



**The ASEAN Electricity Exchange (AEE):
An International Perspective**

HAPUA-UNESCAP Workshop, 17-19 April 2017, Jakarta
Hotel JS Luwansa, Jakarta

WORKSHOP STATEMENT

1. The ASEAN Power Grid (APG) was created in 1997 as an ASEAN flagship project to establish multilateral energy networks across ASEAN with the objectives:
 - (a) to achieve long-term security, availability and reliability of energy supply;
 - (b) to optimize the region's energy resources; and
 - (c) to allow access to affordable energy across ASEAN.

2. While much of the APG infrastructure has since been built, the grid does not yet function on a multilateral basis. For this purpose, ASEAN Energy Ministers have agreed to the *Laos, Thailand, Malaysia and Singapore Power Integration Project* (LTMS-PIP), as a pathfinder to complement existing efforts towards making the APG function on a multilateral basis. They have also considered the creation of an ASEAN Electricity Exchange (AEE), adapted from various models around the world. More recently (2016), ASEAN Energy Ministers approved the creation of an APG Special Task Force, within the Heads of ASEAN Power Utilities/Authorities (HAPUA) and chaired by the ASEAN Power Grid Consultative Committee (APGCC), with a mandate to:
 - (a) oversee a Feasibility Study for the APG to function on a multilateral basis;
 - (b) develop an Action Plan to facilitate APG multilateral power trading; and
 - (c) propose appropriate changes to the current APG Memorandum of Understanding (MOU), signed by Ministers a decade ago.

3. The HAPUA-UNESCAP Workshop was convened on 18-19 April 2017 in Jakarta, to provide an opportunity for the APG Special Task Force to engage in an interactive dialogue with experts, and find out more about regional power integration models around the world, so as to consider the most appropriate approach to developing the AEE model. The Workshop was also to agree an outline for the AEE Feasibility Study, for submission to the APG Special Task Force for its consideration.

4. Experts presented an overview of the benefits from regional power integration around the world, notably in the European Union (E.U.), Nordic countries (Nord Pool), the United States (U.S.), Central America (SEIPAC), Southern Africa (SAPP), and India. Experts also shared the ongoing experience in South Asia, where efforts are being deployed to establish regional power integration between the eight South Asia Countries (SACs) under similar conditions prevalent within ASEAN. Finally, experts reported the findings from an extensive World Bank study covering

twelve different regional power integration, with the explicit objective to search for the ideal model that could be adopted by regions across the world.

5. The Workshop was held under the Chatham House rule, whereby participants are free to use the information received, but neither the identity nor the affiliation of the speakers, may be revealed. It was attended by some 45 participants, including ASEAN officials, experts, practitioners, international organizations, and representative from the donor community. Experts' presentations are accessible through www.hapua.org (under Activities/Other Activities).
6. Experts reported that, based on international experience and analytical studies, regional power integration has the potential to deliver a number of benefits, including:
 - (a) *Achieve a more efficient use of energy resources while enhancing levels of energy security*, by connecting countries with surplus power generation capacity to countries facing a deficit;
 - (b) *Reduce operational costs*, by helping utilities balance their excess supply and demand, therefore reducing investments in power reserves to meet peak demand, which would lower operational costs and reduce system losses, while achieving a more reliable supply and reduce emissions of greenhouse gases and other pollutants;
 - (c) *Provide an enabling environment for sharing renewable energy sources of all forms*, by a more efficient use of renewable power generation capacity available within the region. In particular, ASEAN could enhance deployment of the abundant hydropower resources in Myanmar, Lao PDR, Viet Nam, and Cambodia and the vast geothermal power resource in Indonesia and the Philippines;
 - (d) *Enhance access to electricity*, by allowing cross border interconnections to service deficit areas through cross border power imports when this is more economically viable than through extensions of the national grid.
7. Nevertheless, experts also pointed out that, regardless of the model at work, some of the expected benefits from regional power integration are not realized unless they are specifically targeted within the design of the model. The challenge is to incorporate the proper mechanisms and incentives needed to support the targeted benefits, notably in the case of deployment of renewable energy, expansion of access to electricity, and optimization of regional investment in interconnections.
8. Experts also pointed out that the obstacles in developing a regional power market are similar around the world. The E.U. and the U. S. illustrate the scale of these challenges, and the time and political will needed to overcome them. Nevertheless, some sub-regions of the E.U. and a few states in the U.S. have provided examples of how these challenges could be addressed. Further, India's Power Sector Experience and integration of regional grid to a national grid is also very relevant as the process of Integration played the crucial role in development of competitive power market and Energy exchanges in India. Regions have also illustrated how they have adapted the Nord Pool model to their specific needs and applied it to build their own regional power system, as was the case in southern Africa (SAPP) and India. Participants agreed that these experiences provide valuable lessons for ASEAN in the development of the AEE.

9. Experts described SAPP operational and organizational structures, serving 16 member countries, 280 million people, with installed generation capacity of 62 GW and available capacity of 47 GW. The aim pursued by the creation of SAPP was comparable to the one pursued by ASEAN through the APG, namely to enable national power capacity to optimize social welfare and to increase security of supply. Experts pointed out that SAPP has evolved through time, and is expected to continue evolving at its own pace until it reaches its full potential.
10. Experts also emphasized that bilateral and multilateral contracts could co-exist along with the instruments provided at the regional level through the regional electricity exchange, as is the case in the Nord Pool and SAPP models. Furthermore, independent power producers and independent transmission companies may both participate in the regional market, alongside traditionally vertically integrated companies. Experts also pointed out that subsidies are still prevalent in several countries participating in similar such exchanges, utilities have not all been unbundled and privatized, and each participant country has maintained its own regulatory agency. Likewise, although there is a regional market operator, each country has its own market transmission system operator, working closely with the regional operator.
11. Experts shared the experience of the *South Asia Regional Initiative for Energy Integration* (SARI/EI) in efforts to establish regional power integration among the eight South Asian Countries (Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, and Sri Lanka), including the creation of a regional power exchange, which is also based on the Nord Pool model. The challenges facing SARI/EI include the diverse national regulatory, policy, and legal frameworks across the region; and the prevalence of power sectors at different stages of evolution in terms of market design and operation. The approach adopted by SARI as an immediate step is to expand the existing Indian power exchanges into cooperation for cross border electricity trade transactions and to explore the option in the future to set-up South Asia Regional Power Exchange (SARPEX), able to perform cross border power operations with other countries within the region when these are ready to join.
12. Experts provided an overview of plans developed in the Greater Mekong Sub-region (GMS) for the creation of a multilateral electricity market. However, cross border electricity trading still remains on a bilateral basis. The constraints to progress include technical problems relating to differing grid standards and difficulties of synchronization, as well as the weak commercial viability of some of the planned interconnections. These challenges are complicated by a range of environmental challenges, a low level of trust between parties, and the role of external actors.
13. In describing various regional power integration models, experts reported that the challenges facing policy makers are broadly similar across regions. In the search for best practices in addressing these challenges, the Energy Sector Management Assistance Program (ESMAP, 2010) of the World Bank conducted an extensive study of twelve regional power sector models, with a view to identify salient drivers for their strength, and to highlight recurrent obstacles to their operation. A similar study of various regional power integration models around the world was also conducted (2015) in the framework of the SARI/EI. The objective was to identify a model to adopt, learn lessons from international experience, and formulate recommendations for the creation of the power exchange.
14. Experts presented the results from these two extensive studies, both highlighting similar findings:
 - (a) Power integration models vary in terms of size, resource availability and diversity, ownership, market conditions, and environmental impact. This is because each model has been adapted to the specific characteristics of the region, and tailored to its distinctive requirements, including

the type of established regional institutions, views on the creation of new regional bodies, and objectives of political leaders and their degree of commitment to regional power integration.

- (b) There is no standard model applicable to all, and there is no unique set of rules that would ensure the effectiveness of regional power integration. Although challenges are similar, guidelines for addressing them do not follow a common pattern. Regardless of the model adopted at the outset, it must be adapted to regional circumstances, while leaving considerable room for flexibility, to allow the model to evolve as they mature and conditions change.
 - (c) In all cases studied, some beneficial components co-exist along with persistent problems, even in the most sophisticated models and mature markets. Such mixed results were also present when the performance of various models was tracked over time, as they evolved in reaction to changing social and economic conditions at national and regional levels.
 - (d) Notwithstanding the diversity of models and the mixed results, the ESMAP study identified some common characteristics, or recurrent features, prevalent in all effective regional integration models. However, even such critical drivers across models proved to be necessary, but not sufficient conditions to the success of regional power integration.
15. In discussing some of the key drivers of success, experts identified the following:
- (a) the stepwise approach, both in terms of geographic coverage and product offerings, which would evolve over time, and adjust from simple to more comprehensive models;
 - (b) the transparency in the price formation algorithm and for wheeling fees setting, based on prevalent power surplus and deficit conditions traded on the market at a given time; and the allocation of transmission capacity in a transparent manner;
 - (c) the ability to leverage complementarity and to exploit cost synergies across participating countries, so as to deliver a secure power supply to all involved at a more competitive price.
16. Given such findings, participants agreed that the AEE would be based on a combination of what works best in different exchange models around the world, and adapted to ASEAN specific needs and aspirations. An “ASEAN model” would then emerge, based on some core principles, agreed upon at the outset by ASEAN member states. These core principles include the following:
- (a) *Adopt a stepwise and voluntary approach* whereby a coalition of the willing will join in the AEE initial operation, while making room for other ASEAN member states to join on a voluntary basis, at a later stage, when they are ready. Likewise, consistent with this stepwise approach, the AEE would start with a minimum product offering, which could evolve over time from simple to more comprehensive products and operations.
 - (b) *Trade gaps and excesses only* with sellers voluntarily trading excess supply in national generation capacity, and buyers covering demand gaps. The regional exchange would therefore not interfere with national markets or security of supply considerations, and as such, its creation would not require to modify national pricing systems (including subsidies), or to change the ownership structure of utilities (privatization), or to create regional bodies to supersede national regulatory authorities.
 - (c) *Establish incentives for expanding regional power infrastructure* through mechanisms for shared costs-benefits, supported by participating member states. This would enhance the investment climate, and help members align national plans for infrastructure expansion.

- (d) *Develop a regional pricing model for cross border trade* including a wheeling pricing model, to be agreed by participating member states. This would increase price transparency, and allow cross border power trading on a more efficient and predictable basis.
 - (e) *Incorporate sustainability for power trading* through specific mechanisms and incentives to secure a greater deployment of renewable energy and their optimization across the region. This would enhance deployment of hydropower resources in Myanmar, Lao PDR, Viet Nam, and Cambodia, as well as the vast geothermal power resources in Indonesia and the Philippines, so as to contribute in attaining the ASEAN renewable energy target. Specific mechanisms (e.g. renewable energy certificate) can also be devised to support delivery of affordable power to ASEAN citizens with no access to electricity or clean energy sources.
17. Participants agreed that delivering economic benefits for AMS is the overriding objective pursued through the creation of the AEE. Other benefits are achieving greater system stability, and enhancing its sustainability through more efficient use of renewable energy across the region.
 18. Participants also recognized that the successful creation of the AEE will require as pre-condition strong political support and commitment at the highest level, accompanied by dedication of resources to relevant ASEAN bodies involved in its design and delivery.
 19. Regarding AEE governance structure, participants largely assumed that the exchange will be owned and operated by participating utilities, under corresponding government oversight, as is the case in a number of the models around the world, notably SAPP, the U.S. and SEIPAC.
 20. Participants agreed that the AEE Feasibility Study is to inform ASEAN policy-makers decisions:
 - (a) to determine whether the creation of an AEE would enable the APG to operate on a multilateral basis for trading electricity;
 - (b) to agree the AEE core principles and the approach to building it on the basis of what works best in multilateral power trading models around the world;
 - (c) to agree the high-level plan for the two subsequent phases, each requiring a decision point, namely: the *Design Phase*, to develop its components and deliver the preparatory tasks needed to create it; and the *Implementation Phase*, to deliver an AEE fully ready to operate.
 21. Participants approved the following AEE Feasibility Study Outline, for consideration by the APG Special Task Force during their inaugural meeting on 20 April 2017.

0. Executive Summary

I. Context

- (a) Global context
- (b) ASEAN energy situation and development plans over the next 20 years
- (c) Prospective electricity flows among ASEAN Member States and regions
- (d) Challenges to ASEAN connectivity
- (e) Goals of the *Laos, Thailand, Malaysia, Singapore Power Integration Project*
- (f) Counter factual analysis in moving from bilateral to multilateral ASEAN electricity trade

II. Objectives of the ASEAN Electricity Exchange

- (a) ASEAN needs and AEE goals
- (b) The AEE is an enabling environment for meeting AEC targets (e.g. RE) and Blue Print
- (c) Phased approach and anticipated end outcome

III. National Perspectives

- (a) Analysis of strengths and opportunities from participation in the multilateral market, looking at the potential for future exports and imports over the next decade or so on a country-by-country basis
- (b) Identification of weaknesses and threats from participation in the multilateral market, as well as potential bottlenecks and develop requirements for market mechanisms whereby these can be managed efficiently
- (c) Conduct a dynamic national SWOT analysis (Strength, Weakness, Opportunity, and Threat) to gauge national preparedness to participate in a multilateral market, taking into account the potential growth of electricity requirements over time, and the degree of readiness of private sector to participate. Results would help shape the AEE in a recursive process aimed at minimizing threats and maximizing opportunities.
- (d) Identify energy security requirements of ASEAN member countries and their corresponding willingness to trade; evaluate how security could be enhanced by participation to the AEE.
- (e) Develop mechanisms to secure AEE long-term physical and technical reliability in order to gain trust for expansion from its initial role.

IV. Regional perspective

- (a) National capital expenditures and savings accrued from the multilateral perspective
- (b) Macro-economic impact at national and regional levels
- (c) Emerging extra-regional power trade opportunities

V. International perspectives

- (a) Experiences from electricity exchanges of interconnected grids around the world, as they relate to the agreed core principles underlying the AEE
- (b) Learning lessons from regions with conditions similar to ASEAN, notably from the SARI/EI approach, as well as from other relevant sectors
- (c) Expected benefits, based on international experience

VI. Core Features

- (a) Key principles
 - (i) Voluntary and Stepwise as more ASEAN member states are ready to join
 - (ii) Trading gaps and excesses with co-existence of bilateral trade in energy markets
 - (iii) Regional regulatory functions and national regulatory authorities
 - (iv) Planning expansion of regional power infrastructure
 - (v) Transparent transmission pricing models
 - (vi) Sustainable regional power trading: access to electricity and renewable energy
- (b) Key operational roles
 - (i) Transmission System Operators (TSO) or independent Regional Exchange (market) operator, as well as relevant national ministries and regulators
 - (ii) Utilities and stakeholders in the national electricity market
 - (iii) Agreements and Licenses

VII. High-level Operational Structures

- (a) Business model for the AEE
 - (i) Revenue model
 - (ii) Operational costs
 - (iii) Investment model
- (b) Products and Draft Market rules
 - (i) Market structure and trading instruments
 - (ii) Day-Ahead Market as a tool for connecting ASEAN
 - (iii) Monitoring and settlement functions
 - (iv) Clearing services
 - (v) Congestion management of regional transmission capacity
 - (vi) Connection standards
 - (vii) Registration of market participants
 - (viii) Fiduciary constraints
- (c) Legal setup
 - (i) Governance
 - (ii) Ownership structure
 - (iii) Dispute settlement mechanisms

- (d) IT infrastructure and tools

VIII. Organizational Structures

- (a) Ownership model
- (b) Legal framework
- (c) Governance structure
- (d) Financial models and instruments

IX. Implications for Utilities and other eligible participants

Analyse implications on utilities and governments at the national and ASEAN levels, including on existing liberalized electricity markets, and on current investment and business planning.

X. Phased Approach

- (a) Initial implementation
- (b) Process for continued development (products/features, operational, organizational)
- (c) Timeline and milestones for phased development and implementation

XI. Pre-conditions for the creation of the AEE

- (a) Establishing the legal and regional regulatory frameworks
- (b) Capacity building and IT requirements
- (c) Cost estimates for AEE design and implementation phases
- (d) Identification of decisions for ministerial consideration

*Adopted unanimously
HAPUA-UNESCAP Workshop, Jakarta, 19 April 2017*