II. AEMI benefits

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Abstract

Market integration, ranging from the economy to energy and the environment, has shown it has provided huge benefits for integrated markets. This chapter, which suggests that the ASEAN Energy Market Integration (AEMI) will reap a similar benefit in the energy market, revisits the theoretical background of market integration, reviews the experiences of energy market integration in other areas of the world – i.e., the European Union as well as West African countries – and draws lessons from these experiences for AEMI. In addition, it identifies the benefits that would accrue to AEMI. The identified economic benefits are increases in gross domestic product (GDP), the convergence and stabilization of energy prices, and more foreign direct investment (FDI) in the integrated energy market. The identified energy benefits are enhanced energy security, higher energy efficiency, lower energy system costs and higher energy development indicators. There would also be environmental benefits such as lower CO_2 emissions.

Keywords: Equitable growth; environmental quality; energy security; energy poverty; social welfare; and energy development indicators (EDI).

A. Introduction

The Association of Southeast Asian Nations (ASEAN) will achieve an even higher level of economic integration through the forthcoming ASEAN Economic Community (AEC) in 2015. In the AEC, there will be free movements of factors (i.e., skilled labor and capital) that are extremely useful for creating efficient economic activities in production, distribution and consumption. These factors will move from "less efficient" countries to "more efficient" countries. All economic activities require energy products. Therefore, smooth-functioning economic integration obviously requires energy market integration. An integrated energy market is considered to provide more benefits than costs to the participants of the market. ASEAN, and more specifically the Greater Mekong Subregion (GMS), have a strong potential for economic development and cooperation together with greater possibilities for harnessing energy resources, but major barriers exist to the realization of such potential and possibilities (Bhattacharya and Kojima, 2010; Chang and Yao, 2012; Lidula and others, 2007; Yu, 2003). The European Union's integrated energy market has proved that the benefits from an integrated energy market are greater than the costs of creating such

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a market (Barroso, 2006; *The Economist*, 2007; Leonard, 2005), although there is still room for improvements (Kroes, 2007). A study by Gnansounou and others (2007) examined strategies for regionally integrating electricity supply in West Africa and found that an integrated strategy would bring benefits such as reduced capital expenditures, lower electricity supply costs and enhanced system reliability.

Noticing the creation of a few successful integrated energy markets elsewhere, similar attempts to create an integrated energy market in the ASEAN region have started. It is suggested that the ASEAN members should increase their efforts towards regional cooperation in the area of sharing best practices in the development and utilization of energy and energy efficiency (IEEJ, 2011). In their flagship report, the Asian Development Bank (ADB, 2013) emphasized the need for a secure energy supply to ensure a robust economic growth in the region. Therefore, it recommended the establishment of a region-wide market for energy, including equipment, together with specific recommendations for strengthening the energy sector, i.e., reducing energy demand, replacing energy subsidies with efficient policies, investing in new technologies and putting the use of renewable energy first (ADB, 2013).

A public good approach indicates that economic growth and a number of positive externalities are the possible benefits of an integrated energy market (Andrews-Speed, 2011). The accrued benefits of an integrated energy market are diverse and subtle. Some benefits are direct and tangible while others are indirect and intangible. The benefits of an integrated energy market would be greater than the costs of integrating energy markets across the region.

This chapter examines the possible benefits to be gained from an ASEAN Energy Market Integration (AEMI). It consists of three main parts. First, it revisits the rationale of integration by reviewing the theories of integration with regard to economic, market and energy perspectives. Second, it reviews a few existing integrated energy market cases such as the European Union and West Africa, and examines what benefits have been brought into the integrated energy market. Third, it assesses the potential benefits of the AEMI, ranging from the economic and environmental to the energy and other benefits, possibly by simulation of a computable general equilibrium or non-linear model.

B. Theoretical overview of integration

1. Economic integration

Theoretically, there are five successive stages of economic integration based on the degree of openness, i.e., a Free Trade Area (FTA), Customs Union (CU), Common Market (CM), Economic Union, and Complete Economic Integration (CEI) (Balassa, 1961; McCarthy, 2006). In an FTA, tariffs (and other quantitative restrictions) are abolished by the participating countries. However, each country still maintains its own tariffs against the non-members. In a CU, apart from the introduction of free movement of commodities within the union, common external tariffs in trade with non-member countries are set up. In a CM, not only trade restrictions but also restrictions on factor movements are abolished. In the European Union, the member countries combine the suppression of restrictions on commodities and factor movements with some degree of harmonization of national economic policies, in order to remove discrimination due to disparities in those policies. In CEI, unification of monetary, fiscal, social and counter-cyclical policies are observed; it also requires the setting-up of a supra-national authority whose decisions are binding on the member States.

The only one *de jure* economic integration in East Asia is the ASEAN Free Trade Area (AFTA). In 2015, ASEAN will establish the AEC, which appears to have the similar characteristics to those of a CM. The flow of production factors (capital and labor), trade diversion and trade creation may not be optimized in the AEC due to the absence of common external tariffs. However, ASEAN members have their own way of integrating their economies – the "ASEAN way". So the Governments of ASEAN members are obviously eager to realize the AEC on schedule in 2015. As a regional economic integration, the AEC has four main characteristics: (a) a single market and production; (b) a highly competitive economic region; (c) equitable development; and (d) full integration in the global economy. The AEC also has to consider AEMI in order to support well-functioning distribution, consumption and production within the community. The internal ASEAN energy market, through AEMI, will become a powerful instrument for supporting the AEC and for increasing competition not only within the AEC but also in the global market. In addition, it will help AEMI to become a source of large macroeconomic benefits. However, the benefits of AEMI will be significantly greater if the removal of the remaining cross-border barriers in energy products is achieved. More specifically, AEMI will become a means for generating a more dynamic, innovative and competitive economy in the global market.

2. Market integration

(a) Condition

Market integration will be achieved if prices among different markets follow similar patterns over a long period. Prices often move proportionally to each other; when this movement is very clear among different markets, those markets are integrated. If AEMI is established, there will be co-movements of energy product prices in ASEAN countries.

(b) Characteristics

There is a conflict between the technical efficiency and the agency efficiency in the strategy "to buy from market" ("arm's length" market transaction – market integration) and "to produce domestically" (vertical integration) (Besanko and others, 2010). Similarly, in an international energy market, a country can choose "to buy" (market integration) or "to produce domestically" in order to fulfill domestic energy demand. The benefits of market integration are that: (a) market energy firms (countries) can achieve economies of scale; and (b) market energy firms (countries) will be efficient and innovative.

3. Energy market integration

(a) Comparative Advantage of ASEAN Countries

To examine the pattern of comparative advantages of energy products, a modified measure of Revealed Symmetric Comparative Advantage (RSCA) is applied in the empirical analysis. The $RSCA_{ij}$ index ranges from -1 to +1 (or $-1 \leq RSCA_{ij} \leq 1$). $RSCA_{ij}$ that are greater than zero imply that country i has a comparative advantage in good j. In contrast, $RSCA_{ij}$ that are less than zero imply that country i has a comparative disadvantage in product j. The Trade Balance Index (TBI) is employed to analyze whether a country has specialization in exporting (as a net-exporter) or in import (as a net-importer) for a specific group of products – Standard International Trade Classification (SITC). Values of the index range from -1 to +1. At the extreme, the TBI equals -1 if a country only imports; in contrast, the TBI equals +1 if a country only exports. By using the RSCA and TBI indexes, the "products mapping" is constructed. Products (SITC) can be categorized into four groups, A, B, C and D, as shown in table 1.

Table 1. Product mapping

Revealed Symmetric Comparative Advantage Index (RSCA)		
RSCA>0	**Group B:** Have Comparative Advantage No Export-Specialization (net-importer) (RSCA > 0 and TBI <0)	**Group A:** Have Comparative Advantage Have Export-Specialization (net-exporter) (RSCA > 0 and TBI >0)
RSCA<0	**Group D:** No Comparative Advantage No Export-Specialization (net-importer) (RSCA < 0 and TBI <0)	**Group C:** No Comparative Advantage Have Export-Specialization (net-exporter) (RSCA < 0 and TBI >0)
	TBI <0 Trade Balance Index (TBI)	TBI>0

In the SITC system, the energy products covered are: (a) SITC 322, coal, lignite and peat; (b) SITC 323, briquettes, coke and semi-coke; lignite or peat; and retort carbon; (c) SITC 333, crude petroleum and oils obtained from bituminous minerals; (d) SITC 334, petroleum products, refined; (e) SITC 335, residual petroleum products, n.e.s. and related materials; (f) SITC 341, gas, natural and manufactured; and (g) SITC 351, electric current. Table 2 shows the product mapping of the energy products of ASEAN and individual ASEAN countries. ASEAN has a high comparative advantage for energy products (category A), i.e., SITC 322, coal, lignite and peat; SITC 335, residual petroleum products, n.e.s. and related material; and SITC 341, gas, natural and manufactured, refined. However, SITC 334, petroleum products, refined, is in category B.

ASEAN, as whole, has a high comparative advantage (category A) in primary energy products (SITC 322, coal, lignite and peat; SITC 335, residual petroleum products, n.e.s. and related materials; and SITC 341, gas, natural and manufactured). Primary energy products are transformed in energy conversion processes to secondary energy products, for example, electrical energy, refined fuels, synthetic fuels (hydrogen fuels). This is beneficial for AEMI; ASEAN has a comparative advantage in primary energy products as inputs to secondary products. AEMI will automatically lead to the ASEAN members specializing in either primary or secondary energy products, depending on their comparative and competitive advantages. Comparative advantage focuses more on the endowment factor, so countries such as Indonesia, Malaysia and Thailand could develop primary energy products. Competitive advantage focuses on dynamic rivalry, new entrants, substitutes and complements as well as supply and demand of the energy industries. Therefore, Singapore and the Philippines might develop secondary energy products. Each ASEAN member could develop its own energy products based on that country's comparative and competitive advantages. In short, AEMI will create greater efficiency in both primary and secondary energy industries in ASEAN through:

(a) Liberalization of intra-industry trade and inter-industry trade in energy products;

(b) Resource reallocation from "less efficient" countries to "more efficient" countries;

(c) Trade creation and trade diversion in energy products;

(d) Efficient exploration for sources of primary energy products, which is good for society and the environment;

(e) Healthier competition in primary and secondary products;

(f) Reductions in costs as well as prices of secondary energy products, making it possible for societies to afford the energy products;

(g) Enhancement of economies of scale and the scope of energy industries;

(h) Support for broad economic efficiency and competitiveness, since all economic activities require energy as an input.

Table 2. Product mapping of energy products in ASEAN, 2005

No	SITC	Commodity Description	ASEAN	Singapore	Indonesia	Malaysia	Thailand	Philippines
72	322	Coal, lignite and peat	A	D	A	D	D	D
73	323	Briquettes; coke and semi-coke; lignite or peat; retort carbon	D	D	D	D	D	D
74	333	Crude petroleum and oils obtained from bituminous minerals	D	D	A	A	D	D
75	334	Petroleum products, refined	B	A	D	D	C	D
76	335	Residual petroleum products, n.e.s., and related materials	A	A	A	D	A	D
77	341	Gas, natural and manufactured	A	C	A	A	D	D
78	351	Electric current	D	D	D	C	D	D

Sources: United Nations Comtrade Database; authors' calculation.

(b) Price equalization in energy market integration

Since the domestic energy markets in the ASEAN members are distorted, energy prices do not reflect efficient competitive market prices. With subsidies, domestic energy prices have been set below efficient market level. The energy product prices vary among the ASEAN members. This chapter uses the variation coefficient (VC) to find the discrepancy in energy product prices. The smaller the VC, the less variation there is in energy product prices among the ASEAN members. In contrast, the higher the VC, the more variation there is in energy product prices among the ASEAN countries.

By looking at the trend in the VC, it can be observed whether energy product prices become more equal (less variation) or less equal (more variation) in ASEAN. To make the VC trend smooth, this study uses Moving Average 2. Figure 1 shows the trend in the VC of energy product prices (MA[2]) in ASEAN for 1980-2012. All energy products, except coal, lignite and peat, and briquettes, coke and semi coke, lignite or peat, and retort carbon, show a positive trend in the VC. This implies that those energy product prices are becoming more varied among the ASEAN members. Price differences in energy products show inefficiency among the ASEAN members that may be due to the energy supply side (for example, the type and market price of the primary energy products or fuels used, domestic market competition, the existence of substitute energy products, government subsidies, government and industry regulation) and energy demand side (for example, local weather patterns). The difference in energy prices not only occurs among countries but also among areas within the region. For example, electricity prices might differ between countries and might even vary within a single area or distribution network of the same country. In Indonesia, electricity rates typically vary for residential, commercial and industrial customers. Prices for any single class of electricity customer can also vary by time-of-day or by the capacity or nature of the supply circuit. The price also varies depending on the source of the electricity. For example, in 2002, in the United States the cost of electricity from different sources were: coal, 1-4 cents; gas, 2.3-5.0 cents; oil, 6-8 cents; wind power, 5-7 cents; nuclear, 6-7 cents; and solar power, 25-50 cents. AEMI will create price equalization in energy products in the ASEAN through:

(a) Liberalization in primary energy products (input of secondary energy products);

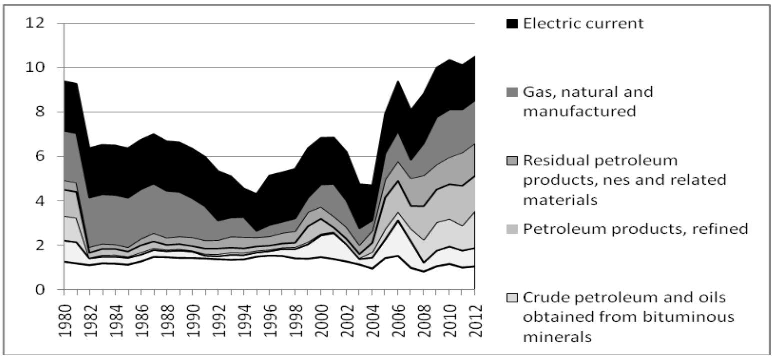
(b) Coordination, cooperation and harmonization in energy policy;

(c) Joint production and marketing of energy supply to achieve economy-of-scale and scope;

(d) Efficiency in energy supply;

(e) An efficient cross-country distribution network for energy.

Figure 1. Trend in variation coefficient of energy product prices in ASEAN, (MA[2])



Source: United Nations Comtrade Database; authors' calculation.

The more energy product prices vary the larger the differences in efficiency among the ASEAN members due to distorted domestic energy product markets. Theoretically, AEMI may be able to provide more efficient energy product prices through the reallocation of resources from less efficient energy product providers to more efficient ones. Thus, equal energy product prices could be achieved in the ASEAN region.

AEMI will lead to energy prices decreasing before they become equalized. First, in the existing distorted energy markets, due to subsidies and other government interventions, AEMI would bring efficiency; therefore the prices of energy would decrease in all countries. Second, if the overall energy market would have been in the efficient situation, AEMI would equalize the market price. In such a situation, energy prices may increase in certain countries but decrease in the others.

The Equivalent Variation (EV) and Compensation Variation (CV) represent the impact of AEMI. The EV can be defined as the United States dollar amount that the country would be indifferent to accepting the changes in energy prices and income (wealth) or not accepting. The CV measures the net revenue of the planner who must compensate the country for food prices and income changes, bringing the country back to its welfare (utility level). (EV and CV are positive if the prices and income changes make the country better off). Theoretically, the impacts are divided into (a) two direct impacts (solely due to decrease of certain energy prices) and (b) an indirect impact (through the other price channels, using cross-price elasticity). Table 3 shows the simulation of the direct welfare impacts of a 10 per cent energy price decrease (in United Sates dollars) due to AEMI and in percentage of current gross domestic product (GDP). For example, a 10 per cent decrease in the price of coal, lignite and peat will result in an increase in welfare in Malaysia by US$ 98,496,773 (or 0.003 per cent of Malaysian GDP). The simulation shows that AEMI will have a direct positive impact on the ASEAN countries' welfare. It also shows that SITC 333, crude petroleum and oils obtained from bituminous minerals, and SITC 334, petroleum products, refined, will record highest direct impact (in percentage of GDP).

Table 3. Direct welfare impact of 10 per cent decrease in price of energy product (US$/year)

Measurement	Indonesia	Malaysia	Philippines	Thailand	Singapore	Viet Nam	Cambodia
1. SITC 322 – Coal, lignite and peat							
Compensating variation	6,705,006	98,496,773	29,953,588	89,787,029	202,257	6,358,473	47,080
	(0.001%)	(0.003%)	(0.012%)	(0.025%)	(0.0001%)	(0.004%)	(0.003%)
Equivalent variation	6,705,263	98,552,373	29,956,53	89,824,488	202,257	6,358,971	47,084
	(0.001%)	(0.003%)	(0.012%)9	(0.025%)	(0.0001%)	(0.004%)	(0.003%)
2. SITC 323 – Briquettes; coke and semi-coke; lignite or peat; retort carbon							
Compensating variation	98,267,719	3,497,646	4,567,822	7,485,555	487,568	61,950,815	678,023
	(0.011%)	(0.001%)	(0.002%)	(0.002%)	(0.0002%)	(0.044%)	(0.0047%)
Equivalent variation	98,322,573	3,497,705	4,567,891	7,485,741	487,569	61,998,271	678,771
	(0.011%)	(0.001%)	(0.002%)	(0.002%)	(0.0002%)	(0.044%)	(0.0047%)
3. SITC 333 – Crude petroleum and oils obtained from bituminous minerals							
Compensating variation	1,550,388,031	569,996,242	6,927,166,346	3,209,329,439	1,795,384,058	396,640,198	4,591,455
	(0.177%)	(0.19%)	(2.8%)	(0.88%)	(0.65%)	(0.28%)	(0.031%)
Equivalent variation	1,562,210,554	571,594,700	6,994,925,228	3,249,254,210	1,805,228,972	398,582,154	4,625,978
	(0.177%)	(0.19%)	(2.8%)	(0.89%)	(0.65%)	(0.28%)	(0.032%)
4.SITC 334 – Petroleum products, refined							
Compensating variation	2,162,680,142	859,060,953	4,400,758,679	502,131,560	3,994,854,118	447,429,536	57,351,017
	(0.25%)	(0.28%)	(1.76%)	(0.13%)	(1.44%)	(0.31%)	(0.4%)
Equivalent variation	2,188,285,691	862,807,056	4,465,385,702	503,107,087	4,039,967,095	449,916,785	57,803,778
	(0.25%)	(0.28%)	(1.78%)	(0.13%)	(1.46%)	(0.31%)	(0.4%)
5.SITC 335 – Residual petroleum products, n.e.s. and related materials							
Compensating variation	63,081,078	37,925,192	27,731,527	67,183,535	73,642,259	329,385,095	198,064
	(0.007%)	(0.01%)	(0.011%)	(0.018%)	(0.027%)	(0.23%)	(0.014%)

Equivalent variation	63,101,603 (0.007%)	37,932,690 (0.01%)	27,734,054 (0.011%)	67,203,788 (0.018%)	73,656,715 (0.027%)	330,716,398 (0.23%)	198,126 (0.014%)

6. SITC 341 – Gas, natural and manufactured

Compensating variation	74,988,583 (0.009%)	55,426,227 (0.02%)	226,926,003 (0.091%)	293,368,430 (0.08%)	13,093,167 (0.0047%)	12,318,071 (0.009%)	18,221 (0.0001%)
Equivalent variation	75,020,835 (0.009%)	55,443,876 (0.02%)	227,066,675 (0.091%)	293,768,899 (0.08%)	13,093,687 (0.0047%)	12,319,946 (0.009%)	18,222 (0.0001%)

7. SITC 351 – Electric current

Compensating variation	240,197 (0.0003%)	1,256,344 (0.0004%)	414 (0.0000002%)	24,998,463 (0.007%)	637 (0.0000002%)	19,435,685 (0.014%)	1,676 (0.00001%)
Equivalent variation	240,197 (0.0003%)	1,256,351 (0.0004%)	414 (0.0000002%)	25,000,686 (0.007%)	637 (0.0000002%)	19,440,353 (0.014%)	1,676 (0.00001%)

Sources: UN Comtrade and ASEAN Secretariat, 2013.
Note: Figures in parentheses are the percentage of Gross Domestic Product in current prices.

C. Lessons learnt from other integrated energy markets

Efforts to create integrated energy markets have been made in other regions of the world. A notable case is the experience of energy market integration in the European Union while a less notable, but very promising case, is the integration of the electricity market in West Africa. This section reviews how energy market integration has been established in the European Union and among West African countries, and draws lessons for AEMI.

1. European Union

(a) Overview

Europe, which heavily depends on oil and gas from external sources, has been engaged since the early 1990s in a debate on building an integrated and competitive energy market. The European Union has agreed to share the responsibility to develop a strategic policy for changing current trends. A truly competitive single European electricity and gas market will improve the security of supply as well as boost efficiency and competitiveness. The approach by the European Union in terms of restructuring energy markets has a broader perspective, which includes not only economic concerns but also strategic/political goals.

(b) **Lessons learnt**

The liberalization and integration of European energy markets is a process of discovery, involving continuous interactions between the market players and the regulatory authorities. One of the key lessons comes from the historical experience, which suggests that to reach a more competitive and efficient market structure, the following stages of energy reform should be completed: (a) the privatization of publicly-owned electricity assets; (b) the opening of the market to competition; (c) the extension of vertical unbundling of transmission and distribution from generation and retailing; and (d) the introduction of an independent regulator (Pollitt, 2009).

Second, it is imperative to balance regulatory governance between national regulatory agencies and one that is European Union-wide. Although national regulatory agencies have been empowered in the European Union, the governance of European energy regulation is still characterized by multiauthority structures at the national level. This structure has been criticized because the lack of a European Union-wide energy regulatory authority has resulted in market integration in Europe being driven mainly by informal regulatory networks among the network operators, standardization authorities and national regulators (Meeus and Belmans, 2008). The European Union experience suggests that member States should create a common energy regulator and try to increase the regulatory impact through enhancing cooperation among national regulators. Apart from such cooperative efforts, each member State must guarantee that its national regulatory authority exercises its powers "impartially and transparently".

Third, designing energy policies and implementing such policies should not be hindered by a slow decision process. The new energy policy was expected to overcome barriers as well as develop a secure supply and increase efficiency. However, the slow decision process of the European Union has resulted in significant difficulties in reaching the aimed-for structure in the foreseeable future. As technical barriers are inherent characteristics of energy sources, and politics and economics are associated with energy sources, the decision process is intertwined with government interventions, environmental issues and energy security.

Fourth, there should be an agreement on the future structure of an integrated energy market. The future structure of the European energy market is still not clearly defined and European policy makers have largely followed a trial and error approach in order to break through these barriers and find an appropriate way to establish the rules and regulations in order to govern energy markets (De Jong and Hakvoort, 2008).

Fifth, it is critical to the success of the regional initiatives to adapt future challenges (European Commission, 2010). The first challenge in the European Union is to match the bottom-up approach of the regional initiatives and the more top-down approach of the third package, particularly in relation to drawing up of framework guidelines and network codes. The second challenge is the risk of divergence if different regions implement different solutions to tackle similar issues. In addition, some important technical and political challenges may slow down, pause or reshape the structure of markets (Domanico, 2007; Pollitt, 2009).

Sixth, it is necessary to reflect non-market considerations in the integrated energy market. Once the security of supply enters the policy framework (Haase, 2008), regulations are less likely to follow competitive market models. With an expected increase in future geopolitical uncertainties, together with a greater import dependency on fewer supplies, energy supply security is likely to move up on the political agenda and needs to balance its position vis-à-vis carbon reduction objectives. Therefore, AEMI should advocate free-market compatible solutions to greater energy-related environmental and supply security problems to avoid industrial competitiveness concerns cooling down the market enthusiasm of energy policy stakeholders.

2. West Africa

(a) Overview

The majority of West African countries have suffered from electricity shortages for several decades, which constitute a serious handicap for their socio-economic development. The situation has worsened during the past few years due to several reasons: (a) the obsolescence of the electricity generation and transmission infrastructures; (b) unfavorable hydrological conditions; and (c) difficulties in attracting the investment needed for construction of new facilities in order to satisfy the increasing energy demand. After identifying the causes of electricity shortages, the Economic Community of West African States (ECOWAS) has established a joint power project to assist in integrating their national power system into a unified regional energy market. The West African

Gas Pipeline (WAGP) project and the West Africa Power Pool (WAPP) project have been established with the goal of cooperatively providing the indispensable building blocks of a sustainable energy infrastructure network in ECOWAS. The two systems will help create regional energy trade and cross-border exchange between national utilities.

WAPP is an emerging partnership between the Governments of ECOWAS member States who collectively have resolved to put in place a regional power pooling mechanism as the preferred means of achieving their long-term vision – a unified regional electricity market where electricity supply costs are lowered and energy security improved in order to contribute towards further regional energy integration. The ECOWAS member States are in the process of ratifying the ECOWAS Energy Protocol to provide a legal and regulatory framework for all regional energy integration initiatives, including the WAPP and WAGP projects. WAPP is also a partnership between the ECOWAS member States and donors (including the World Bank), financing partners (including the Kuwait Fund for Arab Economic Development), the European Investment Bank, African Development Bank (AfDB), Bank for West Africa (BOAD) and, possibly, the European Union. Bilateral donors include the Agence Francaise de Development (AFD) and the United States Agency for International Development (USAID)

The WAGP project is a cooperative effort of the four participating States (Benin, Ghana, Nigeria and Togo), the producers, sponsors, transporters, foundation customers, and the providers of political risk guarantees. The four participating States have established, by treaty, the WAPP Authority to, inter alia: (a) monitor compliance by West African Gas Pipeline Company (WAPCo) with its obligations; (b) approve the pipeline design and construction plan; (c) negotiate and agree with WAPCo on the licenses and access code; (d) negotiate and agree with a third-party operator of the pipeline system; (e) negotiate and agree on any expansion plans; (f) act on behalf of the four States' respective tax authorities; (g) negotiate and agree with WAPCo on changes in tariff methodology; and (h) use its best efforts to ensure that each State complies with the International Project Agreement (IPA)and applicable enabling legislation. The WAGP Authority does not set tariffs, as these are regulated by contract.

(b) Lessons learnt

A report by the World Bank Group identified two most pertinent lessons from the design of the West Africa Power Pool Adaptable Program Lending (WAPP APL). First, the key to successful expansion of multi-country, regional electricity trade is to initially establish an appropriate (simple, flexible and robust) institutional structure consisting of the main national power utilities. Over time, with growing economies and increases in electricity demand in a regional context, the scope and evolution of multi-country, regional electricity trade expands as trading partners build confidence in working together (Moural, 2006).

Second, in order to maintain a balance in the operations of the power transmission system when changing from a national into a multi-country, a regional operations regime is required to implement the WAPP Cooperation Agreement for the 330kV Coastal Transmission Backbone. It is preferable to promote greater independence for national transmission system operators to coordinate and cooperate with each other across borders.

There are other lessons to be learnt. First, in order to facilitate compliance with safeguard procedures across the ECOWAS region in the long term, a process of harmonization of environmental and social rules and regulations is being put in place. The ultimate goal of this effort is to minimize the burden that environmental rules and procedures create across the region. The tools to achieve this will be the adoption of general safeguard framework documents.

Second, in the long term, the key to achieving sustainability of regional energy integration initiatives, such as WAPP and WAGP, lies in the establishment and strengthening of the emerging power utility-led institutional framework – the WAPP institutional framework (WAPP Secretariat and Information Coordination Center, and the network of WAPP Operational Coordination Centers to be set up in Cote d'Ivoire, Ghana, Nigeria and Senegal).

Third, a power pool can be defined as "an arrangement between two or more interconnected electric systems that plan and operate their power supply and transmission in the most reliable and economical manner, given their joint load requirements". Thus, when utilities form a group to consider their joint generation resources and needs, and agree to plan and operate their system to improve reliability and economy, they are pooling. Indeed, due to the difficulties of harmonizing demand and supply, the forecasting and maneuvering of a pooled electric power system necessitates careful synchronization of transmission; an accurate system design is also required. The effect of this pooling system is that energy security will no longer be merely the concern of a single State as it will have been elevated to a regional level.

Fourth, in a practical sense, the mechanism can be described as follows: The control areas are the smallest units of an interconnected power system. In a power pool, these units are responsible for coordinating the planning and operation of the generation facilities and transmission networks in their areas. They can be established by either a single utility or two or more utilities that are tied together by sufficient transmission and contractual arrangements. All the utilities within a control area operate and control their combined resources to meet their loads as if they were one system. Because most systems are interconnected with neighboring utilities, each control area must assure that its load matches its own supply resources plus power exports or imports to/from other control areas.

Fifth, with regard to the contractual arrangements required for power to be possible in ECOWAS, the Treaty and Energy Protocol provides a strong legal basis for regional interconnection (Abdoul, 2012).

D. Assessing the benefits

The theoretical investigation of integration shows that energy market integration brings high levels of various benefits. Such benefits have been assessed quantitatively and qualitatively. This subsection presents the benefits that AEMI will potentially bring in terms of economic, energy and environmental points of views.

1. Economic benefits

It is believed that AEMI will bring extensive economic benefits such as increases in real GDP and foreign direct investment. It will also help prices to converge and stabilize, and make greater elastic demand possible, so that the economies can respond to external shocks more swiftly and, hence, cause less harm.

This study conducted a simulation analysis, based on the Global Trade Analysis Project (GTAP) model, to show that the removal of energy commodity trade barriers under AEMI and ensuing investments in the energy sector will bring economic benefits.[5] The potential benefits accruing from

[5] For the applied studies on using GTAP and the interpretations of results, see: Adams, 2005; Brockmeier; 1996; Hanslow, 2000; and Hertel; 1997.

AEMI have been calculated by equivalent variation (EV) and real GDP.[6] The overall impacts of AEMI on the ASEAN economy are shown in table 4. It is clear that the effects of AEMI, through tariff cuts and subsidies as well as increasing investments, are substantial. The EV values vary but real GDP figures show that the possible benefits accrue would be more than three percentage points.

Table 4. Impacts on macroeconomic variables: EV and the increase in real GDP

	EV (million USD)	Real GDP (percent)
Vietnam	2645.24	3.13
Thailand	5499.87	2.41
Singapore	1695.41	2.14
Philippine	1955.47	1.29
Malaysia	6352.9	3.46
Laos	58.66	1.08
Indonesia	8856.67	1.9
Cambodia	314.96	0.81
Other Southeast Asia	968.1	4.37

Source: authors' GTAP model results.

The impacts of AEMI shown in table 4 support the view that it will have positive impacts on some energy sectors in some ASEAN countries. The simulation results show that Indonesia will potentially gain the highest benefits from tariff cuts and subsidies as well as increasing investment in energy, as it has the highest EV, i.e., US$ 8,856. The next highest benefits will be gained by Malaysia and Thailand. Output will potentially increase in all ASEAN countries due to AEMI, as indicated by increases in real GDP. In terms of increases of real GDP, Malaysia will potentially experience the highest increase (3.46 per cent). It is followed closely by Viet Nam and Thailand. The impacts of AEMI on welfare and output are heterogeneous across the ASEAN members due to the characteristics of protection of the energy sector as well as consumption and production patterns in each ASEAN member.

Apart from evaluating the economic benefits of AEMI through EV, the attempt to quantify the possible benefits from energy market integration shows that there would be more foreign direct investment, which, in turn, would increase the GDP of the host countries. It also suggests that there would be an increase in overall welfare in the integrated natural gas market (Kimura and Shi, 2011).

The resulting possible benefits are price convergence and an increase in GDP (ERIA, 2010).[7] A lower income disparity and catching up in economic development by poorer countries are suggested as possible benefits of an integrated energy market. A study employing the energy trade index and energy market competition index shows that there would be economic convergence and narrower development gaps among members of the integrated energy market (Sheng and Shi, 2011). A study with an economic convergence analysis shows that the higher the level of energy market integration, the lower the income disparity and equitable growth will be (Sheng and Shi, 2013).

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[6] The EV in this section is different to that of section B. In section B, the EV is calculated based on microeconomic modeling of welfare and the imports of energy products. The EV in this section is calculated based on macroeconomic modeling, i.e., the Global Trade Analysis Project (GTAP) model.

[7] In section B, the welfare impacts of price convergence (equalization) due to AEMI have been simulated by using CV and EV microeconomic modeling.

Integrated energy markets help in curbing demand for energy and induce greater supply of energy from cleaner sources (ADB, 2013). An integrated energy market will provide consumers with more choices and alternatives, so that the demand becomes more elastic and consumers can spread the pressure from energy demand (Sheng and others, 2013).

2. Energy benefits

The major benefits of expanded cooperation in the energy sector by AEMI include integrated regional planning and coordination (allowing identification of cost-effective energy projects), and mitigation measures for addressing climate change (public policy actions not only at the national level, but also at the regional level). Furthermore, regional cooperation in energy markets will enable the use of best practices in energy efficiency, renewable energy technologies and clean coal technologies. Sharing resources across borders will also enable the ASEAN members to increase regional energy security, reduce power costs, attract investment by creating greater market scale to interest potential investors, optimize natural resources and develop a common infrastructure (Situmeang, 2013).

ASEAN has been successful in eliminating common threats to the region's energy security. Energy infrastructure, including regional or sub-regional interconnection, which allows for reliable energy supplies at reasonable cost within ASEAN, is important to production efficiency and reliability as well as energy security in the region (ASEAN, 2013; Kimura, 2012; Mulqueeny, 2011). Energy security is the one of the benefits accruing from an integrated energy market (Koyama and Kutani, 2012). There are also compelling long-term economic, environmental and energy security benefits from establishing large-scale and dynamic electricity markets for the ASEAN members (Boethius, 2012).

In ASEAN, energy sustainability is based on three core dimensions – energy security, social equity and environmental impact mitigation. The current ASEAN Plan of Action (2010-2015) places greater emphasis on accelerating the implementation of action plans in order to further enhance energy sustainability for the region with due consideration being given to health, safety and the environment, clean coal technology and renewable energy, among others. Considering such sustainability, the ASEAN Energy Policy is thus formulated as follows (Jude, 2012):

(a) Energy security starts with using less energy far more efficiently to do the same tasks;
(b) Obtain energy from sources that are not vulnerable and obtain energy from sources that increase use of renewable (solar, wind and biomass) energy;
(c) Share energy resources between countries such as the development of sustainable hydropower projects in one country and exporting such power to another where demand is high;
(d) Increase cross-border power trading. Take advantage of differences in peak demand. (Grids will need to be strengthened);
(e) Increase use of domestic energy resources such as natural gas, hydropower and clean coal technologies;
(f) Increase use of alternative energy resources (biofuels/wind/solar/biomass);
(g) Subsidies.

With regard to ensuring greater regional energy security, the ASEAN Memorandum of Understanding on the Trans-ASEAN Gas Pipeline (TAGP) in 2004, for example, concerns the provision of a broad framework for the ASEAN members to cooperate in the realization of the TAGP project (Ramli and Abdullah, 2009).

The energy intensity of primary energy consumption in the ASEAN for 1990 to 2005 improved from 695 TOE/US$ million to 627 TOE/US$ million; it is projected to continue decreasing up to 2030 to 500 TOE/US$ million (Base case) and 452 TOE/US$ million (High case), due to fuel mix improvements (where natural gas replaces fuel oil as the dominant feedstock for power generation) and energy efficiency improvements as a result of regional energy market integration (Hung, 2009).

Energy efficiency has become widely recognized as one of the most cost-effective ways of enhancing energy security, addressing climate change and promoting competitiveness in industry in ASEAN. Thanks to the integration in energy markets, Berger (2011) showed that by 2020, the ASEAN countries could achieve efficiency gains of between 12 per cent and 30 per cent, a projection that would translate into power savings ranging between119 TWh and 297 TWh, or US$ 15 billion and US$ 43 billion, respectively. Moreover, according to EIAS (2013), integrating power transmission among Asian countries would save considerable amounts of money through substituting hydropower for fossil fuels as well as reduce CO_2 emissions by 14 million tonnes per year by 2020.

An integrated electricity market could extend access to electricity and relieve peak demand. The integrated electricity market would result in more renewable energy being harnessed and lower the total cost of meeting the demand for energy (Wu et al, 2012).

There have been strong movements towards bilateral energy development and increasing trade among the ASEAN members. Cooperation in developing hydropower and ensuing bilateral power trade between the Lao People’s Democratic Republic and Thailand could bring various benefits – lower energy system costs, better environmental quality, greater energy diversification and significant export revenues (Watcharejyothin and Shrestha, 2009).

Small-scale power distribution systems in many ASEAN members, incorporating modern technology, can be cost-effective, scalable and financeable (Taw, 2013). Through energy market integration, reduced expenditure on energy imports would significantly have long-term economic benefits for each ASEAN member as well as the region as a whole. By considering three scenarios (no trade, 20 per cent trade and 50 per cent trade in energy) for developing optimal power generation capacity and their impacts on energy market integration in ASEAN (table 5), Chang and Li (2013) found the level of benefit of integration resulting from the reduction in expenditure on the energy. Specifically under the scenarios of partial trade (20% and 50% capacity), the present value of cost savings would be 20.9 billion USD (3.0 per cent), and 29.0 billion (3.9 per cent), respectively. Thus, even with partial integration (cross-border power trading), substantial cost reduction could be realized (table 5).

Table 5. Key findings from different scenarios in the electricity trade

Scenario	Total cost savings	Development of additional capacity (top four in turn)
No trade	n.a.	Gas, coal, hydro and geothermal
20 per cent of demand met by trade	3 per cent (US$ 20.9 billion)	Gas, coal, hydro and geothermal
50 per cent of demand met by trade	3.9 per cent (US$ 29 billion)	Gas, coal, hydro and geothermal

Source: Chang and Li, 2012.

The energy market integration projects in ASEAN have significant security implications for the participating countries through diversity and affordability. In other words, efficient energy market integration will operate uninterrupted by oil price volatility, with the capability to diversify the regional resources. Among the ASEAN members, even though less developed countries may be at a disadvantage, integration will enable them to become more diversified by sharing new technologies (Hamid et al, 2011). Through energy integration, the diversification of the regional energy mix, for example, a shift from coal and oil to biomass and nuclear power) will contribute to improvement in the regional energy security as well as carbon intensity (Malik, 2011).

An integrated energy market would make access to modern energy supply easier and produce fewer amounts of pollutants. The Energy Development Indicator (EDI) can be used to examine the status of access to modern energy among various countries (IEA, 2012).

3. Environmental benefits

In parallel with the increase in energy consumption, CO_2 emissions are a critical issue globally with regard to energy sustainability. The potential benefits of CO_2 emissions reduction through regional dynamic energy markets with energy grids are emerging as one of the most effective means of enhancing energy security and reducing the emissions of greenhouse gases by facilitating the increased use of diversified energies. The integration of the energy market could yield substantial positive gains for the East Asian region as a whole in terms of GDP growth and CO_2 emissions reduction (ERIA, 2010). Similarly, through energy market integration, a 10 per cent reduction of subsidies for energy commodities would slightly reduce the CO_2 emissions of the East Asian region as a whole by 0.23 per cent. Among others, in the countries associated with larger energy subsidies, such as Indonesia and Malaysia, CO_2 emissions reduction effects would be greater (Wu, 2012).

In the ASEAN members, according to the estimation provided by Hung (2009), the 4 per cent annual growth in primary energy consumption will result in a corresponding 5.1 per cent growth in CO_2 emissions. This is due largely to the projected 6.9 per cent annual escalation of coal consumption, which is the most carbon-intensive fossil fuel. The similar 4 per cent annual growth rates in oil and natural gas consumption will also contribute to an increase in emissions. However, energy market integration would allow national Governments of the ASEAN members to more easily address such issues. Furthermore, other main energy policy challenges include security of energy supply and/or demand, economic efficiency of the energy sector and social equity (particularly access to affordable modern energy) would be solved (Andrews-Speed, 2011).

A simulation study of bilateral power trade between the Lao People's Democratic Republic and Thailand shows that environmental gains would accrue to both countries together with economic gains. It shows that CO_2 emissions would decrease by 2 per cent when compared with the base case (Watcharejyothin and Shrestha, 2009). If this CO_2 emissions reduction potential is extrapolated to the other ASEAN or Asian countries, the level of CO_2 emissions reduction would be non-marginal.

E. Conclusion

There are three broadly defined categories of integration – economic, market and energy market integration. Economic integration has five different stages in terms of the degree of removal of tariffs and openness. A free trade area is the lowest level in the economic integration while complete economic integration is the highest one. ASEAN Free Trade Area (AFTA) is currently the only economic integration in the region. AEMI can be considered another economic integration.

Market integration can be accomplished if prices among different markets exhibit similar patterns in the long term. The benefits of market integration are that there would be economies-of-scale among market energy firms and market firms would become efficient and innovative. AEMI will be a form of energy market integration in the region, which will bring convergence in prices in the long term, make the economy-of-scale viable and strongly encourage firms to be efficient and innovative.

Energy market integration in the region can be achieved through the standardization of energy products, which will bring price equalization and an increase in welfare due to decreases in energy prices. It would bring the ASEAN members comparative advantages in primary energy products. AEMI, as a form of energy market integration, will provide more efficient energy product prices through the reallocation of resources from less efficient energy product providers to more efficient ones and, hence, lead to equal energy product prices. The benefits of equal and lower energy prices are quantified by equivalent variation (EV) and compensation variation (CV). The results present direct positive impacts on welfare for the ASEAN members.

The experiences of the European Union in energy market integration offer valuable lessons for promoting AEMI. The strategies used in the European Union were to integrate the energy markets and make them competitive. The lessons drawn from the European Union experiences are: (a) the completion of energy market reform; (b) balancing regulatory governance between national regulatory agencies and a European Union-wide regulatory agency; (c) avoidance of a slow decision process; (d) an agreement on the structure of a future integrated energy market; and (e) adapting future challenges and reflecting non-market considerations in the integrated energy market. Apart from the European Union experience, there have been strong movements in integrating electricity markets in West Africa.

One of the two key lessons for ASEAN with regard to creating successful AEMI, is the establishment of an appropriate institution comprising national power utilities. The other lesson is the creation of a regional operational regime for power transmission. These are the key lessons for achieving success. However, there are also other lessons to be learnt: harmonization of environmental and social rules and regulations; the implementation of a utility-led institutional framework; a power pool as an arrangement between two or more interconnected electric systems; a practical mechanism for an interconnected power system; and a strong legal basis for regional interconnection.

AEMI will help the ASEAN Economic Community (AEC) function well by making energy products and services flow freely, which, in turn, will make energy product prices converge and stable, and encourage firms to be more efficient and innovative. With an integrated energy market, in place ASEAN will enjoy various benefits such as economic, energy and environmental benefits. Higher welfare, measured in equivalent variation (EV), and increases in GDP among member countries are seen as the main economic benefits of AEMI. The welfare benefits range from US$ 58.66 million for the Lao People’s Democratic Republic to US$ 8,856.67 million for Indonesia. An EV approach presents an increase in real GDP for the ASEAN members that could reach between 1 and 3 percentage points of real GDP. Specifically, real GDP would be 0.89 per cent higher for Cambodia and 3.46 per cent higher for Malaysia. Other economic benefits are converging and stable prices, higher foreign direct investment in the region and a more elastic demand that gives consumers more choices.

Apart from the economic benefits, AEMI will provide energy benefits such as improvements in energy security, higher energy efficiency, lower energy system costs, better access, a higher level of energy diversification and improvements in energy development indicators. By linking energy-deficient countries to energy-abundant countries in the region, AEMI will enhance the level of energy security for all those countries. It will also reduce the energy intensity of the countries and, hence, increase energy efficiency. With an integrated energy market, the energy intensity level is expected to reach 452 TOE in 2030 due to a more diversified fuel mix, and higher availability of efficient and cleaner fuels.

AEMI is expected to decrease energy system costs by 3 per cent if up to 20 per cent of each ASEAN member's demand is allowed to be imported, and by 3.9 per cent if up to 50 per cent is allowed. AEMI will enable energy diversification among the countries and, hence, they can become more resilient to exogenous energy shocks. AEMI will raise energy development indicators by enabling greater access to modern energy and producing less amounts of pollution.

Together with economic and energy benefits, AEMI would bring environmental benefits to the ASEAN members. The key environmental benefit will be lower levels in CO_2 emissions. A simulation study of the power trade between two countries shows that the power trade via an integrated energy market could decrease CO_2 emissions by 2 per cent compared with a base case.

The various benefits of AEMI support the necessity for integrating the energy markets in the region. Through AEMI, the materialization of these benefits will be much easier under the AEC, where energy products and services will be able to flow freely. AEMI is therefore an important part of the move towards the implementation of the AEC.

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