



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

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

### **A. Context**

1. The ASEAN Vision 2020 placed emphasis on the need to construct multilateral energy networks across ASEAN, and this priority was embodied in all subsequent ASEAN decisions and plans. The ASEAN Power Grid (APG) was created as the flagship of such a vision with the purpose of delivering three main objectives:
  - (a) achieve long-term security, availability and reliability of energy supply;
  - (b) optimize the region's energy resources; and
  - (c) allow access to affordable energy to populations across the region.
2. Since its inception in 1997, the APG has accomplished gradual progress, particularly through the deployment of several inter-connections, many of which are fully operating on a bilateral basis. However, the APG is yet to operate on a multinational basis, so as to deliver its intended benefits throughout ASEAN. This is the challenge being currently addressed. The ASEAN Economic Community (AEC) Blueprint 2025 includes, as a strategic measure, the development of multilateral electricity trade within at least one ASEAN sub-region by 2018. This would enhance energy security, expand access to electricity, improve deployment of renewable energy, and optimize the use of clean energy sources throughout the AEC.
3. Stepping up their efforts towards energy connectivity and sustainability, ASEAN Energy Ministers adopted connectivity and energy market integration as the principal focus of their latest ASEAN Plan of Action for Energy Cooperation APAEC (2016-2025). The adoption of such a vision represents a significant paradigm shift, elevating efforts into realizing a single regional energy market within the framework of AEC. It creates a framework for ASEAN to achieve its overall regional power integration goals and to align it with the objectives of the 2030 Agenda for Sustainable Development and the Sustainable Development Goals. In particular, electrical power integration offers a mechanism to further support ASEAN's renewable energy target and to enable universal access to energy services for all its citizens.
4. As part of the efforts to establish regional power connectivity through the APG, ASEAN Energy Ministers have recently envisaged the creation of an ASEAN Electricity Exchange (AEE), adapted from various models around the world, notably the Nord Pool and the Southern Africa Power Pool (SAPP). More recently, during their 34<sup>th</sup> meeting (September 2016), ASEAN Energy Ministers approved the creation of an APG Special Task Force to advise ministers on a framework for the APG to operate on a multilateral basis.

5. The APG Special Task Force includes representatives from key ASEAN energy bodies including the Secretary in Charge of the Heads of ASEAN Power Utilities/Authorities (HAPUA); the Chairman of the ASEAN Power Grid Consultative Committee (APGCC); ASEAN Secretariat (ASEC); ASEAN Centre for Energy (ACE); ASEAN Energy Regulatory Network (AERN); AERN Working Group 1 on Technical and Regulatory Harmonization; AERN Working Group 2 on the Database of Legal and Regulatory Document; Laos-Thailand-Malaysia-Singapore Power Integration Project (LTMS-PIP); Regional Energy Planning & Policy Sub-Sector Network (REPP-SSN); HAPUA Working Group Working Group 2 on APG Transmission and HAPUA Working Group 4 on Policy and Commercial Development.
6. The APG Special Task Force reports to the Heads of ASEAN Power Utilities/Authorities (HAPUA) and is chaired by the ASEAN Power Grid Consultative Committee (APGCC). Its mandate is:
  - (a) to oversee a Feasibility Study for the APG to function on a multilateral basis;
  - (b) to develop an Action Plan to facilitate APG multilateral power trading; and
  - (c) to propose appropriate changes to the current APG Memorandum of Understanding (MOU), signed by Ministers a decade ago.
7. The HAPUA-UNESCAP Workshop is convened to provide an opportunity for members of the APG Special Task Force to engage in an interactive dialogue with experts from around the world, to find out more about regional power integration models, their strengths and weaknesses, and assess their suitability to ASEAN. The key models will include those operating around the world, notably in the European Union (EU), Nordic countries (Nord Pool), the United States (US), the Southern African countries (SAPP), and the Central America (SEIPAC). Furthermore, the Workshop will examine findings from sweeping studies that assessed more than a dozen different regional power integration models around the world, and consider their conclusions and recommendations. Finally, the Workshop will also contemplate 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.
8. The expectation is for the Workshop to result in a better understanding of the strengths and weaknesses of various models operating around the world, with a view to making recommendations for the design of a model adapted to ASEAN. At its conclusion, the Workshop will strive to adopt an agreed statement summarizing its conclusions, particularly as it relates to the Feasibility Study, and formulating recommendations in moving forward. The Workshop will be 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, nor that of any other participant, may be revealed. It will be attended by some 35 participants, including ASEAN officials, academics, practitioners, the civil society, international organizations, and the donor community.

## B. ASEAN Connectivity: Potential Benefits

9. Based on international experience and analytical studies, the AEE could provide the framework for the APG to operate on a multinational basis and realize the intended benefits that have motivated its creation in 1997. These benefits, widely documented in various studies, would contribute to realizing significant gains across the AEC, notably:
  - (a) **Realization of a more efficient use of energy resources.** Achieve a more efficient utilization of energy sources across the region, connecting countries with surplus power generation capacity to countries facing a deficit;
  - (b) **Delivery of economic benefits.** Realize financial benefits across the region, from potential infrastructure savings as well as lower energy costs. It would also help utilities balance their excess supply and demand, improve access to energy services, and reduce costs of developing energy infrastructure;
  - (c) **Optimization of regional investment.** Reduce the costs of developing national energy infrastructure, notably by reducing investments in power reserves to meet peak demand, therefore lowering operational costs while achieving a more reliable supply and reducing system losses. Moreover, a properly tailored AEE would attract additional investment in APG interconnection, by providing a price signal as a catalyst for their financial returns;
  - (d) **Expansion of renewable energy.** Accelerate the development and integration of renewable power generation capacity into the APG, notably the abundant hydropower resources in Myanmar, Lao PDR and Viet Nam, as well as Cambodia (with hydropower yet to be fully developed). Such efficient sharing of renewable energy sources would also help substitute hydropower to present coal and other fossil fuels, thereby helping to curb emissions;
  - (e) **Improvement in the access to electricity.** Help expand power networks and client base, in a region where millions of people still lack access to electricity and clean cooking energy sources. In several cases, access to electricity will prove more economically viable through connections to the APG rather than extensions of the national grid, when additional investments are required. Moreover, even countries with an energy surplus can benefit from regional interconnections by servicing their deficit areas more efficiently with power imports from the APG.
10. Nevertheless, the studies of regional power integration around the world have concluded 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 implication is that in designing the regional power exchange, the challenge is to incorporate the proper mechanisms and incentives that would allow it to deliver its full benefits, notably for the deployment of renewable energy; expansion of access to electricity, and optimization of regional resources. [Table 1](#) summarizes the key findings from the studies, along with their recommendations.

Table 1

Targeting Key Potential Benefits <sup>1</sup>

Potential Benefits	Relevance to ASEAN	Findings	Recommendations
<i>Optimization of regional investment</i>	As documented by the AIMS II report (2010), the financial benefits from regional power interconnections within ASEAN could be substantial, when taking into account both infrastructure savings and lower energy costs. The study concluded that even the potential for infrastructure savings alone could be significant.	In several of the cases studied, evidence was given that optimization of generation and transmission investment on a regional basis offers substantial cost reductions over investments on a national basis to achieve the same results. These cost reductions went often unrealized, as countries preferred to follow national priorities, driven by domestic energy supply security consideration, economic nationalism, or sovereignty sensitivities.	Establishing explicit mechanisms to share benefits from cross regional projects may help overcome reluctance to implement regional plans.  None of the cases studied implemented regional planning, with the exception of the PJM case in the US, where this function is mandatory.
<i>Expansion of renewable energy</i>  A regional power market could enhance the integration of variable renewable power generation capacity, and accelerate the development and incorporation of renewable power generation capacity into the regional power supply.	In ASEAN, the diversity of renewable energy sources, coupled with differing energy needs, present the proper conditions for a more efficient deployment of renewable resources for electricity generation.  Sharing hydropower resources potentially exploitable in Myanmar, Lao PDR and Viet Nam (and to some extent Cambodia) would help	None of the cases studied demonstrated an expansion of renewable power sources following integration.  The exception was the Nordic Countries, where Nord Pool has resulted in a more efficient use of renewable resources (hydropower in Norway, wind power in Denmark, thermal resources in Finland, and	Many forms of renewable power (e.g., solar, wind) offer variable electricity generation following natural cycles. This creates challenges for system reliability, and require back-up capacity that adds to total system cost.  Regional integration alone is unlikely to deliver such an objective, or produce a large reduction in

<sup>1</sup> Based on findings in *Regional Power Sector integration: Lessons from Global Case Studies and Literature Review*, ESMAP World Bank (2010) and *Cross-Border Electricity Trade in South Asia: Key Policy, Regulatory Issues, Challenges and the Way forward*, SARI/EI-IRADe (2015).

	<p>substitute hydropower for the present use of coal and other fossil fuels in power generation, thereby curbing emissions and reducing electricity prices.</p> <p>Multilateral interconnections through the APG is likely to render renewable power generation projects more economically viable.</p> <p>The Sarawak (Malaysia) could be included as hydro power source for the Easter APG Sub-Region.</p>	<p>hydro and thermal in Sweden). This has had two demonstrable benefits:</p> <p>(a) while demand for power has steadily increased in the region, investments in new power generation has not had the same growth rate. This is due to the more efficient exploitation of the diversified sources of renewable power generation in the region;</p> <p>(b) the more efficient use of renewable resources on a regional basis has helped expand the use of renewable resources in power generation across the region, and kept downward pressures on energy prices.</p>	<p>emissions, unless it is properly addressed at the design phase, and action considered, for example, to:</p> <p>(a) introduce appropriate mechanisms for shared reserves and access to a larger, more diversified, generating portfolio</p> <p>(b) encourage access to markets willing to pay premium prices for “green power” exported across border.</p> <p>(c) secure expansion and use of renewable energy technologies, and make them more affordable.</p>
<p><i>Extension of access to electricity</i></p>	<p>Expand power connections to some of the people in ASEAN who still lack access to electricity or clean energy sources. This would be particularly viable in cases where access to electricity proves more economically and geographically viable through the regional interconnections rather than through expansion of the national grid.</p>	<p>None of the cases studied exhibited an increase in access to electricity as a result of the introduction of regional power integration.</p> <p>Even countries with energy surplus could benefit from such regional interconnections, when it proves more beneficial to service their deficit areas more efficiently with power imports from the regional market rather than through national power generation.</p>	<p>The objective of broadening access to electricity needs to be addressed explicitly during the design phase of regional power integration, and supported by appropriate measures imbedded into the power exchange and its operation.</p>

### **C. Regional Electricity Exchanges: An overview**

11. The obstacles faced by ASEAN in developing a regional power market are similar to those faced in other parts of the world. The European Union, with its 28 member states, illustrates the scale of these challenges, and the time and political will needed to overcome them. The Nordic states and sub-regions of the European Union, as well as the Southern African Power Pool, have provided examples of how small groups of nations can make substantial progress in building regional electricity markets. This is well illustrated by the Nordic power pool (Nord Pool), one of the most developed power markets in the world that has been adapted and applied to build regional markets in southern Africa and India. These experiences provide useful lessons for ASEAN to address the challenges facing the APG.
12. The overview also includes the current regional power integration efforts conducted in the framework of the South Asia Regional Initiative for Energy Integration (SARI/EI). This initiative started in 2000, and is dedicated to supporting energy market integration among the eight South Asian Countries (Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, and Sri Lanka), collectively accounting for over one-fifth of the world's population. It is currently in its final phase (2012-2017) and is focusing on enhancing multilateral cross-border power trade, including the development of a regional platform for electricity trade. It is therefore most relevant to learn from this ongoing process, which carries many similarities with the one currently proceeding in ASEAN. Indeed, the challenges facing the South Asian Countries in delivering multilateral electricity trade are similar to those prevalent in ASEAN. These include the presence of different sets of national electricity regulation, policy, and legal frameworks; as well as the prevalence of diverse power sectors across the region, each at different stages of evolution in terms of market design and operation.
13. In describing various regional power integration models around the world, experts will be encouraged to focus on some of the key components most relevant to the design of the AEE. This would enhance consistency of the analysis across the models, while providing answers to the most pressing questions about the building blocks in setting up the AEE, and in delivering its Feasibility Study. In particular, these key components include the following:
  - (a) Degree of market integration and regional power trading
  - (b) Regional institutions and governance structure
  - (c) Technical, economic, regulatory, and legal harmonization
  - (d) Roles of regulators and Transmission System Operators (TSOs)
  - (e) Degree of market liberalization and restructuring across region
  - (f) Measures to ensure sustainability, including to increase the share of renewable energy
  - (g) Mechanisms for infrastructure development and financing

### **D. Regional Power Integration Models: Which Model?**

14. Countries around the world are increasingly pursuing regional power integration as an important strategy to help provide reliable, affordable electricity to their citizens, and to reap benefits from such an approach. The challenges faced by policymakers in designing such models 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 regional power sector models around the world, with a view to identify salient drivers for their strength, and to highlight recurrent obstacles to their operation. The cases covered seven regional power markets from around the world, namely:

- (a) Central American Electrical Interconnection System (SIEPAC)
- (b) Greater Mekong Sub-Region (GMS)
- (c) Gulf Coast Countries (GCC)
- (d) Nile Basin Initiative (NBI)
- (e) South East Europe (SEE)
- (f) Southern Africa Power Pool (SAPP)
- (g) Pennsylvania-New Jersey and Maryland Interconnection (PJM)

15. The study finds that the challenges of regional power integration are similar across regions, but that the approaches to addressing them differ widely across the world. The implication is that the resulting 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. Moreover, in all the cases examined, the study found some beneficial components co-existing with some 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.
16. The overall conclusion of the ESMAP study is that there is no standard model applicable to all, and that there is no unique set of rules that would ensure the effectiveness of regional power integration. It further asserts that, although the challenges are similar, the guidelines for addressing them do not follow a common pattern. Regardless of the model adopted as a starting point, it must be adapted to specific regional circumstances, while leaving considerable room for flexibility and adjustment over time, to allow the model to evolve as the markets mature and conditions change.
17. 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. Such critical drivers across models proved necessary, but not sufficient, to the success of regional power integration. Their compilation offers a useful tool, and a worthy source of insights, to policymakers as they strive to adapt a model to their specific regional conditions and aspirations. These main critical drivers are summarized in [Table 2](#).
18. A similar study of various regional power integration models around the world was conducted in 2015, in the framework of the South Asia Regional Initiative for Energy Integration (SARI/EI). The objective was to learn lessons from international experience, and formulate recommendations to the team working on creating the power exchange. The South Asian study covered the same set of regional power networks which was previously included in the ESMAP study, but replaced the US model (PJM) by two additional exchanges: Nord Pool and the European Network of Transmission System Operators for Electricity (ENTSO-E).
19. The findings of the SARI/EI study point to similar conclusions regarding diversity of models and approaches, without a standard approach applicable to all. It reaffirmed that any initial market design needs to be adapted to the region, drawing from experience around the world. To this effect, the study also examined the common critical drivers across different approaches, and formulated some recommendations on that basis, as an input to the working groups tasked with designing the prospective South Asian regional electricity exchange. The results are included in [Table 2](#).

Table 2<sup>2</sup>

## Addressing Common Challenges: Key Lessons Learned

Challenges	ASEAN	ESMAP Findings	SARI Findings
<b><i>Regulatory and Legal frameworks</i></b>	Diverse frameworks relating to power interconnection and trade, including technical standards, codes for planning, design, system operation and maintenance	<p>Harmonization of technical rules and procedures for access to interconnected transmission systems and for securing their stable operation is needed to avoid endangering or loading excessive costs onto neighboring systems.</p> <p>Gradual move towards a uniform approach by national regulators will evolve as market integration develops, ultimately creating a common regional regulatory framework, or a function for a “regional regulator” with discretionary power in the regional market.</p> <p>Harmonization is key to attracting private sector investment. Legal rules are needed on agreed common procedures and mechanisms for dispute resolution.</p>	<p>Proceed with gradual harmonization of regulatory practices across the region, focusing on regulations related to the seamless and stable operation of the transmission systems.</p> <p>The priority areas for gradual harmonization include all technical aspects, rules and procedures concerning transmission access and its pricing, congestion management, operational codes and protocols for system operation, energy accounting and payments, as well as data transfer protocols.</p>
<b><i>Regional institutions</i></b>	In addition to the ASEAN Secretariat, ASEAN has established the Heads of the ASEAN Power Utilities and Authorities (HAPUA) and the ASEAN Energy Regulators Network (AERN). While limited in authority, these do offer forums for collaboration.	<p>Regional institutions are vital for power market integration. However, there is no single institutional approach that would be appropriate to all regions.</p> <p>The most performing institutional arrangements are those which have emerged from building on existing ones,</p>	

<sup>2</sup> Based on findings in *Regional Power Sector integration: Lessons from Global Case Studies and Literature Review*, ESMAP World Bank (2010) and *Cross-Border Electricity Trade in South Asia: Key Policy, Regulatory Issues, Challenges and the Way forward*, SARI/EI-IRADe (2015).



Challenges	ASEAN	ESMAP Findings	SARI Findings
		rather than creating totally new institutions.	
<i>Competitive markets</i>	Contrasting ways in which member states manage their energy sectors, including policy, subsidies, and structures	<p>National competitive power markets are not a prerequisite for initiating regional power integration. Different levels of market liberalization amongst participating countries can be accommodated by a careful design of the regional integration scheme.</p> <p>Linking regional power integration to power sector liberalization may even run the risk of endangering the integration progress, subjecting it to delays in developing and implementing the required market reforms, both from political and economic perspectives.</p> <p>However, rules are needed for the operation of the multilateral market, or for the adjustment of tariffs where prices are regulated. Although this is not a prerequisite for initiating regional power integration, it will be increasingly necessary as cross-border competitive power trade progresses.</p>	<p>Member countries exhibiting different degrees of electricity market reform does not impede the development of regional trade.</p> <p>Independent power producers and independent transmission companies can start to participate in the regional market, alongside traditionally vertically integrated utilities.</p>
<i>Systems planning and operation</i>	No existing institutions, and limited shared planning exercises (generally only the sharing of high-level details on transmission and generation investment plans).		Set up a regional institutional structure to leverage the individual and collective capabilities of Transmission System Operators (TSOs)/Transmission utilities.

Challenges	ASEAN	ESMAP Findings	SARI Findings
			<p>The basic mission of such TSO-led regional institutional structure would be to promote equitable sharing of responsibilities for planning, developing, operating, and maintaining the technical infrastructure (hardware and software) required to assure safe, reliable and cost-effective integration of national power grids.</p>
<p><i>Commercial framework for energy trade</i></p>	<p>Absence of institutional and contractual arrangements for cross-border trade, including taxation for cross border power transactions, transmission tariffs, and third-party access.</p> <p>Predominance of 25-year Power Purchase Agreements (PPAs) in the governance of most bilateral interconnections, with no third party access included.</p>	<p>A critical beneficial factor is the transparency in the price formation and for wheeling fees setting, based on prevailing power surplus and deficit conditions traded on the market at a given time.</p> <p>Bilateral and multilateral contracts could still be prevalent, and co-exist along with the instruments provided at the regional level through the regional electricity exchange.</p>	<p>The operation of cross-border interconnections opens up opportunities for national power utilities to exchange a range of energy services related to the delivery of reliable electricity supply at minimum cost.</p> <p>Utilities to develop a range of new services, including: lowering of generation capacity reserve requirements; achieving economies of scale; increasing load and fuel diversity; opportunities for sale of surplus; obtaining emergency support on major breakdowns.</p> <p>Rules could be established for interconnected national utilities to: set the commercial framework within which energy exchanges will be conducted; agree on pricing principles; oversee and settle transactions; agree and enforce technical standards for metering; arbitrate between power utilities.</p>

Challenges	ASEAN	ESMAP Findings	SARI Findings
<i>Mechanisms for infrastructure development</i>	<p>Lack of participation in investments for developing regional interconnections; inability to attract significant private sector funding.</p> <p>Shortage of technical capacity to integrate an ever-increasing proportion of variable renewable energy.</p> <p>Dominance of national energy security objective, which often translates into a reluctance to depend on another member state for power generation and transmission.</p>	<p>Regional transmission Master Plan is a helpful tool for members and investors.</p>	<p>Develop a long term regional grid master plan, which provides the necessary blue print for delivering regional power integration:</p> <ul style="list-style-type: none"> <li>(i) Helps member countries align their plans for infrastructure expansion, and developers to prioritize their investments for regional projects</li> <li>(ii) Helps transition from the bilateral approach of cross-border electricity exchange to full-scale regional power integration.</li> </ul>
<i>Ownership and financing</i>		<p>Ownership and financing of regional interconnectors, as well as pricing arrangements adopted for interconnectors, vary widely across cases. This is due to the uniqueness of each regional market, where solutions must be fully adapted to the appropriate regional conditions</p>	
<i>Preparatory work</i>		<p>There is no common approach across all cases. Donors can play an important role in supporting the development of regional power integration, by providing financing, technical expertise, and acting as a “neutral” stakeholder.</p>	<p>Work on the regional power grid organized in three Task Forces:</p> <ul style="list-style-type: none"> <li>(i) Harmonization of policy, legal, and regulatory mechanisms;</li> <li>(ii) Advancement of transmission system interconnections;</li> <li>(iii) Establishment of South Asia Regional Electricity Markets.</li> </ul>

## E. Core Requirements for an AEE Model

20. The AEE would be designed to provide a framework to facilitate power trade on a multinational basis across the AEC. It would be based on a combination of what works best in all exchanges models around the world, and adapted to capture lessons learned from their weaknesses. In addition, to capture the ASEAN specificity and collective vision for power integration, the ASEAN model would respect core principles, agreed upon at the outset by member states. These principles, or core requirements, would be fully reflected in the Feasibility Study, and provide the basis for developing the feasibility, design and implementation of the AEE.
21. Some of the core requirements to secure AEE effective operation across ASEAN could include the following six principles, to be reflected in the Feasibility Study and further details worked out:
- (i) ***Stepwise and voluntary.*** The creation of the AEE and its further deployment should allow for a step wise approach, whereby a coalition of the willing will join in its initial operation, while making room for other ASEAN nations to join on a voluntary basis, at a later stage. It would start with regional interconnections ready for cross border trading to operate, and expanding when others are ready. Such approach would allow both bilateral and multilateral arrangements to continue to be developed alongside, and these would ultimately expand as other members join. However, these arrangements should be concluded within the framework of the regional perspective. Likewise, consistent with this stepwise approach, the AEE would start with a minimum product offering. These would evolve and adjust over time from simple to more comprehensive products and operations.
  - (ii) ***Trading gaps and excesses.*** The AEE should not interfere with the operation of national energy markets. It is not a regional pool of all national power generation, but rather a market framework whereby buyers voluntarily trade their excess and cover the gaps in their national generation capacity. As such, the AEE would not require the abolition of energy subsidies as a pre-requisite for its establishment. This is notwithstanding that, from a fiscal perspective, it would be advisable to decouple subsidies from national market energy prices and develop alternative instruments that would target the poor in a more efficient manner.
  - (iii) ***National regulations complemented by regional coordination.*** The AEE would not require complete regulatory harmonization across ASEAN for its implementation. It must be designed so that only a core level of coordination is needed to establish rules for cross border trading through the exchange. A fine balance between the regional regulatory requirements for cross border trading, and the continuing national regulatory bodies should be established in the framework of the AEE.
  - (iv) ***Expanding regional power infrastructure.*** The AEE cannot function at its full efficiency unless it grows within a framework for a fully interconnected power market within the AEC. Such vision will need to be reflected in AEE future interconnection and investment planning. A master regional infrastructure plan, supported by all members, would enhance the investment climate, as well as helping each member align national plans for infrastructure expansion and transition from bilateral to full-scale multilateral trade.
  - (v) ***Development of a regional wheeling pricing model.*** A commitment to a regional pricing model would increase price transparency, as well as efficiency in cross border trading within the region. In particular, a wheeling-pricing model must be agreed early on, to be adopted for the AEE operations throughout the region, so that excess power trading could be effected in a predictable and efficient manner.

- (vi) ***Sustainable regional power trading.*** In line with ASEAN commitment to renewable energy and delivery of affordable, clean energy to its citizens, the AEE design will need to incorporate the proper mechanisms and incentives that would secure a sustainable power system. This includes a greater deployment of renewable energy and their optimization across the region; as well as an expansion of access to electricity across ASEAN.
22. The starting point for the ASEAN model could be developed from the Nord Pool electricity exchange, which is based on marginal power trading. This could serve as starting point for the design of the AEE. An analogous model was similarly adopted with encouraging advances in the Southern African Power Pool (SAPP), connecting twelve countries in Southern Africa, as has more recently been adopted by the SARI/EI Southern Asia Initiative as a starting point. Nevertheless, this would only serve as an initial reference, as the AEE design would be tailored to the region's specific needs and ASEAN's distinct aspirations.

#### **F. Feasibility Study: Objectives and Next Steps**

23. The AEE Feasibility Study will assess the feasibility for the creation of AEE as a framework to allow for multilateral power trading between interconnected nations within ASEAN. The core purpose of the study is to allow ASEAN policy-makers:
- (a) to determine whether the creation of an AEE would enable the APG to operate on a multilateral basis for trading electricity and securing ancillary services;
  - (b) to agree on the design AEE design components, based on what works best in multilateral trading models around the world, adapted to ASEAN specificity;
  - (c) to consider and agree the high-level plan for the two subsequent phases for AEE creation – namely the components for its design, and the roadmap for its implementation.
24. The Feasibility Study should therefore investigate requirements for the creation of an AEE for electricity and ancillary services; and for establishing the needed regulatory and legal frameworks. In doing so, its analysis and conclusions will be based on investigations of the current conditions within ASEAN at the national levels, a full understanding of ASEAN needs and aspirations, and the anticipated situation with the APG in full operation. It will draw on findings from international experience from other regional power markets, so as to identify the best approaches to addressing potential regulatory and/or legal barriers to the functioning of the AEE. This will include the assessment of ongoing discussion on the future ASEAN regulatory framework, and the sharing of international experience on obstacles encountered and the way they have been addressed.
25. The feasibility study would be a first phase for considering the creation of an AEE. The process will be developed through three phases, each providing a clear decision point at ministerial level before proceeding to the next phase::
- (a) Feasibility Phase (6 months), to deliver an AEE Feasibility Study;
  - (b) Design Phase, to develop its components and deliver the preparatory identified tasks needed to create the multilateral market;
  - (c) Implementation Phase, to deliver an AEE fully ready to operate.

## **Feasibility Study: Draft Outline**

### **I. Context**

- (a) ASEAN energy situation and development plans over the next 20 years
- (b) Prospective electricity flows among ASEAN Member States and regions
- (c) Challenges to ASEAN connectivity
- (d) Challenges for the Laos, Thailand, Malaysia and Singapore Power Integration Project (LTMS-PIP)

### **II. Objectives of the ASEAN Electricity Exchange**

- (a) ASEAN needs and AEE goals
- (b) Phased approach and anticipated end state

### **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
- (a) 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
- (b) Conduct a national SWOT analysis (Strength, Weakness, Opportunity, Threat) to gauge national preparedness to participate in a multilateral market, taking into account not only the current situation, but the potential growth of electricity requirements over time
- (c) Identify energy security requirements of ASEAN member countries and thus, implicitly, their willingness to trade
- (d) Develop mechanisms to secure AEE long-term reliability in order to gain trust for expansion from its initial role

### **IV. International perspectives**

- (a) Experiences from electricity exchanges of interconnected grids around the world
- (b) Adaptability to ASEAN needs
- (c) Expected benefits, based on international experience

#### **IV. Implications for Utilities**

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.

#### **V. 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 and energy markets
- (iii) Regulatory Authority and national regulatory authorities
- (iv) Planning expansion of regional power infrastructure
- (v) Transparent 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
- (ii) Utilities and stakeholders in the national electricity market
- (iii) Agreements and Licenses

#### **VI. 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, trading instruments and ancillary services
- (ii) Day-Ahead Market as a tool for connecting ASEAN
- (iii) Monitoring and settlement functions

##### (c) Legal setup

- (i) Governance
- (ii) Ownership structure

#### **VII. Organizational Structures**

- (a) Ownership model
- (b) Legal framework
- (c) Governance structure

**VIII. Phased Approach**

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

**IX. 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 considerations