needs to be agreed and signed. This sets a clear regional ambition for the organisation. It is important that the protocols identify the correct reporting structure for the ATSO, AGTP and APGCC secretariat into the wider ASEAN context.

2. Organisational Establishment
This stage covers the setup of the organisation of the functions, including hiring of coordinators as well as establishing the various working groups under each function.

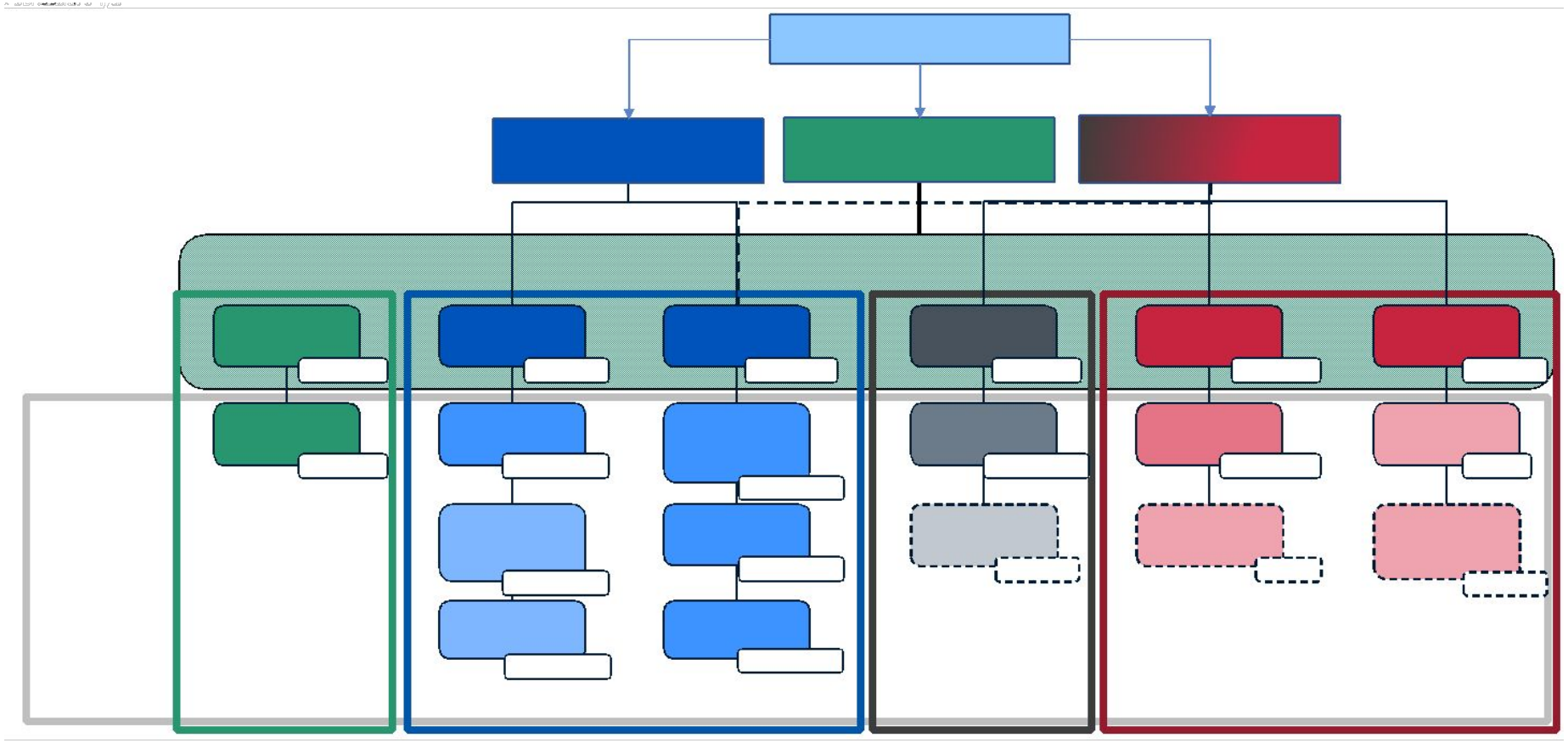
3. Initial Stage of ATSO/AGTP Operation
This section covers the implementation of the first stage of operations for the new APP organisation. As this study covers the AGTP and ATSO functions, the establishment of the market function is mentioned here, but marked as external. This stage is the enabling stage where all detailed functions and methodologies are developed.

4. Advanced Stage of ATSO/AGTP Operation
This stage is where the functions are put into operations and the full benefit will be achieved.

Required Institutional Arrangements

The recommended organisation of the ATSO, AGTP and Asean Market Operator (AMO) is presented in the figure below.

Key aspects: An APGCC organisied decentralised secretariat. APGCC coordinators coordinate the work of different functions and the working groups within these functions.



The Roles of ATSO and AGTP

The APG MoU successor agreement (more precisely its protocols 8, 9 and 10 and separate Terms of Reference (ToR)) need to specify the roles and responsibilities of the ATSO and AGTP functions.

This study provides detailed descriptions of the ATSO and AGTP roles, to be used as input to the process of defining the ToR for the APG bodies and the protocols.

Broad roles and responsibilities of AGTP

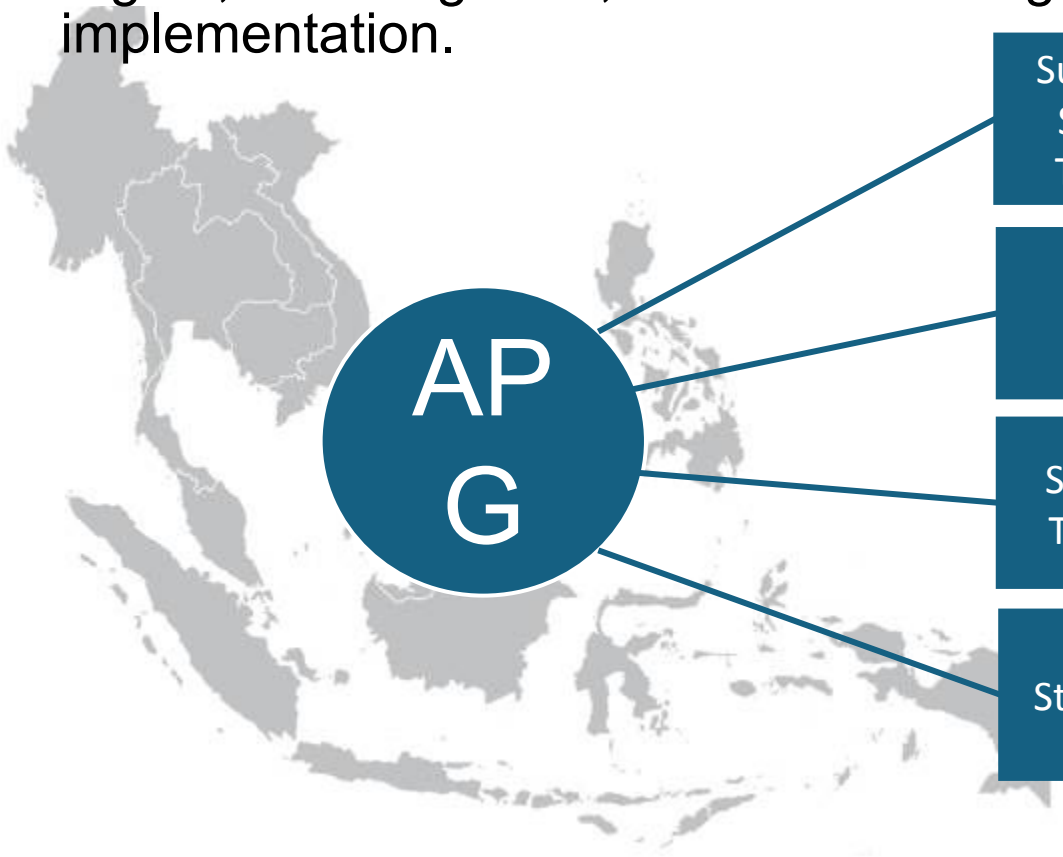
- Evaluation of supply reliability
- Developing proposals for the reinforcement of interconnections
- Acting in an advisory capacity to AMS
- Provide oversight and coordination of the planning processes implemented by the AMS
- Development of planning standards

Broad roles and responsibilities of ATSO

- Security of Supply
- Calculation of Available Transfer Capacities
- Transmission Wheeling Charges and Losses
- System Data Handling
- Coordination and monitoring operation of APG

Advanced Grid Management Technologies for APG (decentralized)

- The APG initiative requires the modernisation and integration of advanced grid management technologies.
- The purpose of this study is to contribute to the realisation of an advanced grid in the ASEAN region by identifying the new grid technologies that should be integrated into the grid in this region, including APG, and summarising the challenges and recommendations for their implementation.



Supply Side Tech	• Real-time monitoring, data analytics, advanced control system • Information sharing platforms and coordinated operation protocols
AI	• Demand forecasting and optimization • Predictive maintenance and grid resilience
Smart Trade	• Improve transparency, and facilitate decentralized energy trading • Streamlining energy transactions and settlements. • Reducing administrative costs and improving transaction speed.
Storage	• Batteries, pumped hydro, hydrogen, EV, Demand Response • Smoothing out the intermittency of RE.

AZEC and APG: Aligned Goals and Additional Synergy

- AZEC principles emphasize innovation, diverse energy pathways, and economic growth compatibility, which align with broader regional energy transition goals, including those potentially supported by interconnected grids like the APG.
  - AZEC Initiative to Promote **Zero Emission Power**: could benefit from cross-border grid interconnections (like the APG) to share **renewable energy** resources.
  - AZEC Initiative to Create **Sustainable Fuel Markets**: may complement efforts to expand and optimize the APG for renewable integration, e.g. **the coupling of power grid and hydrogen-based energy**.
  - AZEC Initiative to Establish **Next Generation Industry**: Targets industrial decarbonization, which may involve energy systems like the APG to enable **high-level of electrification**.
  - APG could be a key pillar to enhancing the **energy security** goal of AZEC while supporting **economic growth** by meeting the growing demand for electricity in industrialization.

How AZEC can Boost the Financing of APG

- An estimated $16 billion in capital investment is needed for the 18 cross-border grid interconnection projects in the ASEAN Power Grid (APG).
- Both **specialized** and **holistic** solutions are required:
  - AZEC to bring in more **sources** (e.g. ODA, green funds and international banks) and **mechanisms** (e.g. JCM and blended financing) of financing, especially for **transition finance**
  - Joining in synergy with other ongoing initiatives concerning APG in the ASEAN region, AZEC to provide additional support in **policy formation, project preparation and implementation**
    - At the same time, **accelerated adoption of renewables** in the power sector would **create additional demand** for APG interconnections as well as the cross-border markets built on the infrastructure
  - More **advanced regional power markets** increase the **commercial value** of cross-border transmission lines and enhance the **stability** of expected revenue streams from these assets
    - Upscaled, versatile and active cross-border trade also reduce the **perceived risks** (political, policy and market risks) and thus **mobilizes private capital** into investment in APG infrastructure

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