

Chapter 8

Summary of the ASEAN Power Pool Guideline Document

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As an integral part of this project, a guideline for the ASEAN Power Pool (APP) was created. It constitutes one of the main deliverables in the project 'Study on the Formation of the ASEAN Power Grid Transmission System Operator Institution (ATSO)' and it is aligned and coordinated with the deliverables from the 'Study on the Formation of the ASEAN Power Grid Generation and Transmission System Planning Institution' undertaken by the Tokyo Electric Power Company.

The guideline covers both the organizational and technical considerations for the establishment of the APP. The open access agreement is defined and discussed as part of the guideline. The objective is to use the guideline as a base point to define and start building the APP organizational and technical aspects and to identify the key functions and tasks that the APP should aim for after its establishment. The guideline proposes a set of APP working groups that will later define, review, and harmonize the needed regional regulation and agreements.

The guideline is split into six chapters to capture all relevant aspects. Chapter 2 discusses open access, Chapter 3 defines the roles and responsibilities in the APG, Chapter 4 lays out the APP's authority and governance, Chapter 5 considers the organizational aspects of the APP, and finally, Chapter 6 illustrates the technical aspects of the regional cooperation. Annex 1 of the guideline, which contains the ATSO Project Questionnaire, gives a short summary of the responses from a questionnaire, carried out as part of this project, with a high-level analysis of what is already sufficient in terms of harmonization and standardization, and what should be the focus areas for the APP going forward.

It should be noted that this summary does not go into details since these are comprehensively discussed in the guideline document. However, the technical aspects are intentionally and briefly summarized here. Hence, this chapter summarizes the key points laid out in the guideline, as follows:

- ▶ Summary of the open access and common transmission mechanism
- ▶ Summary of the APP authority and governance aspects
- ▶ Summary of the APP high-level organization aspects
- ▶ Summary of the main technical aspects

1. Summary of the Open Access and Common Transmission Mechanism

To establish the concept of a greater ASEAN connectivity and develop the ASEAN Power Grid (APG) further, the APP organization will need to develop and agree on an open and non-discriminatory access to transmission in the ASEAN region. The open access can in this circumstance be divided up into two parts. The first is the need to establish and define third-party access (TPA) to the transmission grid in the different ASEAN member states (AMS). The second is the ASEAN common transmission capacity mechanism methodology, which needs to be developed and agreed to enable region-wide trade. With a common transmission capacity agreement in place, member states could use each other's available (spare) transmission capacities to transfer power, not only to the countries in absolute proximity, but could reach further by using countries as transit grid providers. It will also be important to establish a clear view on how the future ASEAN international transmission infrastructure shall allocate its future available transmission capacity.

A potential ASEAN transmission capacity mechanism methodology or wheeling arrangement needs to be transparent and must support the effort of making the APG more efficient. The cost or wheeling charge of sending power throughout the ASEAN grid should be calculated based on an agreed published wheeling methodology. This methodology should be developed and defined at the ASEAN level to ensure transparency and provide common capacity-pricing methodology for the whole region.

A stepwise approach is proposed when implementing these changes to the ASEAN region. It should be clear that both regional agreements and changes to national legislations will be needed. As the TPA might involve fundamental changes to national legislation, enabling access to available regional transmission capacities should be a priority for the APP. This can be done by establishing regional transmission capacity and pricing arrangement, or as named in this document as a common transmission capacity mechanism.

Table 6. Key Points in the Third-Party Access

Key Points
<ul style="list-style-type: none"> • The signing of an agreement between the national TSOs in each country, in which they agree to offer TPA to any IPP that seeks to connect to the national networks for the purposes of trading electricity.
<ul style="list-style-type: none"> • Clear national licensing arrangements for the transmission owner and TSO in each country, either as independent organizations or as functions within a vertically integrated utility.
<ul style="list-style-type: none"> • A national licence obligation to offer terms to new potential generators seeking to generate electricity for domestic consumption, or to export electricity under wheeling arrangements.
<ul style="list-style-type: none"> • A national Transmission Connection Agreement that sets down clearly the rights and obligations of generators, the transmission owner, and the TSO when a new connection is sought.
<ul style="list-style-type: none"> • A national Transmission Use of System Agreement that supports the right of the generator to be and to remain connected to and energized by the national transmission network.
<p>IPPs = independent power producers, TPA = third party access.</p>

Source: Author.

2. Summary of the ASEAN Power Pool Authority and Governance

To establish this intergovernmental organization, high-level regional agreements and more needs to be in place to set a clear regional objective for the organization. The APP organization will also need more detailed agreements to give it the appropriate authority to function as a regional body. The APP will require mandate to facilitate and own certain processes and agreed principles within the APG. An intergovernmental agreement shall state the objectives of regional power trading and the need to collaborate and coordinate among the AMS, hence, the need for a coordinating institution. A second step would be to establish an ASEAN Cooperation Agreement for the establishment of the APP organization along with its different departments and working groups. In this cooperation agreement, the APP's proposed functions shall be stated and its role as a coordinating body in the ASEAN explained. In this agreement, the APP guidelines and codes shall also be acknowledged as official governing documents that the AMS shall adopt and follow.

As noted above, it will be very important for APP to have the correct reporting point in the ASEAN organization. This will ensure good alignment with other regional initiatives led by ASEAN and that power-related inquires will reach the right sector within the ASEAN. The recommended authority is the ASEAN Power Grid Consultative Committee (APGCC).

Table 7a. Key Points for ASEAN Power Pool Authority and Governance

A hierarchy list of governing documents includes the following:
1. ASEAN Intergovernmental Agreement on regional power trading
2. ASEAN Cooperation Agreement for the establishment of the APP organization (Parties: ASEAN TSOs) <ul style="list-style-type: none"> - (APP Articles of incorporation, business model, and a business plan structure that is dependent on the legal form of the vehicle – a company or another organizational type structure)
3. APP Operational Guidelines and network codes (a future work to be conducted by the APP) <ul style="list-style-type: none"> - APG agreed technical, performance, and operational standards - APG system planning, generation, and interconnection plan - APG wheeling methodology agreement - APG third-party access agreement - An ASEAN power market rule book (a future task for the relevant working group)

APG = ASEAN Power Grid, APP = ASEAN Power Pool, TSOs = transmission system operators.

Source: Author.

Table 7b. Key Points for ASEAN Power Pool Authority and Governance

The proposed governance structure comprises the following:
1. Executive committee
2. Chief executive officer
3. Department manager
4. Working group manager and a subunit manager

Source: Nord Pool Consulting

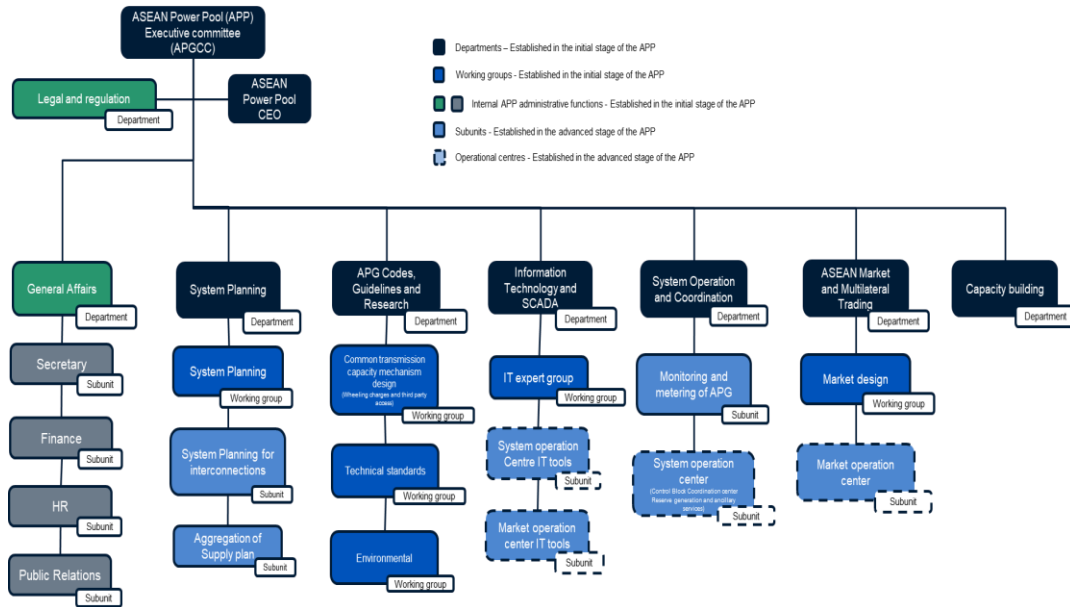
3. Summary of the ASEAN Power Pool High-Level Organization

The APP should act with full independence from buyers and sellers in the electricity market. The departments are responsible for carrying out the day-to-day work and are the main responsible units for APP operation. Each department may have one or several subunits with more focused and targeted tasks to carry out designated functions. Also, each department may have so-called working groups that are semi-internal units consisting of experts from relevant stakeholders. The working groups essentially feed in information to the departments on best practices in relevant topics, and have key role in defining, developing, and maintaining the framework of functions for each department. An overview of the proposed APP organization is presented in Figure 14.

The proposed APP organization is built upon main departments carrying out specific functions, which may have more focused working groups and subunits under them. Going forward, APP may choose to create more subunits with targeted specific tasks within the department. Organization-wise, these task force subunits will report to the department and the department leader. Resources for subunits will be allocated from the departmental resource pool. The subunits will utilize the departmental resource pool for people they will need to carry out certain development and operations within the APP functions.

In addition to the subunits, each department may have specific regional working groups under it. The reason for forming these groups is to gather specific field experts from each AMS to contribute and enrich the development process of APP tasks. Hence, these groups shall consist of part-time, consultancy-engaged experts from each AMS. These working groups have significant responsibility and opportunity to assist APP departments in creating, for example, the network codes or operation standards. Thus, these groups are important gateways for harmonizing the standards and procedures in the ASEAN region. It should be noted that some of the AMS have multiple TSOs, hence, establishing these working groups will need to take this into account to get them all represented. Working groups report directly to the respective departments and department heads. However, they should have formal decision-making power for their given tasks.

Figure 14. Proposed ASEAN Power Pool Organizational Chart



Source: Author.

4. Summary of Some Main Technical Aspects

The principle behind the need for harmonized technical standards is to ensure that all members of the ASEAN interconnected system maintain minimum technical, design, and operational criteria to ensure security and reliability of supply for the system. The technical standards apply to all systems that have an impact on security and reliability of supply. A full set of policies or grid codes will be required to be developed to define all the requirements for interconnected operations. This set includes but not limited to the following:

1. Preamble with definitions and glossary
2. Governance, which defining process to manage policies / codes
3. Connection Policies / Codes:
 - Demand Connection Code;
 - Synchronously Connected Generators Connection Requirements;
 - High Voltage Direct Current Connections; and
 - HVDC Connected Generators Connection Requirements
4. Operational Policies /Codes:
 - Operational Security
 - Operational Planning and Scheduling
 - Load Frequency Control and Reserves
 - Emergency & Restoration
5. Market Policies /Codes (Operational Aspects):
 - Capacity Allocation and Congestion Management
 - Electricity Balancing
 - Forward Capacity Allocation
6. Metering Policy /Code
7. Operator Training Policy /Code

The key technical aspects for regional cooperation, based from the guideline, are summarized in the following tables.

Table 8. Frequency Range for ASEAN Interconnections

Frequency Ranges for ASEAN interconnections	
Nominal Frequency:	50 Hz
In case of normal operation, the Frequency Deviation does not exceed:	±200 mHz for systems greater than 10,000 MW ±50 mHz for systems greater than 100,000 MW

Source: Nord Pool Consulting

Table 9. Voltage Control requirements for ASEAN interconnection/s

Voltage Control requirements	Value for ASEAN
Normal Condition	Nominal V ≤230kV +/-10% V>230kV +5%/-5%
Emergency Situation	Nominal+/-10%
The TSOs shall strive to maintain sufficient availability of dynamic and static reactive power capability in order to maintain transmission system voltages at connection points within the above specified levels at all times by means of one or more of the following measures: <ul style="list-style-type: none"> - the charging capacitance of the Transmission System; - user MVAR demand; - Transmission System MVAR losses; - generating unit MVAR production or absorption; - through on-load tap changing of generating unit step-up transformer; - voltage control facilities, such as capacitor banks and reactors; and - dynamic voltage support, such as SVC (Static VAR Compensator). 	Yes
Voltage Control is an Ancillary Service; all Participants are obliged to provide minimum requirements as established in the Grid Code.	Yes
The excitation system of each generating unit shall be operated under the control of a continuously acting Automatic Voltage Regulator (AVR), which shall be set so as to maintain a constant terminal voltage. The generator may not disable or restrict the operation of the AVR except for the safety of personnel and/or plant, in which event the generator shall notify the TSO immediately.	Yes
The TSO shall endeavour to maintain sufficient availability of dynamic and static Reactive Power in order to maintain the Transmission System voltages at connection points within the level specified at all times. Determination of Reactive Transfer Limit (MW flow limitation across an interface to protect the system from large voltage drops 5% caused by a contingency). Reactive Transfer Limits shall be calculated every 5 minutes on EMS (SCADA).	Yes

EMS = energy management system, MVAR = Mega Volt-ampere, SCADA = supervisory control and data acquisition, TSOs = transmission system operators.

Source: Nord Pool Consulting

Table 10. Required Power System Studies for the ASEAN Countries

Requirements Studies	ASEAN
- N-1 Criteria	Yes
- Load Flow	Yes
- Short Circuit	Yes
- Steady State Stability	Yes
- Transient Stability	Yes
- Voltage Stability	Yes

ASEAN = Association of Southeast Asian Nations.

Source: Nord Pool Consulting

Table 11. Operational studies status of ASEAN countries which are also GMS countries

Operational Studies	Cambodia	China	Lao PDR	Myanmar	Thailand	Viet Nam
Steady-state analysis (N, N-1)	Yes	Yes	Yes	Yes	Yes	Yes
Credible N-2 steady-state analysis	Not often	Yes	No	No	Yes	Yes
Multiple time-point studies	-	Yes	No	No	Yes	No
Voltage stability studies	Yes	Yes	Yes	Yes	Yes	Yes
Transient stability studies	-	Yes	Yes	No	Yes	Yes
Transfer analysis	Yes	Yes	No	No	Yes	Yes
Sensitivity analysis	-	Yes	No	No	Yes	No

ASEAN = Association of Southeast Asian Nations, GMS = Greater Mekong Subregion.

Source: Nord Pool Consulting

Table 12. Proposed Fault Clearance Times Requirements for ASEAN Countries

Requirements	ASEAN
Maximum Fault Clearance times: 500 kV	80 ms
220–230 kV	100 (1) – 120 ms (2)
115–132 kV	120 (1) – 150 ms (2)
	Note: (1) Targeted value (2) Admissible transitory value

ASEAN = Association of Southeast Asian Nations, kV = kilovolt, ms = Milliseconds

Source: Nord Pool Consulting

Table 13. Proposed Short-Circuit Current Level Requirements for ASEAN Countries

Requirements	ASEAN
Short-circuit current levels: 500 kV	50 kA
220–230 kV	40 kA
115–132 kV	31.5 kA

ASEAN = Association of Southeast Asian Nations, kA = kilo amps, kV = kilovolt.

Source: Nord Pool Consulting

Table 14. Data Exchange Standards

Data Exchange Standards
Real Time Data Exchange using Inter-Control Center Communications Protocol (ICCP) or International Electrotechnical Commission (IEC) 60870-6/TASE.2)
File Transfer Exchange using the FTP server
E-mails on electronic highways using TSO mail server (SMTP protocol) or a remote mail server (SMTP/POP3 protocols) at another TSO
Information Publication on EH using HTTP Server. <ul style="list-style-type: none">• Voice transmission standards. The voice quality should conform at least to the CCITT standards G729.• FAX transmission standard. For fax transmission, the standard usually adopted is the European Standard G3 (Group 3).• Video-conferencing transmission standard. For video conferencing, International Telecommunication Standardization Sector (ITU-T) standards H.320 and H.323 are applicable.

TSO = transmission system operator.

Source: 

Table 15. Connection Conditions

Connection Conditions for Generators	Connection Conditions for Consumers
<ul style="list-style-type: none"> • Frequency tolerance, active power, and frequency control requirements • Synthetic inertia for non-synchronously connected generators • Voltage tolerance, voltage control, and reactive power provision • Fault ride through capability • Power oscillation damping requirements • Sub-synchronous torsional interaction (SSTI) damping requirements • Short-circuit contribution during faults • Power quality • Protection requirements • System restoration, islanding, and black start capability • Information requirements • Connection, compliance, and testing requirements 	<ul style="list-style-type: none"> • Frequency tolerance, active power, and frequency control requirements • Voltage tolerance, voltage control, and reactive power provision • Short-circuit requirements • Reactive power requirements • Protection requirements • Control requirements • Information requirements • Demand disconnection or demand connection • Power quality • Connection, compliance, and testing requirements

Source: Nord Pool Consulting