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ASEAN ENERGY MARKET INTEGRATION (AEMI)
AEMI FORUM

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DRAFT AEMI PAPERS

The *ASEAN Energy Market Integration (AEMI)* initiative addresses ASEAN triple energy challenges: (1) *energy gap*, resulting from the doubling of ASEAN energy demand by 2030 due to the steady increase in energy demand (4.4% per annum to 2030) necessary to sustain continuous economic growth (5.2% per annum), population growth, greater electrification rates, and expansion of the transport sectors throughout the region; (2) *energy dependence*, due to a significant increase in vulnerability to energy imports, particularly on Middle East oil; (3) *energy footprint*, with a doubling of ASEAN contribution to global carbon emissions by 2030, and direct implications on the environment in the region and beyond.

The *AEMI Initiative* was fueled by an emerging consensus among a number of ASEAN academics that a successful AEMI would be a necessary condition for achieving sustainable growth in the framework of the *ASEAN Economic Community* (AEC). It would enhance energy security and environmental viability across the region and undoubtedly yield significant benefits to all involved, from the economic, societal, and environmental perspectives. These academics from across ASEAN (with the exception of Myanmar thus far) have constituted themselves into an *AEMI Group*, as part of their commitment to work together to develop AEMI in the framework of the AEC. The 31st Senior Officials Meeting on Energy (SOME) endorsed the AEMI initiative last June in Bali.

The *AEMI Forum* is convened on behalf of the *ASEAN Secretariat*, the *ASEAN Centre for Energy*, *Chulalongkorn University* as well as the *AEMI Group*. Participants include Senior Officials of Energy (SOEs), representatives from ASEAN Specialized Energy Bodies (ASCOPE, HAPUA, AFOC) and Subsector Networks (RE, EE&C, REPP, NEC), as well as some government officials, international organizations, and research institutes. The purpose of the *AEMI Forum* is to engage a dialogue between academics (the *AEMI Group*) and policymakers (ASEAN officials) on *AEMI* and seek their feedback and guidance in an *informal* academic setting.

For this purpose, the members of the *AEMI Group* have prepared *AEMI Papers* as a first step to provide analytical underpinnings for the rational for AEMI, its building blocks and its implementation. The *AEMI Papers* focus essentially on three analytical dimensions: (a) *Why* – Investigating the rationale for AEMI and its potential benefits for every nation within the AEC; (b) *What* – Identifying the key building blocks for AEMI from the policy and operational perspectives; and (c) *How* – Determining the sequencing and strategy for the emergence of AEMI. The *AEMI Group* will present the findings from their *AEMI*.

The present *Draft AEMI Papers* should serve as a background to the discussion during the *AEMI Forum.* They will be finalized shortly thereafter and published by the *ASEAN Studies Center*, *Chulalongkorn University*, as part of the proceedings of the *AEMI Forum.*

I. Rationale for AEMI

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1. Introduction

The ASEAN region has been experiencing buoyant economic growth for the past few decades and is expected to expand further into the future. GDP per capita for ASEAN is projected to be more than double from 2010 to 2030, reaching USD 3736/person (in 2000 USD) indicating a general improvement in lifestyle and income for the member countries, as well as strong population and economic growth rates. To meet this strong growth, primary energy demand in the region will also double over the same time period to reach 956 Mtoe in 2030 (IEEJ, 2013, p.160).

This thirst for energy will likely cause various energy security and environmental issues in the near future. It has been posited that integrating the ASEAN energy market may "lead to a less volatile, more flexible and resilient market through regional cooperation such as infrastructure connectivity, trade and investment arrangement, and the harmonization of regulatory and technological framework" (ERIA, 2011). To better understand the rationale behind creating an integrated ASEAN energy market, it is important to first understand the current energy situation in ASEAN countries, as a whole and as individual nations.

This background paper will represent the rationale behind creating an integrated ASEAN energy market by first reviewing the existing national energy conditions across ASEAN and then defining the concept of the ASEAN Energy Market Integration (AEMI). This will serve as a common platform for identifying gaps and opportunities in developing and integrating ASEAN energy markets.

Scope of Work

The scope of this paper can be broadly categorised under two objectives:

1. Mapping out the ASEAN Energy Challenge
    - Map out current national energy market conditions across ASEAN, indicating the extent and nature of "energy balances" (gas, oil, coal, electricity, renewable energy) and identify where energy resources lie across ASEAN and where energy gaps are expected to be by 2030.

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- Map out current physical infrastructure, indicating potential energy flows from energy surplus to energy deficit countries within ASEAN, given the current state of connectivity; and
- Provide an overview of ASEAN national energy market structures and policies.

2. Defining ASEAN Energy Market Integration (AEMI)

- Review definitions of energy market integration in the context of the EU and East Asia (EMI) and provide a definition for AEMI, using terminology consistent with that of the ASEAN Secretariat.
- Establish the core objectives pursued by AEMI, notably to achieve open and competitive national energy markets across ASEAN, which are physically and institutionally integrated; and
- Identify AEMI hardware components (e.g. infrastructure, physical energy trading), as well as software ones (e.g. policies, standards, regulations) needed for AEMI to deliver its promise.

Methodology

This study will encompass four main areas:

1. Reviewing the existing national energy conditions across ASEAN

   The idea is to provide an overview of ASEAN energy demand and supply trends, national energy market structure and relevant energy policies by reviewing the available studies, outlooks and databases (listed below).

Energy Database and Outlooks Available

Publication	Publication Details	Outlook Details	Scenarios
The 3rd ASEAN Energy Outlook	Published in February 2011 by ASEAN Centre for Energy and The Institute of Energy Economics, Japan (IEEJ)	Base Year: 2007 Projection Years: 2008-2030 Data: Disaggregated energy data for all ASEAN countries	1. Business-As-Usual 2. Alternative Policy Scenario: assumes energy savings targets are met for each country
The Asia/World Energy Outlook 2012	Published in January 2013 by IEEJ	Base Year: 2010 Projection Years: 2011-2035 Data: Aggregated energy data for all ASEAN countries, disaggregated data available for Indonesia, Malaysia, Philippines, Thailand, Vietnam and Singapore (6/10 ASEAN countries)	1. Reference Scenario 2. Technologically Advanced Scenario

Energy Database and Outlooks Available (continued)

Publication	Publication Details	Outlook Details	Scenarios
APEC Energy Demand and Supply Outlook 5th Edition 2013	Published in February 2013 by Asia Pacific Energy Research Centre	Base Year 2009, Projection Years: 2010-2035 Data: Disaggregated energy data available for Brunei Darussalam, Indonesia, Malaysia, Philippines, Thailand, Vietnam and Singapore (7/10 ASEAN countries)	1. Business-as-usual Scenario 2. High Gas Scenario 3. Alternative Urban Planning Scenario 4. Virtual Clean Car Race
Asian Development Outlook 2013	Asian Development Bank	Only historical macroeconomic data	

A suitable database/projection has been chosen that can be used as a basic reference point for the whole AEMI study. So far, the best candidate is the IEEJ's Asia/World Energy Outlook as this is the latest publication, covers all ASEAN countries and has taken into account the latest energy developments and policies in their methodology (i.e.: rapid economic growth in the region, Fukushima Nuclear Accident, and latest renewable energy policies etc).

2. Reviewing the ASEAN resource availability and accessibility

As before, existing studies on potential energy resources (gas, coal, oil, electricity, renewable energy) and energy infrastructure (electricity grid and gas pipelines) will be reviewed to provide an overview of ASEAN resource availability and accessibility. Some of the information sources that have been identified are compiled as below.

Information on Energy Resources Availability by Country

- World Energy Resources 2010
- BP Statistical Review of World Energy 2012
- US Geological Survey
- Clean Energy Info Portal
- Energy Information Agency, International Energy Database 2013

Information on the existing and future energy interconnections for the ASEAN region will be based on the ASEAN Centre for Energy 2013 publication, Development of ASEAN Energy Sector.

3. Mapping out the ASEAN energy challenge

   With a clear idea on how the geographical distribution of energy resources and demand lies across the region, as well as the current state of connectivity, it would be possible to map-out the potential energy flows within ASEAN from areas with energy surplus to areas with energy deficit. At the same time, using energy demand projections up to 2030, areas where Energy Gaps will tend to occur can be identified. It would also be possible to determine whether the overall ASEAN Energy Gap can be sufficiently addressed by improving energy efficiency and technology alone, or further cooperative measures are required.

4. Defining the AEMI

   The definition of AEMI will be based on reviews of existing definitions of energy market integration, for instance under the EU and East Asia (EMI) context, will the terminology be consistent with that of the ASEAN Secretariat. The major components of AEMI will likely be investment, trade, infrastructure, national market openness, and energy pricing. A quick review of the current status of these five areas under the AEMI will be done to identify the AEMI hardware components (e.g. infrastructure, physical energy trading), as well as software components (e.g. policies, standards, regulations) needed for AEMI to deliver its promise.

2. Energy Demand and Supply in ASEAN

2.1 Historical Trends and Outlook in Energy Demand and Supply

The latest aggregated information available for ASEAN is the IEEJ Asia/World Energy Outlook 2012 (http://eneken.ieej.or.jp/en/whatsnew/410.htm).

Energy and Economic Indicators

In the past, energy demand in ASEAN was driven by strong GDP and population growth. While GDP and population growth is projected to gradually slow down in future, with improving GDP per Capita, shift from rural to urban lifestyle, increasing use of automobile ownership, more industrialised economic structure etc, primary energy consumption per capita is expected to more than double from 0.77 Mtoe per Capita in 2010 to 1.63 Mtoe per Capita in 2035.

Table 1: Energy and Economic Indicators (IEEJ, 2013)

Energy and economic indicators								AAGR (%)				
	1980	1990	2000	2010	2020	2030	2035	1990-2010	2010-2020	2020-2030	2030-2035	2010-2035
GDP ($2000 billion)	214	367	601	992	1,643	2,507	3,043	5.1	5.2	4.3	4.0	4.6
Population (million)	348	430	504	571	628	671	689	1.4	1.0	0.7	0.5	0.8
CO_2 emissions (Mt)	205	358	705	1,086	1,706	2,427	2,864	5.7	4.6	3.6	3.4	4.0
GDP per capita ($2000)	615	855	1,193	1,738	2,615	3,736	4,417	3.6	4.2	3.6	3.4	3.8
Primary energy consump. per capita (toe)	0.21	0.32	0.55	0.77	1.07	1.42	1.63	4.4	3.3	2.9	2.7	3.0
Primary energy consumption per GDP*2	338	380	465	443	408	381	369	0.8	-0.8	-0.7	-0.6	-0.7
CO_2 emissions per GDP*3	956	974	1,172	1,094	1,038	968	941	0.6	-0.5	-0.7	-0.6	-0.6
CO_2 per primary energy consumption*4	2.83	2.57	2.52	2.47	2.55	2.54	2.55	-0.2	0.3	0.0	0.1	0.1
Automobile ownership (million)	4.5	10	20	36	56	88	108	6.6	4.6	4.6	4.3	4.5
Automobile ownership*5	13	23	40	63	89	131	157	5.1	3.6	3.9	3.8	3.7

*2 toe/$2000 million, *3 t/$2000 million, *4 t/toe, *5 vehicles per 1,000 people

Primary Energy Consumption

Primary energy consumption mix will be dominated by oil at 34% share in 2035, followed by coal and gas at 28% share each. Renewable energy will experience the highest growth during the same period, driven by improving technology and strong policy support.

Table 2: Primary Energy Consumption (IEEJ, 2013)

Primary energy consumption	Mtoe							Shares (%)			AAGR (%)				
	1980	1990	2000	2010	2020	2030	2035	1990	2010	2035	1990-2010	2010-2020	2020-2030	2030-2035	2010-2035
Total*1	72	140	280	439	670	956	1,124	100	100	100	5.9	4.3	3.6	3.3	3.8
Coal	3.6	12	32	84	161	257	319	8.9	19	28	10.0	6.7	4.8	4.4	5.5
Oil	58	88	153	197	265	339	379	63	45	34	4.1	3.0	2.5	2.3	2.6
Natural gas	8.4	29	71	122	192	268	310	21	28	28	7.4	4.6	3.4	2.9	3.8
Nuclear	-	-	-	-	-	12	19	-	-	1.7	-	-	-	10.6	-
Hydro	0.8	2.3	4.1	6.0	12	18	20	1.7	1.4	1.8	4.8	6.8	4.5	2.0	4.9
Geothermal	1.8	6.6	18	25	33	51	60	4.8	5.6	5.3	6.8	2.9	4.5	3.3	3.6
Other renewables	-	0.3	0.6	4.3	9.1	17	22	0.2	1.0	1.9	15.2	7.9	6.2	5.3	6.7

*1 Trade of electricity and heat are not shown

Final Energy Consumption

Industry sector will continue to be the largest energy consumer in the ASEAN region, as countries in the region continue to shift towards a more industrialized nation. Oil will continue to be the dominant fuel although at a lower share.

Table 3: Final Energy Consumption (IEEJ, 2013)

Final energy consumption	Mtoe							Shares (%)			AAGR (%)				
	1980	1990	2000	2010	2020	2030	2035	1990	2010	2035	1990-2010	2010-2020	2020-2030	2030-2035	2010-2035
Total	51	91	182	297	439	610	710	100	100	100	6.1	4.0	3.3	3.1	3.5
By sector															
Industry	18	28	59	101	155	221	260	31	34	37	6.6	4.4	3.6	3.3	3.8
Transport	17	32	62	92	123	156	174	35	31	25	5.4	2.9	2.5	2.2	2.6
Buildings, etc.	13	19	41	56	94	145	177	21	19	25	5.6	5.2	4.4	4.1	4.7
Non-energy use	2.4	11	21	47	67	88	99	13	16	14	7.4	3.6	2.7	2.4	3.0
By energy															
Coal	2.1	6.1	14	36	65	95	113	6.7	12	16	9.3	6.2	3.8	3.5	4.7
Oil	41	67	125	179	230	296	333	73	60	47	5.1	2.5	2.5	2.4	2.5
Natural gas	2.5	7.4	17	29	48	66	76	8.1	9.8	11	7.0	5.1	3.3	2.7	3.9
Electricity	4.7	11	28	52	93	147	181	12	17	26	8.0	6.0	4.7	4.3	5.1
Heat	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Renewables	-	-	-	0.9	2.6	5.6	6.6	-	0.3	0.9	-	11.2	8.0	3.2	8.3

Given that by 2009, only five ASEAN countries have achieved access to electricity of above 95%[5], the other ASEAN countries will likely continue to strive to provide better electricity access to their

[5] From The World Bank Database, "Access to Electricity" is defined as the percentage of population with access to electricity, and the ASEAN countries that have achieved above 95% are: Brunei Darussalam, Malaysia, Singapore, Thailand and Vietnam.

population in line with their individual Millennium Development Goals (MDG) targets. At the same time, even in countries with good electricity access, electricity use will also probably continue to grow.

This growing electricity use can mainly be contributed to the improving economies and lifestyle in ASEAN countries, which will entail the purchase of more electrical appliances for daily use like space cooling/heating, cooking, cleaning and even entertainment. ASEAN countries are currently plagued by traffic congestions, and a popular solution for this problem is to build electricity-based transit systems. These factors contribute to the projection that electricity consumption will almost double its share from 17% in 2010 to 26% in 2030 of the total final energy consumption mix.

Electricity

To meet the growing electricity demand, total electricity generated is expected to more than triple from 2010 to 2035. Most of the electricity will be generated from thermal energy, however with slightly decreasing share of 86% in 2010 to 83% in 2035. It is encouraging to see that non-fossil fuel has become increasingly important in the ASEAN electricity mix as these non-fossil fuels sources emit less carbon compared to fossil fuel combustion.

Table 4: Electricity Generation (IEEJ, 2013)

Electricity generated	TWh							Shares (%)			AAGR (%)				
	1980	1990	2000	2010	2020	2030	2035	1990	2010	2035	1990-2010	2010-2020	2020-2030	2030-2035	2010-2035
Total	62	154	370	674	1,256	2,007	2,449	100	100	100	7.7	6.4	4.8	4.1	5.3
Coal	3.0	28	79	185	404	716	926	18	27	38	10.0	8.1	5.9	5.3	6.7
Oil	47	66	72	59	84	97	100	43	8.8	4.1	-0.6	3.6	1.5	0.5	2.1
Natural gas	0.7	26	154	335	580	856	1,012	17	50	41	13.7	5.7	4.0	3.4	4.5
Nuclear	-	-	-	-	-	45	74	-	-	3.0	-	-	-	10.6	-
Hydro	9.8	27	47	70	137	212	235	18	10	9.6	4.8	6.9	4.5	2.0	5.0
Geothermal	2.1	6.6	16	19	38	59	69	4.3	2.9	2.8	5.5	7.0	4.5	3.3	5.2
Other renew., etc.	-	0.6	1.0	6.1	13	23	33	0.4	0.9	1.4	12.3	8.2	5.4	7.9	7.0

ASEAN Outlook as a Whole and the APAEC Initiative

The ASEAN economic growth projected for the next 25 years is encouraging; however, this economic growth will spur demand growth for energy, more than doubling from 2010 to 2035. This development may become unsustainable, as it will likely require increasing energy imports and producing more carbon emissions.

ASEAN leaders and policy makers have been fully aware of these implications, and the political will to jointly address these energy challenges were clearly expressed in the 1997 Summit Declaration entitled the ASEAN Vision 2020, in which the ASEAN Heads of Governments agreed to "establish interconnecting arrangements for electricity, natural gas and water within ASEAN through the ASEAN Power Grid and the Trans-ASEAN Gas Pipeline and promote cooperation in energy efficiency and conservation, as well as development of new and renewable energy resources".

A series of medium-term action plans are prepared to act as a blueprint for ASEAN cooperation in attaining the ASEAN 2020 Vision, and the current action plan, the third in the series, is the 2010 ASEAN Plan of Actions for Energy Cooperation (APAEC 2010-2015). The program areas relevant to the AEMI concept are included in the next two sections.

The APAEC 2010-2015 - Program Area No. 1

ASEAN Power Grid

Para #31: ASEAN recognizes the critical role of an efficient, reliable and resilient electricity infrastructure for stimulating regional economic growth and development. The continuing efforts of the ASEAN Member States in strengthening and/or restructuring their respective power market industry are oriented towards this direction. Currently, electricity is accessed by roughly 66% of the ASEAN peoples made available through grid power supply, stand-alone and distributed power generation systems. Electricity is produced through a mix of oil, gas, coal, hydro, geothermal and other renewable energy sources. Regional electricity production grew at an average yearly rate of 8% from 1990 to 2005 and is projected to grow at 6.1% annually from 2005 to 2030. Enhancing electricity trade across borders, through integrating the national power grids of the ASEAN Member States, is expected to provide benefits of meeting the rising electricity demand and improving access to energy services.

Para #32: The ASEAN Power Grid (APG) is a flagship program mandated in 1997 by the ASEAN Heads of States/Governments under the ASEAN Vision 2020 towards ensuring regional energy security while promoting the efficient utilization and sharing of resources. To pursue the program, ASEAN adopts a strategy that encourages interconnections of 15 identified projects, first on cross-border bilateral terms, then gradually expand to sub-regional basis and, finally to a totally integrated Southeast Asian power grid system. Currently, the APG is in progress with four on- going interconnection projects and additional 11 projects are planned for interconnection through 2015. The investment requirement of the APG is estimated at USD 5.9 billion. A potential savings of about USD 662 million dollars in new investment and operating costs is estimated resulting from the proposed interconnection projects.

Para #33: Objective: To facilitate and expedite the implementation of the ASEAN Interconnection Master Plan and to further harmonize technical standards and operating procedures as well as regulatory and policy frameworks among the ASEAN Member States.

Strategic Goals

- To achieve a long-term security, availability and reliability of energy supply, particularly in electric through regional energy cooperation in Trans-ASEAN Energy Network,
- To optimize the region's energy resources towards an integrated ASEAN Power Grid System, and
- To further harmonize all aspect of technical standard and operating procedure as well as regulatory frameworks among member country

Highlights

- Implement 15 interconnection projects of which 4 are in operation, 3 under construction, and 8 under preparation
- Total investment including upgrading of existing interconnections is estimated at USD 5.9 billion
- Projects are open for private and public sector investment, supported by the ASEAN Infrastructure Financing Mechanism (AIFM) which will be formulated by the ASEAN Finance Ministers

The APAEC 2010-2015 - Program Area No.2

Trans-ASEAN Gas Pipeline (TAGP)

Para #34: The ASEAN Vision 2020 emphasizes on the establishment of the interconnecting arrangements towards achieving a long-term security, availability and reliability of energy supply, particularly in oil and gas through regional energy cooperation in Trans-ASEAN Energy Network comprising of the Trans-ASEAN Gas Pipeline (TAGP) and the ASEAN Power Grid (APG). TAGP aims to interconnect the gas pipeline infrastructure of ASEAN Member States and to enable gas to be transported across the borders of the Member States. APG, on the other hand, ensures that gas for power is also being optimized with other potential sources of energy.

Para #35: The original TAGP aims to develop a regional gas grid by 2020, by linking the existing and planned gas pipeline networks of the ASEAN Member States. The updated ASCOPE-TAGP Master Plan 2000 involves the construction of 4,500 kilometers of pipelines mainly undersea, worth USD 7 billion. Eight bilateral gas pipeline interconnection projects, with total length of approximately 2,300 km, are currently operating. They are: i) P. Malaysia to Singapore in 1991, ii) Yadana, Myanmar to Ratchaburi, Thailand in 1999, iii) Yetagun, Myanmar to Ratchaburi, Thailand in 2000, iv) West Natuna, Indonesia to Singapore in 2001, v) West Natuna, Indonesia to Duyong, Malaysia in 2001, vi) South Sumatra, Indonesia to Singapore in 2003, vii) Malaysia-Thailand Joint Development Area ⌴ Malaysia via Songkla in 2004, and viii) Malaysia-Singapore in 2006. These interconnections form part of the backbone of energy security and sustainability of supply objectives of ASEAN to be accelerated by 2015 and serve as a key driver of growth to the various energy consuming sectors of the ASEAN economies.

Para #36: Over the years, natural gas demand has increased tremendously while new gas finds are not imminent to meet this new regional demand growing yearly at about 7-8%. ASEAN consumes approximately 10 billion cubic feet per day (BCFD) of natural gas. ASCOPE has reflected in its updating of the TAGP 2000 Study and Roadmap the latest gas supply and demand situation in the region. Findings indicated that there is a widening supply gap from 2017 rising to more than 12,000 MMSCFD by 2025. ASCOPE E&P BDC has been tasked to study on how best to further increase the gas supply. Many options are considered to address the future shortfall on gas such as exploring new discoveries in the region, or by increasing imports of LNG Gas. Coal Bed Methane (CBM) is also identified as possible additional supply source. However, the East Natuna gas field of Indonesia remains as the main source of energy in ASEAN for the future and its commercialization is the key to address the supply gap. The said gas field has about 70% CO2 and reserve of 45 trillion cubic feet (excluding CO2), with gas price that is affordable and competitive to alternative fuels, such as, coal or fuel oil. ASEAN Member States are also building LNG regasification terminals to supplement their energy needs. Moreover, ASCOPE and HAPUA are strategizing actions to strike a supply-demand balance for gas to be used in the TAGP and APG in view of the growing regional gas demand.

Para #37: **Objective**: To facilitate the implementation and realization of the Trans- ASEAN Gas Pipeline Infrastructure Project to ensure greater security of gas supply.

Strategic Goals

- To achieve a long-term security, availability and reliability of energy supply, particularly in oil and gas through regional energy cooperation in Trans-ASEAN Energy Network,
- To work on managing high CO2 gas fields,

- To commercializes East Natuna Gas Field to fulfill current demand and address future supply gap
- To further explore and secure additional gas supply from non-conventional source, i.e. Coal Bed Methane (CBM),
- To expedite the pipeline construction under ATGP Updated Masterplan 2008, once the East Natuna supply is available,
- To leverage existing bilateral pipeline interconnections for future gas mobility within the region.

Highlights

- To promote and increase cleaner coal use and trade for regional energy security,
- To strongly encourage the use of clean coal technologies through regional cooperation.

The APAEC 2010-2015 and the ASEAN Energy Market Integration

It is interesting to note that the APAEC 2010-2015 document, while advocating for the *integration* of energy networks (both pipelines and power grids), does not mention the introduction of a *trade/energy markets*. The existing cross border energy exchange thus far are limited to zero exchange or pre-established purchase agreement (bilateral) (ACE, 2013).

The establishment of a regional market will require political willingness and compromise among the governments. A truly competitive market needs suitable market structures, adequate guarantee of supply, common transmission networks with adequate access and pricing rules, a minimum level of harmonization among member markets involved (Pérez-Arriaga, 2010). For ASEAN, this will likely require further negotiations and legislation from the top-level that goes beyond bilateral agreements and network integration.

The next section on institutional framework, energy industry structure and relevant energy policies look at some of the criteria based on existing national conditions for each ASEAN member economies.

2.2 Institutional Framework, Energy Market Structure and Relevant Energy Policies

The following table contains an overall view of the energy institutional profile for each ASEAN country. Three categories are covered, the institutional framework (i.e. who regulates the energy sector?), the energy industry structure (i.e. who provides the energy services) and relevant energy policies (i.e. which laws and policies governs the energy sector?). This table focuses more on information related to gas and electricity as these are the commodities covered under the AEMI project (TAGP and AGP).

The information is collected from various sources; Clean Energy Info Portal (http://www.reegle.info/index.php); APEC Energy Demand and Supply Outlook 5th Edition (http://aperc.ieej.or.jp); and documentation/websites of the individual countries.

Table 5: Regulatory Conditions in Each ASEAN Economy

Country	Institutional Framework	Energy Industry Structure	Relevant Energy Policies
Brunei Darussalam	Energy sector is overseen by the Energy Department under the Prime Minister Office (EDPMO) Regulated energy prices.	Fully overseen the government. Electricity is provided by the Department of Electrical Services (DES) and Berakas Power Management Company (BPMC) O&G sector major players: Brunei Shell Petroleum, Total E&P Offshore	- Oil Conservation Policy (1981) - Brunei Natural Gas Policy (Production and Utilization) (2000) - Five-year National Development Plans

Country	Institutional Framework	Energy Industry Structure	Relevant Energy Policies
Cambodia	Overseen by Ministry of Industry, Mines and Energy (MIME) and its three departments: 1. Department of Energy Development 2. Department of Technique 3. Hydropower Department Electricity is regulated by Electricity Authority of Cambodia (EAC). Cambodia National Petroleum Authority (CNPA) regulates the petroleum sector.	Electricity provided by Electricity du Cambodge (EdC) (government-owned power utility) and IPPs. Private sector participation through IPP power purchase agreements.	- Power Sector Strategy 1999-2016 - Rural Electrification by Renewable Energy Policy (2006) - Renewable Electricity Action Plan (REAP) 2002-2012 - National Strategic Development Plan (NSDP) of Cambodia (2009)

Country	Institutional Framework	Energy Industry Structure	Relevant Energy Policies
Indonesia	Overseen by the National Energy Council (DEN). Ministry for Energy and Mineral Resources (MEMR) regulates the energy sector, along with its sub-agencies: - Directorate General of Oil and Gas - Directorate General of Mineral and Coal - Directorate General of Electricity - Directorate General of New Energy, Renewable and Energy Conservation Regulated energy prices.	O&G industry currently undergoing regulatory changes. E&P based on production sharing contracts with Pertamina (government-owned). Major IOCs operating in Indonesia are Chevron, Total, Conoco Philips, Exxon and BP. Downstream gas pipelines are operated by the state-owned gas distribution utility Perusahaan Gas Negara (PGN). Initial restructuring of the electricity took place in 1994. The Perusahaan Elektrik Negara (PLN) is the government-owned electricity utility that is the sole buyer and seller of electricity in the power market. The utility shares its generation business with IPPs and cooperatives. At the transmission and distribution level, certain assets have been decentralized (i.e. the Java-Bali Electricity Transmission Unit)	- National Energy Policy (2006) - Oil and Gas Law (Law No 21/2001) - Electricity Law (Law No 30/2009)
Lao PDR	Overseen by Ministry of Energy and Mines (MEM). Relevant departments under MEM are: - Department of Energy Promotion and Development (DEPD) - Department of Electricity (DOE) - Department of Geology and Mines	Electricity provided by state-owned, vertically-integrated utility Electricité du Laos (EdL).	- Electricity Law (1997) - National Policy on the Environmental and Social Sustainability of the Hydropower Sector (2005)

Country	Institutional Framework	Energy Industry Structure	Relevant Energy Policies
Malaysia	The key ministries and agencies for Malaysia's energy sector are: - Energy Unit of the Economic Planning Unit (EPU) of the Prime Minister's Department - Ministry of Energy, Green Technology and Water (KeTTHA) - Energy Commission (ST) Regulated energy prices.	Petronas holds exclusive ownership rights for O&G exploration and production. Other companies must operate through production sharing contracts (PSC). The electricity industry has been partially deregulated with participation by IPPs. The main government-linked electricity utilities are Tenaga National Berhad (TNB), Sabah Electricity Berhad (SESB) and Sarawak Energy Berhad (SEB).	- National Energy Policy (1979) - National Depletion Policy (1980) - Economic Transformation Program (2010)
Myanmar[6]	Ministry of Energy (MOE) is the focal point for overall energy policy and coordination and O&G regulation. Other ministries involved in energy sector are: - Ministry of Electric Power - Ministry of Mines (MOM) for coal - Ministry of Agriculture and Irrigation (MOAI) for biofuels and micro-hydro (for irrigation purposes) - Ministry of Science and Technology (MOST) for renewable energy - Ministry of Environmental Conservation and Forestry (MOECAF)	State-owned enterprises related to O&G sector: - Myanma Oil and Gas Enterprise (MOGE): E&P and transportation of O&G - Myanma Petroleum Products Enterprise (MPPE): Operates refineries, fertilizer plants, LPG plants and methanol plant - Myanma Petrochemical Enterprise (MPE): Operates the Marketing and Distribution of petroleum products	- Myanmar Electricity Law (1984) - Electricity Rules (1985) - The Petroleum Act (1934) - Petroleum Rules of 1937 (as amended in 1946) - National Environment Policy (1994) - Myanmar Energy Policy

[6] ADB, Myanmar Energy Sector Initial Assessment, http://www.adb.org/sites/default/files/myanmar-energy-sector-assessment.pdf

Country	Institutional Framework	Energy Industry Structure	Relevant Energy Policies
	- Ministry of Industry (MOI) for energy efficiency		
Philippines	Energy sector is overseen by the Department of Energy (DOE). The department has oversight of five government-owned and controlled corporations: - National Power Corporation (NPC) - National Electrification Administration (NEA) - Philippine National Oil Company (PNOC) - Philippine Electricity Marketing Corporation (PEMC) - Power Sector Assets and Liabilities Management Corporation (PSALM) Oil pricing is deregulated, electricity pricing is set by the Energy Regulatory Commission (ERC). The ERC also regulates the electricity sector.	O&G E&P activities are undertaken by private entities through service contracts with DOE, which is contracted through the annual Philippine Energy Contracting Round (PECR) Mechanism. The Wholesale Electricity Spot Market (WESM) was established in Luzon and Visayas. Other parts of the power market are serviced by the state-owned National Power Corporation (NPC) that generates its own electricity and buys from IPPs. Electricity distribution is serviced by a mixture of private utilities and electricity cooperatives.	- Philippine Energy Plan 2004-2013 - Electricity power Industry Reform Act (2001)
Singapore	Electricity and Gas industries are regulated Energy Market Authority (EMA).	Open electricity and gas markets. Domestic gas pipeline network is owned and operated by PowerGas Ltd. Generations companies compete in the National Electricity Markets of Singapore (NEMS) to sell electricity to the grid network operated by EMA.	Energy for Growth: National Energy Policy Report (2007) Gas Network Code (2008)

Country	Institutional Framework	Energy Industry Structure	Relevant Energy Policies
Thailand	Energy sector is overseen by the Ministry of Energy. Government agencies responsible for energy include the: - Office of the Minister - Office of the Permanent Secretary - Department of Alternative Energy Development and Efficiency (DEDE) - Department of Energy Business - Department of Mineral Fuels - Energy Policy and Planning Office (EPPO) - Electricity Generating Authority of Thailand (EGAT) - Energy Regulatory Commission - Nuclear Power Program Development Office	Three major state enterprises in the O&G sector are: - Petroleum Authority of Thailand (PTT) - PTT Exploration and Production Co. Ltd (PTTEP) - Bangchak Petroleum Public Co. Ltd (Bangchak) Electricity is generated by the Electricity Generating Authority of Thailand (EGAT) and IPPs, Small Power Producers (SPP) and Very Small Power Producers (VSPP). EGAT also owns the whole transmission system but electricity distribution and retailing is conducted by the Metropolitan Electricity Authority (MEA) and Provincial Electricity Authority (PEA).	- Power Development Plan (2012 Update) - Energy Business Act (2007)

Country	Institutional Framework	Energy Industry Structure	Relevant Energy Policies
Vietnam	The Ministry of Industry and Trade (MOIT) is responsible for the state management of all energy industries. Inside MOIT, the General Directorate of Energy administers the Viet Nam Electric Power Group (EVN), the Viet Nam National Coal and Mineral Industries Group (Vinacomin) and the Viet Nam Oil and Gas Group (PetroVietnam, or PVN). Power market is regulated by the Electricity Regulatory Authority of Viet Nam (ERAV) Regulated energy prices.	Upstream O&G production is carried out by PVN and private companies that have Product Sharing Contracts (PSC) with PVN. Downstream functions are carried out by PVN. Electricity is supplied by state-owned Electricité du Vietnam (EVN) and other companies that operate based on Build-Operate-Transfer and IPP schemes. The state maintains a monopoly on the transmission operations.	- National Energy Development Strategy (2007) - Electricity Law (2005)

National Regulations and the ASEAN Energy Market Integration

Table 5 clearly demonstrates the varied regulatory conditions throughout the ASEAN region. For electricity, the only country with a competitive market is Singapore. Some countries like Malaysia and Thailand have a deregulated supply side, but with no power purchase pool, the Philippines have power pools in certain parts of the electricity network, while other countries like Brunei Darussalam and Lao PDR are served by state-owned utilities. For natural gas markets, the majority of the ASEAN countries operate based on the Product Sharing Contract mechanism while access to the gas transmission pipeline are usually owned and regulated by state owned companies. Furthermore, the prevalence of national electricity utilities and price control mechanisms (i.e. subsidies) in several ASEAN countries will most likely become a challenge to AEMI development in the near future as certain ASEAN countries may choose to protect their national interests rather than pursuing regional objectives.

Obviously, there is still much to be done in terms of harmonizing energy institutions across ASEAN before AEMI could become a realistic option. Some of the key actions include:

- harmonization of technical, legal, regulatory and commercial frameworks
- adopting more trade-compatible industry structures (liberalization of energy markets)
- developing integrated transmission networks with transparent access for market players (both for gas pipelines and power grids, and includes technical access and common access tariffs)
- creating new regional level institutions (made up of national operators) that oversees the co-operation framework, administers disputes, organizes regional planning framework etc
- removing trade and investment barriers (rationalization of inefficient energy subsidies, creating a secure investment environment)

3. Mapping the ASEAN Energy Challenge

3.1 Energy Resources in ASEAN Countries

Current Availability

The ASEAN region as a whole is blessed with abundance of fossil fuel resources, namely oil, natural gas and coal. Oil and natural gas are largely concentrated in few countries – Indonesia, Malaysia, Vietnam and Brunei Darussalam. As for coal, Indonesia has the biggest recoverable coal in the ASEAN region at 6,718 Million Tons followed by Thailand (1,505 Million Tons). It is estimated that the ten member countries of ASEAN have 14 billion barrels of oil reserve, 286.6 trillion cubic feet of natural gas reserve, 9,408.4 billion tons of coal reserve. **Figures 1, 2 and 3** show the available reserves in ASEAN by countries, in 2012.

Figure 1: Crude Oil Proved Reserves by Country (EIA, 2013)

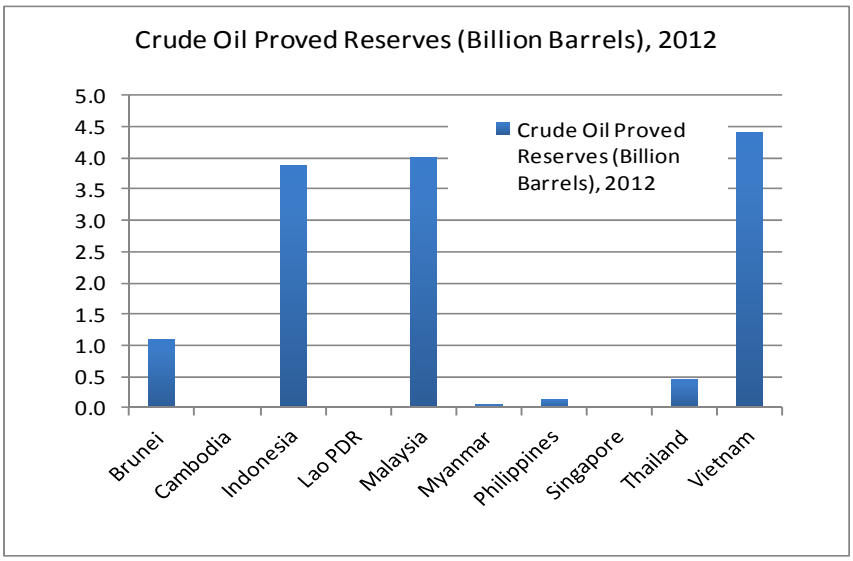


Figure 2: Proved Reserve of Natural Gas by Country (EIA, 2013)

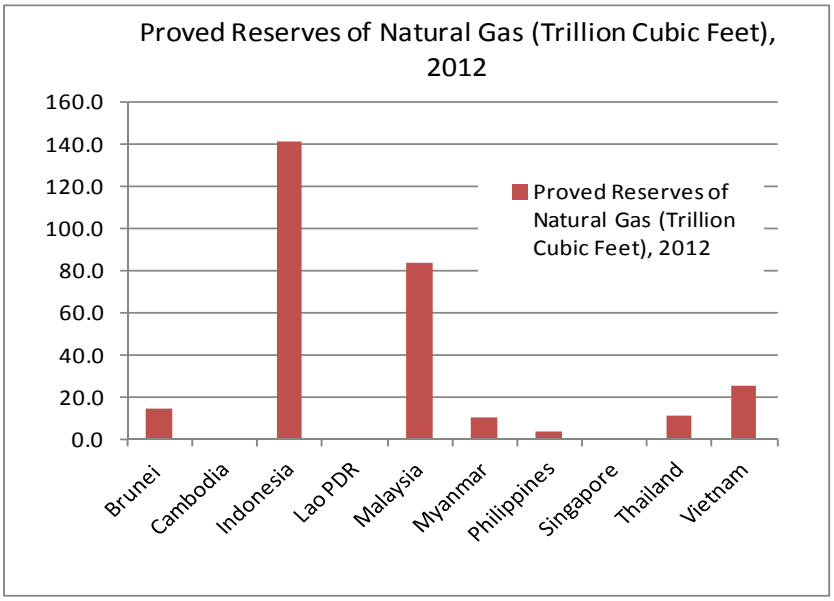
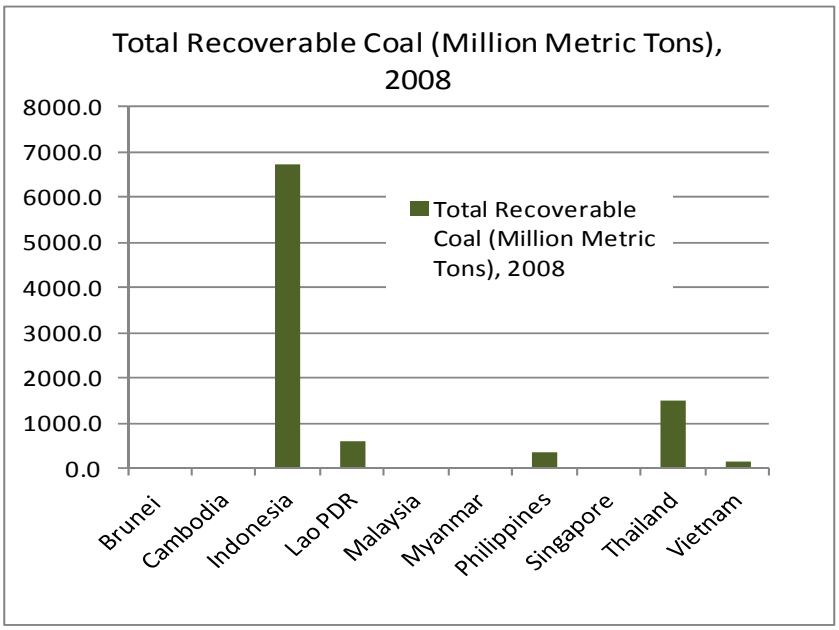


Figure 3: Total Recoverable Coal by Country (EIA, 2013)



ASEAN countries are also capable of harnessing their own indigenous renewable energy resources to produce electricity; however the type and amount of renewable energy available varies from country to country. The table below shows the renewable energy potential for hydropower and geothermal which illustrates the varied distribution of energy resources in ASEAN. Unfortunately, a common source for solar energy potential is not available, but based on a brief literature survey, it is clear that the region is highly suitable for solar photovoltaics but not solar thermal, and therefore there is much potential for solar PV installations in ASEAN countries, even for resource-poor Singapore.

Table 6: Renewable Energy Potential (WEC, 2010)

	Technical Hydropower Potential (TWh/year)	Geothermal Potential
Brunei Darussalam	N/A	-
Cambodia	34	-
Indonesia	402	27.67GW_e
Lao PDR	63	-
Malaysia	123	-
Myanmar	139	-
Philippines	20	4340MW_e
Singapore	-	-
Thailand	16	N/A
Vietnam	123	340 MW_e

Note: Hydropower and geothermal potential from (WEC, 2013)

ASEAN Energy Dependence Outlook

The Asia Pacific Energy Research Centre (APERC, 2013) has projected the Coal, Oil, Gas and Electricity production for seven of the ten ASEAN member countries. The expected total primary energy production and electricity production for these seven countries are tabulated as below. For detailed data on production by types of fuel, please refer to the tables provided by APERC at their website (http://aperc.ieej.or.jp).

Table 7: Total Primary Energy Production and Electricity Production (APERC, 2013)

	Primary Energy Production (Mtoe)			Electricity Production (TWh)		
	2009	2020	2030	2009	2020	2030
Brunei Darussalam	18.8	17.1	13.8	3.6	3.7	3.9
Indonesia	355.7	409.7	505.7	159.8	285.9	478.5
Malaysia	90	96.3	93.4	108.1	145.6	190.9
Philippines	24.3	29.1	28.9	67.1	103.8	154.7
Singapore	0	0.1	0.1	44.3	50.8	52.9
Thailand	61.7	70.3	80.9	152.8	196.7	269.7
Vietnam	78.9	100.1	116.1	92.2	173.8	313.9

Note: Statistics for Cambodia, Lao PDR and Myanmar are not readily available.

APERC has also projected the final consumption for these seven countries, however, for the sake of completeness; the table below includes the total final energy demand and total primary energy consumption for Cambodia, Lao PDR and Myanmar produced by the ASEAN Center for Energy in 2011. Note that the base year for these countries is 2007 and not 2009.

Table 8: Total Final Energy Demand and Total Primary Energy Consumption (ACE, 2011; APERC, 2013)

	Total Final Energy Demand (Mtoe)			Total Primary Energy Consumption (Mtoe)		
	2007/2009	2020	2030	2007/2009	2020	2030
Brunei Darussalam	0.9	1.6	1.6	3.1	3.1	3.1
Cambodia*	4.6	7.7	10.9	5.2	9.3	13.2
Indonesia	145.9	192.2	260.7	202.0	259.2	428.9
Lao PDR*	2.0	3.7	6.0	2.2	6.2	8.7
Malaysia	39.8	51.4	68.9	66.8	83.0	101.9
Myanmar*	14.0	21.6	32.6	15.7	23.8	35.2
Philippines	23.1	29.8	41.1	38.8	52.1	70.1
Singapore	14.1	18.2	21.0	18.5	27.2	29.8
Thailand	75.8	102.4	133.0	103.3	141.2	201.9
Vietnam	55.6	80.8	116.5	64.0	99.8	153.9

Note: *Statistics for Cambodia, Lao PDR and Myanmar are from (ACE, 2011) and the base year is 2007.

Based on available data, the energy self-sufficiency for 7 out of the 10 ASEAN countries can be calculated and the results tabulated as below. It can be easily observed that only two of the seven countries analyzed will remain energy independent by 2030, but even for these two countries, the self-sufficiency ratio is steadily declining.

Table 9: Energy Self-Sufficiency for ASEAN Countries

	Energy Self-Sufficiency		
	2010	2020	2030
Brunei Darussalam	6.1	5.5	4.5
Indonesia	1.8	1.6	1.2
Malaysia	1.3	1.2	0.9
Philippines	0.6	0.6	0.4
Singapore	0.0	0.0	0.0
Thailand	0.6	0.5	0.4
Vietnam	1.2	1.0	0.8

Note: Statistics for Cambodia, Lao PDR and Myanmar are not readily available.

The Looming ASEAN Energy Gap

Energy resources in ASEAN is unevenly distributed, as can be seen from Figures 1, 2 and 3, and Table 6, some countries are rich in fossil fuel resources, others have vast hydropower potential while some are resources-poor and have limited indigenous energy potential.

However, analysing the consumption and self-sufficiency projections for ASEAN economies reveals a worrying trend. Energy demand for each ASEAN country (even Brunei Darussalam) is projected to continue to increase up to and likely beyond 2030. For some countries, like Indonesia and Lao PDR, the increase is more than double of the demand at the base year. What this may mean is that energy production may be not enough to meet the rapidly increasing demand, that is, the supply-demand gap will keep increasing over the outlook horizon if 20 years. In fact, based on Table 9, by 2030, it seems likely that only Brunei Darussalam and Indonesia will remain self-sufficient.

The looming energy gap for ASEAN countries can be attributed to two main reasons; the rapidly increasing energy demand and the depleting energy reserves. There are also other factors that may further exaggerate the situation, for instance, technically available hydropower potential may not be exploitable if the cost of harnessing this potential is too expensive, or using nuclear energy for electricity generation may not be pursued if perceived as a risk to national stability.

3.2 Energy Trade in ASEAN Countries

Current Energy Trade in ASEAN Countries

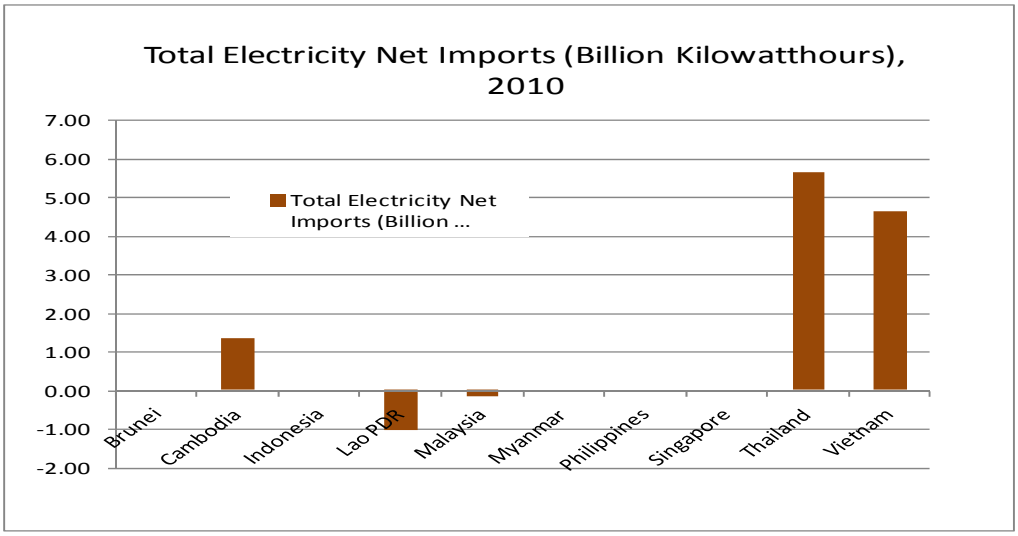
Trade is the import or export of commodity to or from a country. To keep consistency, for this report, the net import for each commodity is shown for each country where net import is the difference between energy import and export quantity for a particular country. A country with a *negative* net import is a country at a positive net export position (i.e. an exporting country). This indicator is important in order to determine the possibility of securing energy supply within the region through the existing and future energy infrastructure interconnection.

Four commodities are covered in this report: electricity, natural gas, coal and oil. It should be noted that electricity and natural gas can be traded between ASEAN member economies via either the ASEAN Power Grid (electricity) or the Trans-ASEAN Gas Pipeline (natural gas) while coal and oil are transported via more conventional means (road, rail or shipping).

Electricity Trade

Electricity net import position for all the ASEAN member countries are shown in **Figure 4**. Lao PDR and Malaysia are net exporters of electricity at 1.02 Billion KWh and 0.151 Billion KWh in 2010 respectively. On the other hand, Thailand and Vietnam both have high electricity net import values at 5.672 Billion KWh and 4.635 Billion KWh each in 2010. Cambodia is also a net importer of electricity at 1.357 Billion KWh in 2010.

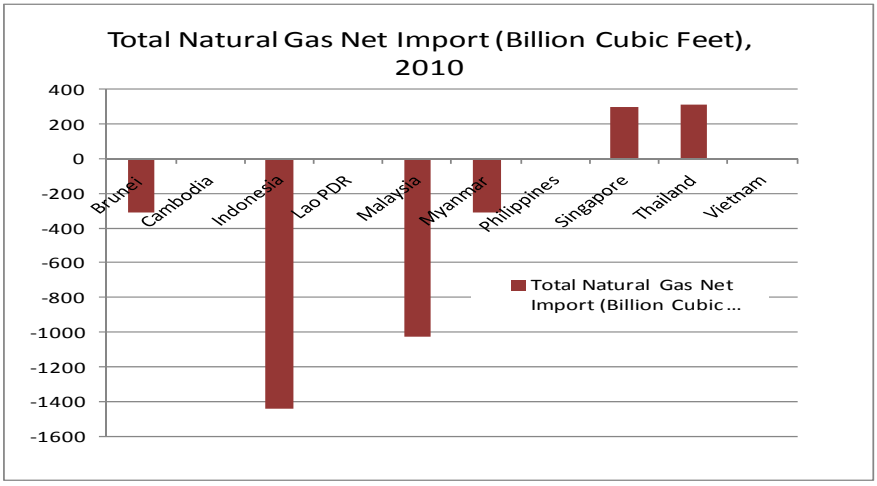
Figure 4: Electricity Net Import in ASEAN Countries (EIA, 2013)



Natural Gas Trade

In 2010, four of the ten ASEAN member countries are natural gas net exporters, namely Indonesia, Malaysia, Brunei Darussalam and Myanmar. Indonesia has the biggest net exporter value at 1,444.38 Billion Cubic Feet, followed by Malaysia (1,025.90 Billion Cubic Feet), Brunei Darussalam (311.83 Billion Cubic Feet) and Myanmar (311.13 Billion Cubic Feet). Singapore and Thailand are net importers of natural gas in 2010, at 311.13 Billion Cubic Feet and 296.65 Billion Cubic Feet respectively.

Figure 5: Natural Gas Net Import in ASEAN Countries (EIA, 2013)

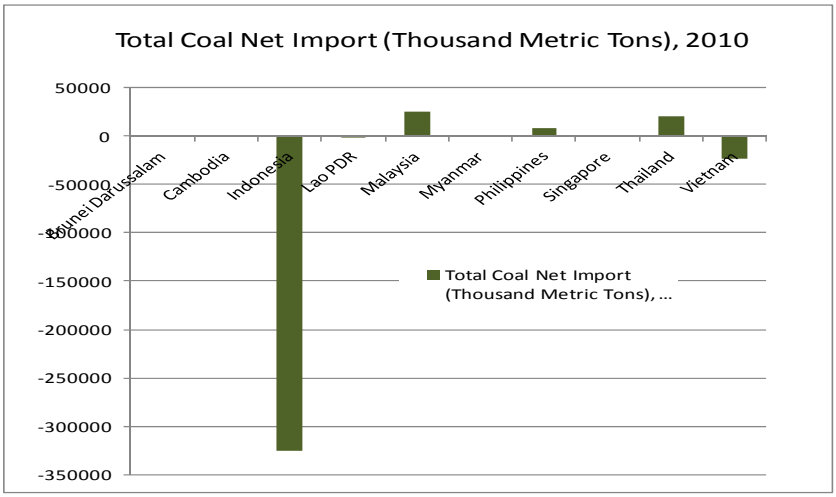


Coal Trade

Indonesia is the largest net exporter for coal in the ASEAN Region, amounting to about 324,606 Thousand Metric Tons in 2010. Vietnam and Lao PDR are also net exporters of coal, albeit at much lower values of at about 22,689 Thousand Metric Tons and 460 Thousand Metric Tons in 2010

respectively. On the other hand, five of the ASEAN's ten member countries are net importers of coal namely Malaysia, Thailand, Philippines, Cambodia and Singapore; this is mainly to fuel their power generation sector and for application in the Industry sector. **Figure 6** depicts the coal net import in the ASEAN Region.

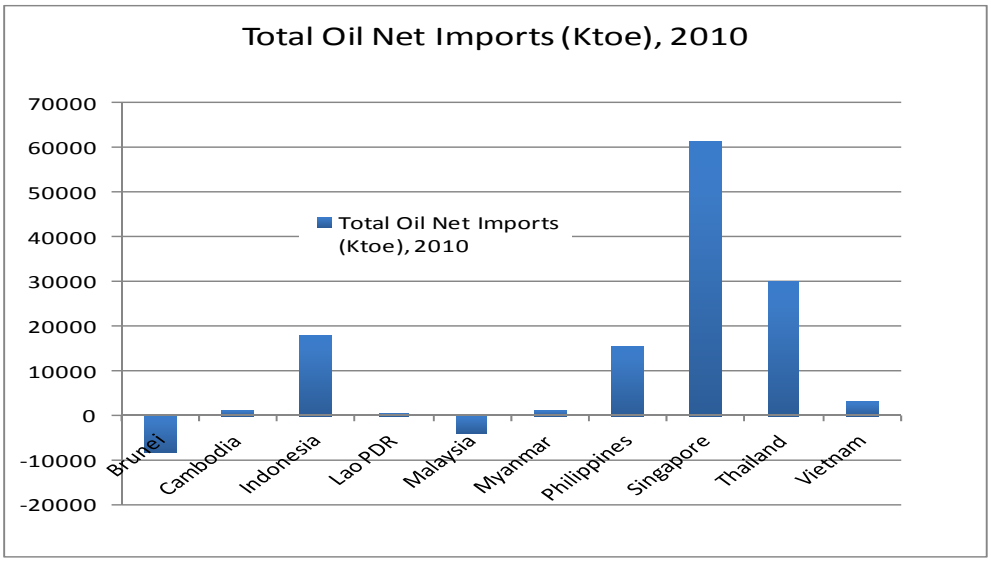
Figure 6: Coal Net Import in ASEAN Region (EIA, 2013)



Oil Trade

Figure 7 shows that most of the ASEAN countries are net oil importers in 2010; only Malaysia and Brunei Darussalam are oil net exporters. Oil is essential for the transportation sector.

Figure 7: Oil Net Import in the ASEAN Region (Pornkeratiwat, 2013)



Energy Sources Import/ Export Outlook

The Asia Pacific Energy Research Centre (APERC) in its 2013 publication has projected the Import/Export of Coal, Oil, Gas and Electricity for seven of the ten ASEAN member countries. **Tables 10 and 11** below are the projected net import values for coal, oil, gas and electricity of up to 2030.

It is projected that Indonesia will remain to be a major coal net exporter in 2030. Philippines, Thailand, Malaysia, Vietnam and Singapore will remain net importers of coal.

As for oil resources, all ASEAN member countries are expected to become oil net importers by 2030, with exception of Brunei Darussalam. Brunei will remain as oil net exporter throughout the projection period (2010 to 2030).

Table 10: Coal and Oil Net Import (APERC, 2013)

	Coal Net Import (Mtoe)			Oil Net Import (Mtoe)		
	2010	2020	2030	2010	2020	2030
Brunei Darussalam	0.00	0.00	0.00	-7.54	-6.66	-5.09
Indonesia	-141.56	-195.86	-278.68	19.28	53.63	98.74
Malaysia	9.37	14.05	11.99	-7.70	11.45	25.16
Philippines	2.87	7.74	18.59	13.72	17.10	25.14
Singapore	0.12	0.63	0.49	56.80	72.15	85.13
Thailand	10.02	14.95	17.56	34.50	49.32	69.74
Vietnam	-7.70	-4.03	7.45	-2.96	6.48	23.09

Note: Projections for Cambodia, Lao PDR and Myanmar are not readily available.

Through 2030, Malaysia and Brunei Darussalam are expected to remain net exporters of natural gas. On the other hand, Indonesia and Vietnam are expected to become net importers of gas by 2030, changing their status from net exporters of gas in 2020. Singapore and Thailand will likely remain natural gas importers throughout the projection period.

Thailand and Vietnam are projected to maintain their status as net importers of electricity through the projection period. Malaysia, on the other hand, will be a net exporter of electricity, albeit at a very low value.

Table 11: Coal and Oil Net Import (APERC, 2013)

	Gas Net Import (Mtoe)			Electricity Net Import (Mtoe)		
	2010	2020	2030	2010	2020	2030
Brunei Darussalam	-7.99	-7.14	-5.58	0.00	0.00	0.00
Indonesia	-27.06	-6.54	36.15	0.00	0.00	0.00
Malaysia	-21.81	-35.94	-32.16	-0.01	-0.02	-0.02
Philippines	0.00	0.00	0.00	0.00	0.00	0.00
Singapore	7.82	8.91	9.50	0.00	0.00	0.00
Thailand	4.16	11.17	19.34	0.49	2.63	3.85
Vietnam	0.22	-1.71	9.34	0.48	0.69	0.69

Note: Statistics for Cambodia, Lao PDR and Myanmar are not readily available.

3.3 Meeting the Energy Gap Challenge

This analysis on the historical trends and outlook of energy demand and supply shows that energy supply security concerns are three-fold;

i. Rapidly increasing energy demand.

ii. Over-dependency on fossil fuel resources to meet demand.

iii. Increasing dependence on energy imports due to depleting domestic resources.

These three factors will lead to increasing energy gap between demand and supply of energy for the ten countries in the ASEAN Region. It is possible for ASEAN member economies to take advantage of the physical proximities of demand and supply centers in order to secure the energy supply, particularly gas (via pipelines) and electricity (via power grids).

Potential Mitigation measures for the energy gaps

The strategic options to achieve sustainable energy development could also act as the potential mitigation measures for the energy gaps. These measures can be segregated into four main segments as discussed below.

i. Efficient utilisation of energy (EE).

By enhancing energy efficiency (EE) in the residential & commercial sector; reducing demand for personalised modes of transport and planned public transport scheme for the transportation sector; promoting cogeneration in industrial facilities and tackling technology inefficiency in the industry sector.

ii. Reducing carbon content of energy.

By developing renewable energy, development of low carbon electricity such as nuclear power plants, application of carbon capture and storage system at coal-based power plants, and increasing the use of alternate fuels and cleaner source of energy for transport sector.

iii. Diversifying sources of energy supply.

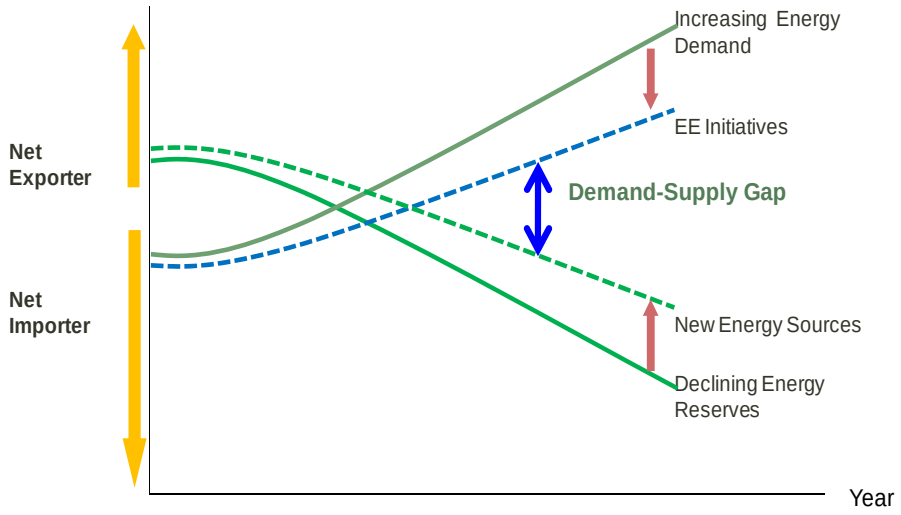
By intensifying hydro resources development; securing more gas from foreign sources; **strengthening and expanding supply infrastructures to facilitate regional interconnection** and exploring and building capacity for the nuclear options (Endang Jati et. al., 2013).

iv. Regional Interconnection of Energy Supply Infrastructure and Resources

The three measures to mitigate the energy gaps could be combined as depicted in **Figure 8** below. Energy efficiency measures will reduce the growth of energy demand, while declining energy reserves could be tackled by introducing new types of energy sources and by diversifying the location of the sources of energy supply.

Expanding energy supply infrastructure and resources to facilitate regional interconnection is one of the key measures to diversify the energy supply. In order to reduce the greenhouse emissions from the energy sector, measures to reduce carbon content of energy could be introduced concurrently with other measures.

Figure 8: Measures to Mitigate Energy Gaps

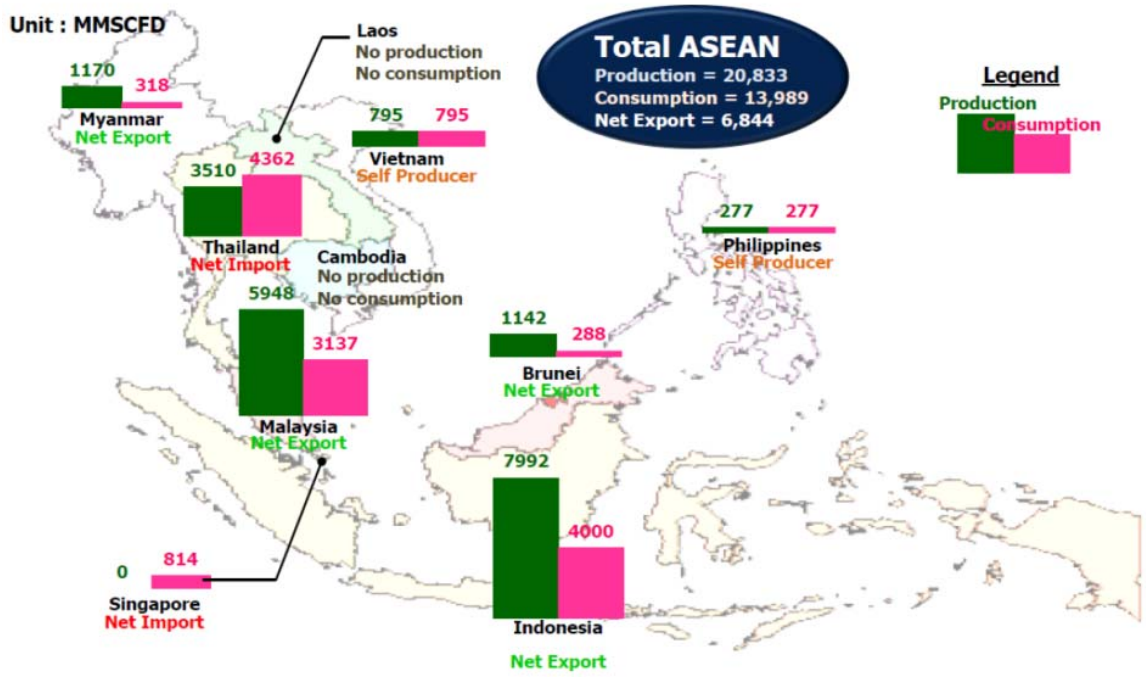


Note: Adapted from EPU, 2012.

3.4 Mapping the Potential Energy Flows from Energy Surplus to Energy Deficit Countries

In 2013, there are two energy interconnection infrastructures exist in the ASEAN Region, namely Trans-ASEAN Gas Pipeline to transport natural gas, and ASEAN Power Grid to transport electricity. Currently, there is enough supply of natural gas within the region to meet regional demand; as a group, the ASEAN Region is a net exporter of natural gas at 6,844 MMSCFD.

Figure 9: Natural Gas Production and Consumption in ASEAN Region



Note: Adapted from Pornkeratiwat, 2013

Current State of ASEAN Connectivity

1. The ASEAN Power Grid[7]

The Heads of State/Government of ASEAN Member States called for the establishment of electricity interconnecting arrangements within the region through the ASEAN Power Grid (APG) under the ASEAN Vision 2020 adopted in the Second ASEAN Informal Summit in Kuala Lumpur on 15 December 1997.

The ASEAN Power Grid is an effective ways for ASEAN member economies to essentially pool electricity, by the means of interconnecting the various independent power systems through transmission networks between neighboring countries. Technically, this will improve the overall network reliability and stability of the interconnected power grids. From an economic point of view,

[7] This section was adapted from ACE, 2013

expansion of power grids will allow investment economies of scale in power supply instead of individual power systems building independent facilities and these interconnections would enable ASEAN member states that exports electricity to earn revenue from the sales. At the same time, large interconnected system would offer more opportunities for environmentally favourable energy resources for power generation to be developed than the isolated and smaller ones (APERC, 2000).

The underlying concepts for the development of the ASEAN Power Grid are to:

(1) Maximize use of resources in the region to achieve best benefits for ASEAN
(2) Encourage development of large- scale power production in commercial scale
(3) Promote cooperation in the generation and use of power in ASEAN.

At the same time, the main objectives of establishing the ASEAN Power Grid are:

(1) to promote a more efficient, economical, and secure operation as well as to foster harmonious development of the national electricity network in the ASEAN countries by establishing or achieving a region-wide interconnection linking the member countries' national networks
(2) to optimize or maximize the use of energy resources in the region by sharing the benefits
(3) to reduce the financial burden from generation capacity expansion
(4) to share experiences amongst member countries
(5) to establish close power cooperation within the region

By 2013, the existing linkage of ASEAN Power Grid is listed in **Table 12** while Figure 10 shows the same interconnections on the ASEAN map. **Table 13** is a status report of current and future ASEAN Power Grid Interconnection Projects.

Table 12: Existing Linkage of ASEAN Power Grid (ACE, 2013, Table 2.5)

No.	Interconnected Projects	System	Capacity (MW)	Type	SCOD
1.	Thailand-Peninsular Malaysia				
	• Sadao-Chuping	HVAC	80	EE	1980
	• Khlong Ngae-Gurun	HVDC	300	EE	2002
2.	Thailand-Lao PDR				
	• Nakhon Phanom-Thakhek-Theun Hinboun	HVAC	214	PP: La→Th	1998
	• Ubon Ratchathani 2-Houay Ho	HVAC	126	PP: La→Th	1999
	• Roi Et 2-Nam Theun 2	HVAC	946	PP: La→Th	2010
	• Udon Thani 3-Na Bong-Nam Ngun 2	HVAC	597	PP: La→Th	2011
	• Sakhon Nakhon 2-Thakek-Theun Hinboun (Expansion)	HVAC	220	PP: La→Th	2012
3.	Peninsular Malaysia-Singapore				
	• Pentong-Woodlands	HVAC	450	EE	1985
4.	Viet Nam-Cambodia				
	• Chau Doc-Takeo-Phnom Penh	HVAC	200	PP: Vn→KH	2009
5.	Thailand-Cambodia				
	• Aranyaprathet-Banteay Meanchey	HVAC	100	PP: Th→Kh	2007
		Total	3,483		

SCOD stands for Scheduled Commercial Operating Date

Figure 10: Map of the ASEAN Power Grid (ACE, 2013)

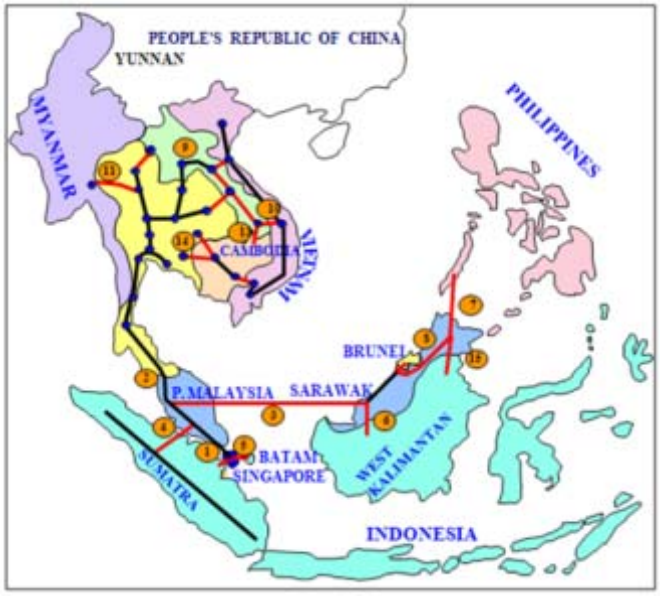


Table 13: Status of the ASEAN Power Grid Projects (ACE, 2013, Table 2.4)

No.	Interconnection Projects	Revised Earliest COD
1.	Peninsular Malaysia-Singapore (New)	2018
2.	Thailand-P.Malaysia:	
	• Sadao-Bukit Keteri	Existing
	• Khlong Ngae-Gurun	Existing
	• Su Ngai Kolok-Rantau Panjang	2015
	• Khlong Ngae-Gurun (2nd phase, 300 MW)	2016
3.	Sarawak-Peninsular Malaysia	2015-2021
4.	Peninsular Malaysia-Sumatra	2017
5.	Batam-Singapore	2015-2017
6.	Sarawak-West Kalimantan	2015
7.	Philippines-Sabah	2020
8.	Sarawak-Sabah-Brunei:	
	• Sarawak-Sabah	2020
	• Sabah-Brunei	Not Selected
	• Sarawak-Brunei	2016-2017
9.	Thailand-Lao PDR	
	• Roi Et 2-Nam Theun 2	Existing
	• Sakon Nakhon 2-Thakhek-Then Hinboun (Exp.)	2012
	• Mae Moh 3-Nan-Hong Sa	2015
	• Udon Thani 3-Nabong (converted to 500KV)	2017
	• Ubon Ratchathani 3-Pakse-Xe Pian Xe Namnoy	2018
	• Khon Kaen 4-Loei 2-Xayaburi	2019
	• Thailand-Lao PDR (New)	2015-2023
10.	Lao PDR-Viet Nam	2011-2016
11.	Thailand-Myanmar	2016-2025
12.	Viet Nam-Cambodia (New)	2016
13.	Lao PDR-Cambodia	2015
14.	Thailand-Cambodia (New)	2015-2017
15.	East Sabah-East Kalimantan	Feasibility Study
16.	Singapore-Sumatra	2020

2. Trans-ASEAN Gas Pipeline

The Trans-ASEAN Gas Pipeline project was endorsed by the 17th ASEAN Ministers on Energy Meeting (AMEM) in July 1999. The responsibility of implementing the project was entrusted to ASEAN Council on Petroleum (ASCOPE), in collaboration with national focal points and relevant institutions. During the 20th AMEM on 5 July 2002 in Bali, Indonesia, the Ministers signed the ASEAN Memorandum of Understanding (MoU) on the Trans-ASEAN Gas Pipeline (TAGP) Project, which sets out the cooperative framework for greater public-private partnership and collaboration in the Trans-ASEAN Gas Pipeline implementation (ACE, 2013).

The objectives of TAGP are to:

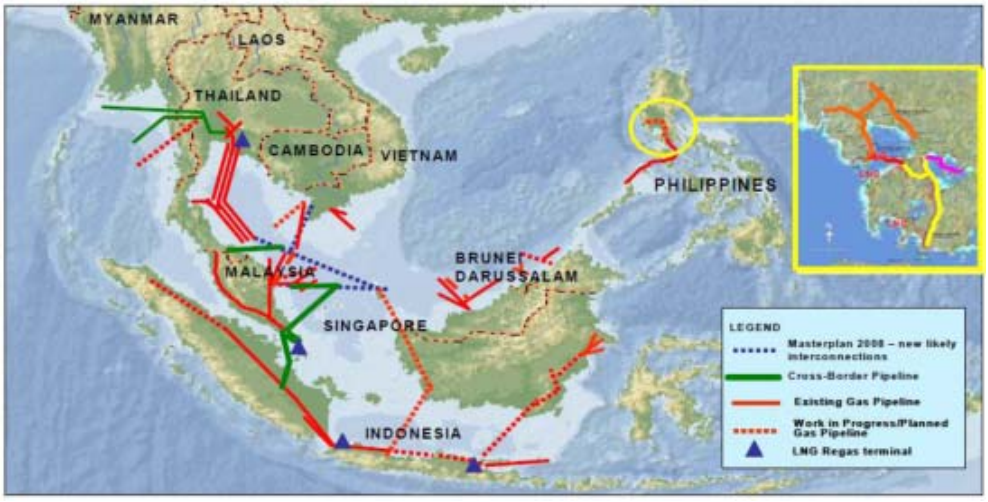
- Provide security of energy supply, which is essential for industrial development.
- Strengthen cross-border economic and political ties.
- Enable the members to share the least cost gas resources, which has environmental impact advantage compared to other energy resources

Currently there are eleven cross-border gas pipeline interconnection projects in operation; the total length of the gas pipeline is approximately 3,019 km. The 12th cross-border gas pipeline, a 150 km new pipeline connection from Myanmar to Thailand, will be in operation in 2013 (**Figure 11**). The gas infrastructure serves as a key driver of growth to the various energy-consuming sectors in the ASEAN economies. The list of existing pipelines is listed in Table 14.

Table 14: Existing Gas Pipeline Interconnections (ACE, 2013 and APAEC, 2010)

No	Interconnection	Completion Year	Length
1	P. Malaysia – Singapore	1991	5 km
2	Yadana, Myanmar to Ratchaburi, Thailand	2000	470 km
3	Yetagun, Myanmar to Ratchaburi, Thailand	2000	340 km
4	West Natuna, Indonesia to Singapore	2001	660 km
5	West Natuna, Indonesia to Duyong, Malaysia	2001	100 km
6	CAA-Malaysia	2002	270 km
7	South Sumatra, Indonesia to Singapore	2003	470 km
8	CAA-Vietnam	2007	330 km
9	Malaysia - Joint Development Area (JDA)	2009	100 km
10	Singapore to Malaysia	2006	4 km
11	Thailand - Joint Development Area (JDA)	2009	100 km
12	*M9-Thailand*	*2013*	*250 km*

Figure 11: Map of the Interconnection Gas Pipelines under the Trans-ASEAN Gas Pipeline Project (ACE, 2013)



Expanded State of Connectivity

1. ASEAN Power Grid

The updated status of ASEAN Power Grid Projects is listed in **Table 15**, these are on-going projects with Tariffs or Memorandums of Understanding (MOU) already signed.

Table 15: Updates on ASEAN Power Grid Status (ACE, 2013, Table 2.6)

No.	Interconnection Projects	System	Capacity (MW)	Type	SCOD
1.	Thailand-Peninsular Malaysia				
	• Su Ngai Kolok-Rantau Panjang	HVAC	100	EE	2015
2.	Peninsular Malaysia-Sumatra				
	• Malaka-Pekan Baru (Selected by AIMS-II, Priority Project)	HVDC	600	EE	2018
3.	Sarawak-West Kalimantan				
	• PPA signed in September 2012, Priority Project	HVAC	230	PP: Sw→WK (5 years) then convert to EE	2014
4.	Serawak-Sabah-Brunei				
	• Sarawak-Brunei (Committed in AIMS II)	HVAC	2x100	EE	2012 2016
5.	Thailand-Lao PDR				
	• Mae Moh 3-Nan 2-Hong Sa	HVAC	1473	PP: La→Th	2015
	• Udon Thani 3-Na Bong-Nam Ngiep 1	HVAC	269	PP: La→Th	2018
	• Ubon Ratchathani 3-Pakse-Xe Pian Xe Namnoy	HVAC	390	PP: La→Th	2018
6.	Lao PDR-Viet Nam				
	• Ban Hat San-Pleiku	HVAC	1,000	PP: La→Vn	2015
	• Nam Mo-Ban Ve	HVAC	TBC	PP: La→Vn	TBC
	• Xekaman 1-Thankhmy	HVAC	488	PP: La→Vn	2013
	• Stung Treng-Chau Doc	HVAC	207	PP: La→Vn	2014
	• Luang Prabang-Nho Quan	HVAC	1,410	PP: La→Vn	2015
7.	Lao PDR-Cambodia				
	• Ban Hat-Stung Treng (G2G Agreement)	HVAC	300	PP: La→Kh	2016
		Total	6,467		

SCOD stands for Scheduled Commercial Operating Date

2. Trans-ASEAN Gas Pipeline

East Natuna gas resource in Indonesia is estimated to be the main source of gas for ASEAN region in the future. Ability to exploit the gas resource is a key to address the supply gap (ACE, 2013). Proposed cross-border natural gas pipeline from East Natuna is listed in **Table 16**.

Table 16: Proposed Cross-Border Natural Gas Pipelines from East Natuna (ACE, 2013, Table 3.2)

<table>
<tr><th>No.</th><th>Cross-Border Pipeline</th><th>Length (km)</th><th>Note</th><th>Status</th></tr>
<tr><td>1.</td><td>East Natuna, Indonesia-JDA-Erawan, Thailand</td><td>1500</td><td rowspan="4">Commencement date will be approximately 7 years from East Natuna gas supply sanction. Approximate volume to make each pipeline viable is 1 BSCF/day (i.e. 36”- 42” diameter of pipeline)</td><td rowspan="4">Subject to Supply Commercial viability</td></tr>
<tr><td>2.</td><td>East Natuna, Indonesia-Kerteh, Malaysia</td><td>600</td></tr>
<tr><td>3.</td><td>East Natuna, Indonesia-Java, Indonesia</td><td>1400</td></tr>
<tr><td>4.</td><td>East Natuna, Indonesia-Viet Nam</td><td>900</td></tr>
<tr><td>5.</td><td>East Natuna, Indonesia-Brunei Darussalam-Sabah, Malaysia-Palawan, Philippines</td><td colspan="3">Regional assumptions on East Natuna Gas field have changed since the 2000 Original TAGP Master Plan. High demand and limited gas supply with high CO_2 content has increased cost of development of this pipeline.</td></tr>
</table>

AEMI and the ASEAN connectivity

The existing ASEAN connectivity for both gas pipelines and power networks are not yet at sufficient levels to allow for the seamless adoption of AEMI. However, this may not be a negative point. As discussed earlier, the current cross border interchanges for power in ASEAN are based on bilateral agreements since market integration was not a priority when the APEAC was first formulated. Therefore, if ASEAN countries decide to make AEMI a priority in the future, upcoming interconnections can be designed with the view of market integration.

4. The Integrated ASEAN Energy Market

Energy market integration (EMI) has been pursued in ASEAN and East Asia (EAS) for decades. However, no explicit definition of EMI has been established. What would be the vision and goals of EMI; how it should proceed in East Asia has not been clear at all (Shi and Kimura, 2010a, 2010b). To define the possible scenarios of EMI, it is worthwhile to review the development of EMI globally.

The European Union (EU) is one example often cited as a model for economic integration, including EMI. However, the EU still needs to do further work to realise all the competitive benefits that the EU aspires (Bannister et al., 2008). The European Union has been working on EMI between its member countries for many years, both in electricity and pipeline gas. Although the longer term goal of buyers and sellers operating competitively across national borders and without constraints has not been achieved, there has been some success, such as cross-broader energy flow (Bannister et al., 2008). The unachieved goal of competition may partly due to doubt in Germany and France that an ownership unbundling, that is, forcing large electricity-generating firms (monopolies and incumbent groups) to cede control over their distribution networks, is necessary for a better functioning energy market with better prices, greater supply security and environmental sustainability (Euractiv, 2007); and partly due to overlook or politically debating of important technical and regulatory challenges that lead to confusion about the best way to proceed with the liberalisation drive (Bannister et al., 2008). In summary, ownership unbundling, technical and regulatory challenges are still present while energy trade flows has occurred.

At the East Asia regional level, attempts to define EMI have started from 2010, with the launch of ERIA's study for the EAS Summit and its energy ministers. A conceptual framework was gradually developed for the study on EMI in East Asia, which effectively identify the major components of EMI in the whole EAS are: (i) trade liberalization, (ii) investment liberalization, (iii) development of regional energy infrastructure and institutions, (iv) liberalization of domestic energy markets, and (v) energy pricing reform, in particular, removal of fossil fuel subsidies (Shi and Kimra, 2010a, 2010b). The first four elements were agreed and pricing although sensitive, was noted explicitly by the fifth EAS Energy Ministers Meetings (ASEAN website, 2011).

Shi and Kimura (2011) argued that these five issues are important elements of EMI and are interrelated. A well-functioning and transparent national energy markets are essential to developing an open, competitive, and more integrated EAS regional energy market. In order to increase the efficiency of energy market, it is necessary to remove impediments and distortions that prevent the efficient functioning of the market. This should include, but not limited to, trade and investment liberalization and the reduction or removal of barriers, such as price restrictions, subsidies, and monopolies. A region-wide movement of energy products requires both physical infrastructure and institutions to be in place. This framework was also followed by the later ERIA studies on EMI including Shi and Kimura (2011) and Wu, et al. (2012).

The brief overview of EU and the EAS efforts on EMI finds that there is no single or authoritative definition of EMI. The definition of EMI depends completely on each regional block's background, including political willingness, and regulatory framework. In ASEAN, the EAS EMI framework proposed by ERIA should also be applicable due to the close relationship between ASEAN and EAS. Trade and investment liberalization has been achieved, or at least attempted, in the AFTA and AEC. ASEAN regional infrastructure has long been attempted with the ASEAN Power Grid (APG)

and Trans-ASEAN Gas Pipeline (TAGP) as the two flagship programs. Institutional apart from the infrastructure, such as Gas Swap Principle, has also been formulated recently(Shi and Malik, 2012).

The other two elements, domestic market liberalization and energy pricing reform, however, have rarely been mentioned in ASEAN. Fuel subsidies have a great presence in many ASEAN countries, such as Brunei, Indonesia and Malaysia. Energy subsidies are deep rooted in ASEAN social and political structures starting from the time of colonization because Western forces used cheaper energy as an instrument to reduce protests from the local people over extraction of natural resources (Kojima and Bhattacharya, 2011).

Plans or actions for liberalizing energy prices and removing subsidies for fossil energy have been implemented in many countries, such as Indonesia and Malaysia. However, little advancement has been demonstrated in these two countries to reduce the subsidy. Fuel subsidies are still heavy in Brunei, Indonesia and Malaysia. With such subsidy policies in place, countries have to close their boundaries. In order to prevent leakage of subsidies to others, limitations on purchasing fuels, and preventive smuggling measures, are often enforced in the boarders of Singapore-Malaysia, Thailand-Malaysia and Cambodia-Vietnam. In an integrated energy market, the national government would have difficulties, if not impossible, to control or manipulate fuel prices. The open market will bring fuels from cheaper to more expensive markets.

Similarly, for AEMI to be successful, it needs an open competitive national energy market as part of an integrated market. However, many ASEAN energy countries still have dominant national players, with electricity market as a distinguished example (Shi and Kimura, 2010b).

However, EMI in ASEAN is more promising than the EAS and it is possible to have a clear vision of ASEAN EMI in the near future. The situation in ASEAN is a little bit better than that in East Asia as ASEAN has an institutional goal of establishing ASEAN Economic Community (AEC), which provides an overall architecture for EMI. The ASEAN energy section has close relation with all the four pillars under the AEC. As a commodity group and production input, energy is a necessary part of the single market and production base. Pursuing a competitive regional market requires an open and competitive energy sector, in line with the national economy in general. Energy is also important to equitable economic development by providing electricity service to more than one hundred million people who have no access to electricity in ASEAN, in line with the aims of UN Conference on Sustainable Development (Rio+20). However, ASEAN Free Trade Zone, and AEC by 2015, is not a custom union as that in the EU. Each member state still has its own national tariff scheme, which however, has to be limited to 0-5% in the majority of cases. The segmental arrangements and the need for a clear vision make AEMI more challenging in moving towards an ASEAN energy market.

Given the above understanding a proposed vision for AEMI is as follows:

- By the end of 2015 when the ASEAN Energy Community (AEC) is expected to be established, ASEAN energy markets are likely to be a group of institutionally and physically connected, but not fully opened competitive national markets.
- After 2015, given the condition that AEC is seriously moving forward and ASEAN overcome its challenges to become an integrated glomeration, ASEAN energy market will emerge at first as a more harmonized, more open and competitive regional market with some national restrictions on investments and import of electricity. However, electricity

may be traded among member countries. The trading of electricity, if happened, will likely be stimulated by the development of hydroelectricity in the Greater Mekong sub-region.

- Another challenging step further is to achieve a fully liberalized and competitive national energy markets by 2030. Beyond 2030, we may see a regional energy market, which although does not have identical national energy markets, can allow free flow of energy goods, investment and services. Economically feasible electricity trade can be realized without any institutional constraints. The success of AEMI requires higher levels of political trust and commitment among ASEAN member countries. The ASEAN member countries can change from national energy security paradigm to an ASEAN regional energy paradigm.

5. Conclusion

This paper has touched upon two important issues relating to the rationale for ASEAN Energy Market Integration; namely mapping out the ASEAN energy challenges and defining ASEAN Energy Market Integration.

The ASEAN region has been experiencing rapid economic growth for the past few decades and is expected to expand further into the future; the regional economic growth projected for the next 25 years is encouraging and the GDP per capita for ASEAN is projected to be more than double from 2010 to 2030, reaching USD 3736 per capita (in 2000 USD). However, this economic growth will spur demand growth for energy, which expected to be more than doubling from 2010 to 2035. Energy demand for each ASEAN country (even Brunei Darussalam) is projected to continue to increase beyond 2030. For some countries, like Indonesia and Lao PDR, the increase is more than double of the demand at the base year. The implications are energy production unable to meet the rapidly increasing demand, further widening the supply-demand gap over the outlook horizon in 20 years.

The increasing energy gap for ASEAN countries can be attributed to two main factors namely; the rapidly increasing energy demand and the depleting energy reserves. There are also other factors that may further exaggerate the situation, for instance, technically available renewable energy and hydropower potential may not be exploitable if the cost of harnessing this potential is too expensive, or using nuclear energy for electricity generation may not be pursued if perceived as high risk to national safety and stability in the region.

This paper has identified four potential mitigation measures for the energy gap as follows; i) efficient utilisation of energy (EE) - enhancing energy efficiency (EE); reducing demand for personalised modes of transport and planned public transport scheme for the transportation sector; promoting cogeneration in industrial facilities and tackling technology inefficiencies in the industry sector; ii) reducing carbon content of energy - developing renewable energy, development of low carbon electricity such as nuclear power plants, application of carbon capture and storage system at coal-based power plants, and increasing use of alternate fuels and cleaner source of energy for transport sector; iii) diversifying sources of energy supply - intensifying hydro resources development; securing more gas from foreign sources; strengthening and expanding supply infrastructures to facilitate regional interconnection and exploring and building capacity for the nuclear options; and iv) regional interconnection of energy supply infrastructure and resources.

Energy resources in ASEAN are unevenly distributed, some countries are rich in fossil fuel resources, others have vast hydropower potential while some are resources-poor and have limited indigenous energy potential. Expanding energy supply infrastructure and resources to facilitate regional interconnection are some of the key measures to tackle the issue on energy gap and security.

Recognizing the importance of regional interconnection of energy supply infrastructure and resources, efficient utilisation of energy and reducing carbon content of energy, ASEAN leaders and policy makers have jointly expressed in the 1997 Summit Declaration entitled the ASEAN Vision 2020, in which the ASEAN Heads of Governments agreed to "establish interconnecting arrangements for electricity, natural gas and water within ASEAN through the ASEAN Power Grid and the Trans-ASEAN Gas Pipeline and promote cooperation in energy efficiency and conservation, as well as development of new and renewable energy resources". A series of medium-term action plans are prepared to act as a blueprint for ASEAN cooperation in attaining the ASEAN 2020 Vision, and the current action plan, the third in the series, is the 2010 ASEAN Plan of Actions for Energy Cooperation (APAEC 2010-2015).

It is interesting to note that the APAEC 2010-2015 document, while advocating for the *integration* of energy networks (both pipelines and power grids), does not mention the introduction of a *trade/energy markets*. The existing cross border energy exchange thus far are limited to zero exchange or pre-established purchase agreement (bilateral) (ACE, 2013).

Therefore towards achieving AEMI, a proposed vision for AEMI is as follows:

i. By the end of 2015 when the ASEAN Energy Community (AEC) is expected to be established, ASEAN energy markets are likely to be a group of institutionally and physically connected, but not fully opened competitive national markets.

ii. After 2015, given the condition that AEC is seriously moving forward and ASEAN overcome its challenges to become an integrated glomeration, ASEAN energy market will emerge at first as a more harmonized, more open and competitive regional market with some national restrictions on investments and import of electricity. However, electricity may be traded among member countries. The trading of electricity, if happened, will likely be stimulated by the development of hydroelectricity in the Greater Mekong sub-region.

iii. Another challenging step further is to achieve a fully liberalized and competitive national energy markets by 2030. Beyond 2030, we may see a regional energy market, which although does not have identical national energy markets, can allow free flow of energy goods, investment and services. Economically feasible electricity trade can be realized without any institutional constraints. The success of AEMI requires higher levels of political trust and commitment among ASEAN member countries. The ASEAN member countries can change from national energy security paradigm to an ASEAN regional energy paradigm.

On the outset, the purpose of the paper is to provide a background review on the current energy challenge and how best to link to AEMI core objectives. Although the paper had provided a comprehensive review of the energy challenges, and some ongoing initiatives that foster collaborative work at the ASEAN level through the nascent physical and institutional integration, much work needs to be undertaken to move AEMI towards the next step to bring about AEMI objectives to fruition. The context of a successful AEMI would be a necessary condition for the success of the AEC that would enhance energy security and environmental viability across the region and undoubtedly yield significant economic benefits to all involved, from the economic,

societal, and environmental perspectives. The core areas for further research is to enhance the knowledge base at each individual ASEAN countries with respect to their challenges in tackling the energy gap, to understand the national perspectives and action plans to move towards an integrated energy market in terms of new interventions required in relation to policy and infrastructure developmental needs; the level of acceptance and preparedness in liberalizing the energy market both at the national and ASEAN level; how best to institutionalize the interconnections and energy trading from bilateral to open market system and; the need to further enhance the understanding and development of AEMI definitions, objectives, and the hardware and software for the integration to materialise the vision towards building a blueprint for ASEAN energy market integration.

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II. AEMI Benefits

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Abstract

Market integration ranging from economy to energy has shown it has brought huge benefits to the integrated market. The benefits are economic, energy and environmental benefits. This paper suggests that the ASEAN Energy Market Integration (AEMI) will bring huge benefits to the integrated energy market. It revisits the theoretical background of market integration, reviews the experiences of energy market integration in the world, namely, the European Union and West African countries and draws lessons from these experiences for the AEMI, and identifies what benefits would be accrued to the integrated energy market. The identified economic benefits are increases in GDP, convergence of energy prices and stable price in the market and more direct foreign investment into the integrated energy market while the identified energy benefits are enhanced energy security, higher energy efficiency, lower energy system costs and higher energy development indicators. There would be environmental benefits as well such as lower CO_2 emissions in the integrated energy market.

Keywords: Equitable growth; Environmental quality; Energy security; Energy poverty; Social welfare; Energy development indicators (EDI)

1. Introduction

ASEAN will achieve even higher level of economic integration i.e., the ASEAN Economic Community (AEC). 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. 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 bring more benefits than costs to the participants of the market. The Association of Southeast Asian Economies (ASEAN) and more specifically the Greater Mekong Sub-region (GMS) have a strong potential for economic development and cooperation along with greater possibilities of harnessing energy resources but there exists huge barriers to realizing such potentials and possibilities (Yu, 2003; Lidula, et al, 2007). The European Union's integrated energy market has proved that the benefits from an integrated energy market are larger than the costs of creating such a

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market (Leonard, 2005; Economist 2007). A study that examines strategies for regionally integrating electricity supply in West Africa finds that an integrated strategy would bring benefits such as reduced capital expenditures, lower electricity supply cost, and the enhanced system reliability. (Gnansounou et al, 2007).

Noticing a few successful creation of an integrated energy market elsewhere, similar attempts of creating an integrating energy market in the region have started. It is suggested that the ASEAN countries should increase efforts of 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) has emphasized securing energy supply for a robust economic growth in the region and suggested establishing a region-wide market for energy including equipment along with specific recommendations for strengthening the energy sector such as reducing energy demand, replacing energy subsidies with efficient ones, investing new technologies and putting renewable energy first (ADB, 2013).

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

This background paper aims to examine the possible benefits from the 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 respect to economic, market and energy perspectives. Second, it reviews a few existing cases of an integrated energy market such as the European Union and West Africa and examines what benefits have been brought into the integrated energy market. Third, it assesses the benefits of the AEMI ranging from economic and environmental benefits to energy and other benefits, possibly by simulation of a computable general equilibrium or non-linear model.

2. A Theoretical Overview of Integration

2.1 Economic Integration

Theoretically, there are five successive stages of economic integration by the degree of openness, i.e., Free Trade Area (FTA), Customs Union (CU), Common Market (CM), Economic Union (EU), and Complete Economic Integration (CEI) (Balassa, 1961; McCarthy, 2006). In FTA, tariffs (and other quantitative restrictions) among the participating countries are abolished. However, each country still maintains its own tariffs against the nonmembers. In CU, besides introduction of the free movements of commodities within the union, the common external tariffs in trade with the nonmember countries are set up. In CM, not only trade restrictions but also restrictions on factor movements are abolished. In EU, the countries combine the suppression of restrictions on commodity and factor movements with some degree of harmonization of national economic policies, in order to remove discrimination due to disparities in these policies. In CEI, unification of monetary, fiscal, social and countercyclical policies will be observed. It also requires the setting-up of a supra-national authority whose decisions are binding for the member states.

The only one *de jure* economic integration in the East Asia is the ASEAN Free Trade Area (AFTA). The ASEAN will establish the ASEAN Economic Community (AEC) in 2015. The AEC appears to have the similar characteristics with those of Common Market (CM) in third successive stage of the theoretical economic integration. Flow of production factors (capital and labor), trade diversion and trade creation might not be optimized in the AEC due to the absence of common external tariffs. However, ASEAN countries have their own way in integrating their economy, "ASEAN way". So, the governments of the ASEAN have been obviously eager to realize the AEC on schedule 2015. As a regional economic integration, the AEC have main characteristics: (1) single market and production; (2) highly competitive economic region; and (3) equitable development; (4) fully integrated into the global economy. The AEC also has to consider ASEAN Energy Market Integration (AEMI) to support distribution, consumption and production well functioning in the community. The internal ASEAN energy market through the AEMI will become a powerful instrument to support the AEC and to increase competition not only within the AEC but also in the global market, and that the AEMI will be the source of large macroeconomic benefits. Nevertheless, these benefits of the AEMI will have been significantly larger if the removal of the remaining cross-border barriers in energy products is achieved. More specifically, the AEMI will become means for generating a more dynamic, innovative and competitive economy in the global market.

2.2 Market Integration

2.2.1 Condition

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

2.2.2 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 make domestically" (vertical integration) (Besanko et al, 2010). Similarly, in international energy market, a country can choose "to buy" (market integration) or "to make domestically" in fulfilling domestic energy demand. The benefits of market integration are: (1) market energy firms (countries) can achieve economies of scale; (2) market energy firms (countries) must be efficient and innovative.

2.3 Energy Market Integration

2.3.1 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 $-1 \leq RSCA_{ij} \leq 1$). $RSCA_{ij}$ greater than 0 imply that country i has comparative advantage in good j. In contrast, $RSCA_{ij}$ less than 0 imply that country i has comparative disadvantage in product j. Trade Balance Index (TBI) is employed to analyze whether

a country has specialization in export (as net-exporter) or in import (as net-importer) for a specific group of products (Standard International Trade Classification, SITC). Values of the index range from -1 to +1. Extremely, 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 depicted in table 2.1.

Table 2.1 Products Mapping

Revealed Symmetric Comparative Advantage Index (RSCA)	TBI <0	TBI>0
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)

Trade Balance Index (TBI)

In the SITC system, all the energy products covered are: SITC 322 Coal, lignite and peat; SITC 323 Briquettes; coke and semi-coke; lignite or peat; retort carbon; SITC 333 Crude petroleum and oils obtained from bituminous minerals; SITC 334 Petroleum products, refined; SITC 335 Residual petroleum products, nes and related materials; SITC 341 Gas, natural and manufacture; and SITC 351 Electric current. Table 2.2 shows the product mapping of the energy products of ASEAN and individual ASEAN countries. ASEAN have high comparative advantage of energy products (in A category) i.e. SITC 322 Coal, lignite and peat; SITC 335 Residual petroleum product, nes and related material; SITC 341 Gas, natural and manufactured, refined. SITC 334 Petroleum product, refined is in B category.

The ASEAN as whole has high comparative advantage (A category) in primary energy products SITC 322 Coal, lignite and peat, SITC 335 Residual petroleum products, nes and related materials, and SITC 341 Gas, natural and manufactured. Primary energy products are transformed in energy conversion processes to secondary energy products for instances: electrical energy, refined fuels, synthetic fuels (hydrogen fuels). This is beneficiary for the AEMI; the ASEAN has comparative advantage in primary energy products as inputs of secondary product. The AEMI will automatically make the ASEAN countries specialize in either primary or secondary energy products. It depends

on their comparative and competitive advantages. Comparative advantage more focuses on the endowment factor, so countries like Indonesia, Malaysia and Thailand could develop the primary energy products. Meanwhile, comparative advantage focuses on the dynamic rivalry, new entrant, substitute and complement, as well as supply and demand of the energy industries. Therefore, Singapore and the Philippines might develop the secondary energy products. Each ASEAN countries might develop their own energy products based on their comparative and competitive advantages. In short, the AEMI will bring efficiency in both primary and secondary energy industries in the ASEAN economies through:

- Liberalization intra-industry trade and inter-industry trade in energy products
- Resource reallocation from "less efficient" countries to "more efficient" countries
- Trade creation and trade diversion in energy products
- Efficient exploration or sources of primary energy product which is good for the society and environment
- Healthier competition in both primary and secondary products
- Reduce cost as well as price of secondary energy products so that societies can afford the energy product
- Enhance the economies of scale and scope in energy industries
- Support broad economic efficiency and competitiveness since all economic activities require the energy as an input

Table 2.2 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, nes 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

Source: UNCOMTRADE, author's calculation

2.3.2 Price Equalization in Energy Market Integration

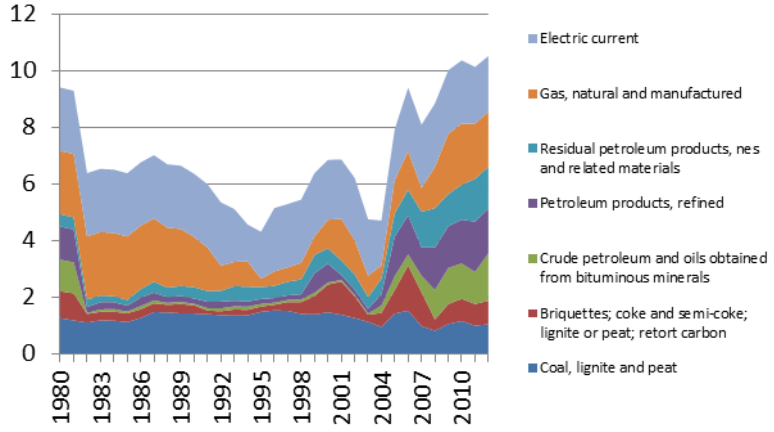
Since the domestic energy market in the ASEAN countries are distorted, the energy prices do not obviously reflect the efficient competitive market price. With subsidy, the domestic energy prices have been set below the efficient market. The energy product prices vary among the ASEAN countries. This paper uses variation coefficient (VC) to see the discrepancy of energy product

prices. The smaller VC, the less variation of energy product prices among the ASEAN countries is. In contrast, the higher VC, the more variation of energy product price among countries among the ASEAN countries.

By looking at the trend in VC, it can be examined whether energy product prices become more equal (less variation) or less equal (more variation) in the ASEAN countries. To make smooth the trend of VC, this paper uses the Moving Average 2. Figure 2.2 shows the trend of variation coefficient of energy product prices (MA(2)) in the ASEAN for 1980-2012. All energy products; except Coal, lignite and peat and Briquettes, coke and semi coke, lignite or peat, retort carbon; have positive trend in VC. It implies that those energy product prices getting more varied among the ASEAN countries. Price differences in energy products show inefficiency among the ASEAN countries that might due to energy supply side supply (for instances: 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, etc.) and energy demand side (for instance: local weather patterns). The difference in energy prices does not only occur among countries but also even among region within region. For example, electricity prices might differ between countries and might even vary within a single region 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 from the source of the electricity. For example in 2002, In the US the costs of electricity by different sources are Coal: 1-4 cents; Gas: 2.3-5.0 cents; Oil: 6-8 cents; Wind: 5-7 cents; Nuclear: 6-7 cents; Solar: 25-50 cents. AEMI will create price equalization in energy products in the ASEAN through:

- Liberalization in primary energy products (input of secondary energy products)
- Coordination, cooperation and harmonization in energy policy
- Joint production and market of energy supply to achieve economic scale and scope
- Efficiency in energy supply
- Efficient cross country distribution network in energy

Figure 2.1 Trend in Variation Coefficient of Energy Product Prices in ASEAN, (MA(2))



Source: UN Comtrade, Author's Calculation

The more variations in energy product prices reflect large differences in efficiency among the ASEAN Countries due to distorted domestic energy product market. The ASEAN Energy Market Integration (AEMI) theoretically might be able to provide more efficient energy product prices through reallocation of resources from less efficient energy product providers to more efficient ones. In the end of the day, equal energy product prices can be achieved in the ASEAN region.

The AEMI will lead to energy prices decrease before they get equalized. First, in the existing distorted energy market due to the subsidy and other government interventions, the AEMI would bring efficiency therefore the price of energy would lead to decrease in all countries. Second, if the all energy market would have been in the efficient situation the AEMI would lead to equalize the market price. In the situation, it could be energy price increases in certain countries but decreases in the other countries.

The Equivalent Variation (EV) and Compensation Variation (CV) present the impact of the AEMI. The EV can be defined as the dollar amount that the country would be indifferent to in accepting the changes in energy prices and income (wealth). The CV measures the net revenue of the planner who must compensate the country for the 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 would make the country better off). Theoretically, the impacts are divided into two direct impact (solely due to decrease of certain energy price) and indirect impact (through the other price channels, using cross price elasticity). Table 2.3 shows the simulation of the direct welfare impacts of energy prices decrease 10 percent due to the AEMI in US dollar and in percentage of current price Gross Domestic Product (GDP). For instance, a 10 percent decrease in the price of Coal, lignite and peat will result in an increase in welfare of Malaysia by US $ 98,496,773 (or 0.003% of Malaysian GDP). Simulation shows that the AEMI will bring direct positive impact on the ASEAN countries' welfare. It also shows that the AEMI in SITC 333 Crude petroleum and oils obtained from bituminous minerals and SITC 334 Petroleum products, refined will bring highest direct impact (in percentage GDP).

Table 2.3 Direct Welfare Impact of Decrease in Price of Energy Product 10 percent (in US $/Year)

Measurement	Indonesia	Malaysia	Philippines	Thailand	Singapore	Vietnam	Cambodia
1. SITC 322 Coal, lignite and peat							
• **Compensating Variation**	6,705,006 (0.001%)	98,496,773 (0.003%)	29,953,588 (0.012%)	89,787,029 (0.025%)	202,257 (0.0001%)	6,358,473 (0.004%)	47,080 (0.003%)
• **Equivalent Variation**	6,705,263 (0.001%)	98,552,373 (0.003%)	29,956,53 (0.012%)9	89,824,488 (0.025%)	202,257 (0.0001%)	6,358,971 (0.004%)	47,084 (0.003%)
2. SITC 323 Briquettes; coke and semi-coke; lignite or peat; retort carbon							
• **Compensating Variation**	98,267,719 (0.011%)	3,497,646 (0.001%)	4,567,822 (0.002%)	7,485,555 (0.002%)	487,568 (0.0002%)	61,950,815 (0.044%)	678,023 (0.0047%)
• **Equivalent Variation**	98,322,573 (0.011%)	3,497,705 (0.001%)	4,567,891 (0.002%)	7,485,741 (0.002%)	487,569 (0.0002%)	61,998,271 (0.044%)	678,771 (0.0047%)

Measurement	Indonesia	Malaysia	Philippines	Thailand	Singapore	Vietnam	Cambodia
3. SITC 333 Crude petroleum and oils obtained from bituminous minerals							
• **Compensating Variation**	1,550,388,031 (0.177%)	569,996,242 (0.19%)	6,927,166,346 (2.8%)	3,209,329,439 (0.88%)	1,795,384,058 (0.65%)	396,640,198 (0.28%)	4,591,455 (0.031%)
• **Equivalent Variation**	1,562,210,554 (0.177%)	571,594,700 (0.19%)	6,994,925,228 (2.8%)	3,249,254,210 (0.89%)	1,805,228,972 (0.65%)	398,582,154 (0.28%)	4,625,978 (0.032%)
4.SITC 334 Petroleum products, refined							
• **Compensating Variation**	2,162,680,142 (0.25%)	859,060,953 (0.28%)	4,400,758,679 (1.76%)	502,131,560 (0.13%)	3,994,854,118 (1.44%)	447,429,536 (0.31%)	57,351,017 (0.4%)
• **Equivalent Variation**	2,188,285,691 (0.25%)	862,807,056 (0.28%)	4,465,385,702 (1.78%)	503,107,087 (0.13%)	4,039,967,095 (1.46%)	449,916,785 (0.31%)	57,803,778 (0.4%)
5.SITC 335 Residual petroleum products, nes and related materials							
• **Compensating Variation**	63,081,078 (0.007%)	37,925,192 (0.01%)	27,731,527 (0.011%)	67,183,535 (0.018%)	73,642,259 (0.027%)	329,385,095 (0.23%)	198,064 (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%)

Source: UN Comtrade and ASEAN Secretariat (2013)
Note: Figure in parentheses shows as percentage of current price Gross Domestic Product

3. Lessons Learnt from Other Integrated Energy Markets

There have been efforts of integrating energy markets in the world. A notable case is the experience of energy market integration in the European Union and less notable but very promising case is the integration of electricity market in Western Africa. This sub-section reviews how the energy market integration has been established in the EU and West African countries and draws lessons for integrating Asian Energy Market Integration.

3.1 European Union

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

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: the privatization of publicly owned electricity assets, the opening of the market to competition, the extension of vertical unbundling of transmission and distribution from generation and retailing, and the introduction of an independent regulator (Pollitt, 2009).

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

Third, designing energy policies and implementing such policies should not be hindered by slow decision process. The new energy policy was expected to overcome barriers and to develop security supply and increase efficiency. However, slow decision process of the EU has incurred significant difficulties to reach the aimed 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 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 pass over these barriers and find the

appropriate way to establish the rules and regulations so as to govern energy markets (De Jong and Hakvoort, 2008).

Fifth, it is critical for the success of the regional initiatives lesson to adapt future challenges (EC Report, 2010). The first challenge in the EU is to match the "bottom-up" approach of the regional initiatives, and the more "top-down" approach of the third package, particularly in the 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 required to reflect non-market considerations into the integrated energy market. Once the security of supply enters the policy framework, as Haase (2008) points out, regulations are less likely to follow competitive market models. 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-a-vis carbon reduction objectives. The AEMI should advocate free-market compatible solutions to greater energy-related environmental and supply security problems lest industrial competitiveness concerns cool down the market enthusiasm of energy policy stakeholders.

3.2 West Africa

The majority of West African countries have suffered from the electricity shortages for several decades, which constitute a serious handicap for their socio-economic development. The situation has been worsened during the past few years due to several reasons: the obsolescence of the electricity generation and transmission infrastructures, unfavorable hydrological conditions and difficulties to attract the investments for construction of new facilities required to satisfy the increasing energy demand. Upon identifying 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 to cooperatively provide the indispensable building blocks of a sustainable energy infrastructure network in ECOWAS. The two systems would 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 the regional power pooling mechanism as the preferred means to achieve 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 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 include Kuwait Fund for Arab Economic Development and European Investment Bank, the African Development Bank (AfDB), the 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 (AUSAID)

The WAGP is a cooperative effort of the four States (Benin, Ghana, Nigeria, and Togo), the producers, the Sponsors, the Transporters, the Foundation Customers, and the providers of political risk guarantees. The four States have established by treaty the WAPP Authority to, inter alia: a) monitor compliance by WAPCo of its obligations; b) approve pipeline design and construction plan; c) negotiate and agree with WAPCo 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 to changes in tariff methodology; and use its best efforts to ensure that each State complies with the IPA and applicable enabling legislation. The WAGP Authority does not set tariffs, as these are regulated by contract.

Mourad, a World Bank Group, identified two most pertinent lessons from the design of the 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 increase in electricity demand with a regional context, the scope and evolution of multi-country, regional electricity trade expands as trading partners build confidence in working together.

Second, in order to maintain balance in the transmission of power system operations from a national into a multi-country, regional operations regime 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 learnt. First, in order to facilitate compliance with safeguard procedures across the ECOWAS region in the long run, 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 and rules and procedures across the region. The tools to achieve 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 because transmission but also accurate system design is required. The effect of this pooling system is that energy security will no longer merely be the concern of a single State but has been elevated to a regional level.

Fourth, in a practical sense, the mechanism can be described as follow: 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 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 system are interconnected with neighboring utilities, each control area must assure that its load matches its own supply resources plus power exports or import to other control areas.

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

4. Assessing Benefits

The theoretical investigation of integration shows that the energy market integration (EMI) brings various benefits in huge quantity. Such benefits have been assessed quantitatively and qualitatively. This sub-section presents what benefits the ASEAN-Energy Market Integration (AEMI) will potentially bring in terms of economic, energy and the environmental point of views.

4.1 Economic Benefits

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

This research conducts a simulation analysis based on the Global Trade Analysis Project (GTAP) model presenting the removal of energy commodity trade barriers under AEMI and ensuing investments in the energy sector will bring economic benefits. The potential benefits from the AEMI have been calculated by equivalent variation (EV)[8] and real GDP. The overall impacts of the AEMI on the ASEAN economy is shown in table 4.1. It is clear that the effects of the AEMI through tariff cut and subsidies and increasing investments are substantial. The values of EV are varying but real GDP figures exhibit the possible benefits accrue more than three percentage.

[8] EV in this section is different with that of section II. In section II, we calculate the EV based on microeconomic modeling of welfare and the imports of energy products. EV in section IV is calculated based on macroeconomic modeling i.e. the Global Trade Analysis Project (GTAP) model.

Table 4.1 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 the AEMI shown in Table 4.1 supports that the AEMI has positive impact on some energy sectors in some ASEAN countries. The simulation result shows that Indonesia will potentially have highest benefits of the tariff cut and subsidies and increasing investments in energy which shown by the highest EV i.e. USD 8856. This is followed by Malaysia, Thailand, Vietnam and so on. Output will potentially increase in all ASEAN countries due to the AEMI that is shown by increases in real GDP. In term of increase of real GDP, Malaysia will potentially experience with the highest increase (3.46 percent). It is followed by Vietnam, Thailand and so on. The impacts of the AEMI on welfare and output are heterogeneous across the ASEAN Countries due to characteristics of protection of energy sector, consumption and production pattern in each ASEAN countries.

Apart from valuating economic benefits of the AEMI through EV, the attempt of quantifying the possible benefits from energy market integration presents that there would be more foreign direct investments, which increases 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[9] and an increase in GDP (ERIA, 2010). A lower income disparity and poorer countries' catching up of economic developments are suggested as possible benefits of an integrated energy market. A study employing 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 level of energy market integration the lower income disparity and equitable growth (Sheng and Shi, 2013)

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

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

4.2. Energy Benefits

The major benefits of the expanded cooperation in the energy sector in the AEMI includes the integrated regional planning and coordination (allows for identifying cost-effective energy projects), mitigation measures to addressing climate change (public policy actions not only at the national level, but also at the regional level). Furthermore, regional cooperation in energy market 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 countries to increase regional energy security, reduce power costs, and attract investments by creating greater market scale to interest investors, optimize natural resources, and develop common infrastructure (Situmeang, 2013).

The 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 at reasonable cost in the ASEAN, is important for production efficiency and reliability as well as for energy security in the region (ASEAN, 2013). Energy security is the one of the benefits from an integrated energy market (Koyama and Kutani, 2012). There are also compelling economic, environmental and energy security benefits of establishing large-scale and dynamic electricity markets in the long-term for the ASEAN countries (Boethius, 2012).

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

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

With regards to ensuring greater regional energy security, the ASEAN Memorandum of Understanding on the Trans-ASEAN Gas Pipeline (TAGP) in 2004, for example, is to provide a broad framework for the ASEAN Member Countries to co-operate towards the realization of the TAGP Project (Ramli and Abdullah, 2009).

The energy intensity of the primary energy consumption in the ASEAN for the period 1990 to 2005 has improved from 695 TOE/million USD to 627 TOE/million USD and will continue to decrease in 2030 as projected in mount of 500 TOE/million USD and 452 TOE/million USD due to improvement in fuel mix where natural gas replaces fuel oil as the dominant feedstock for power generation, and improvements in energy efficiency as a result of the regional energy market integration (Hung, 2009).

Energy efficiency has become significantly recognized as one of the most cost-effective ways of enhancing energy security, addressing climate change, and promoting competitiveness in industry in the ASEAN. Thanks to the more integration in energy market, Berger (2011) shows that by 2020, the ASEAN countries could achieve efficiency gains of between 12% and 30%, a projection that would translate into power savings ranging between119 TWh and 297 TWh, or USD 15 billion USD, and 43 billion USD. Moreover, according to EIAS (2013), integrating power transmission among Asian countries would save considerable amounts of money by substituting hydropower for fossil fuels, and 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 make more renewable energy harnessed and the total cost of meeting the demand for energy would be lower (Wu, Shi and Kimura, 2012).

There have been strong movements of developing bilateral energy development and trade among the ASEAN member countries. A cooperation of developing hydropower and ensuing bilateral power trade between Laos and Thailand could bring various benefits – lower energy system costs, better environmental quality, greater energy diversification and significant export revenues (Watcharejyothin and Shrestha, 2009).

The small scale distributed power systems in many ASEAN countries, incorporating modern technology, can be cost-effective, scalable and financeable (Taw, 2013). Through the energy market integration, reduced expenditure on energy imports would significantly have long-term economic benefits for each ASEAN member country as well as the region as a whole. Considering three scenarios (no trade, 20% trade and 50% trade in energy) of 4 developing optimal power generation capacity and their impacts on energy market integration in the ASEAN as shown in the Table 4.1, Chang and Li (2012) found the benefit of the integration indicated by 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%), and 29.0 billion USD (3.9%), respectively. Thus even with partial integration (cross-border power trading), substantial cost reduction could be realized.

Table 4.1: Key Findings from Different Scenarios of Electricity Trade

Scenario	Total Cost Savings	Development of Additional Capacity (Top Four in Turn)
No Trade	N.A.	Gas, Coal, Hydro and Geothermal
20% of demand met by trade	3.0% (20.9 billion USD)	Gas, Coal, Hydro and Geothermal
50% of demand met by trade	3.9% (29.0 billion USD)	Gas, Coal, Hydro and Geothermal

Sources: Chang and Li (2012).

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

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

4.3. Environment Benefits

In parallel with the increase in energy consumption, CO_2 emissions are a globally critical issue for energy sustainability. CO_2 emissions reduction potentials 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 regional 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 the energy integration, a 10% reduction of subsidy for energy commodities would slightly reduce CO_2 emissions of the East Asian region as a whole by 0.23%. Among others, in the countries associated with heavier energy subsidy such as Indonesia and Malaysia, CO_2 emissions reduction effects are larger (Wu, 2012).

In the ASEAN countries, according to the estimation provided by Hung (2009), the 4% annual growth in primary energy consumption will result to a corresponding 5.1% growth in CO_2 emissions. This is due largely to the projected 6.9% annual escalation of coal consumption that is the most carbon-intensive fossil fuel. The similar 4.0% annual growth rates in oil and natural gas consumption will also contribute to an increase in the emissions. However, the energy market integration would allow national governments of the ASEAN members to more easily address such issues. Furthermore, other main energy policy challenges including 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, 2011).

A simulation study of bilateral power trade between Laos and Thailand shows that there would be environmental gains accrued to both countries along with economic gains. It presents that CO_2 emissions would decrease by 2% when compared to the base case (Watcharejyothin and Shrestha, 2009). If this CO_2 reduction potential is extrapolated to the ASEAN or Asian countries, the level of CO_2 emissions reduction would be non-marginal.

5. Conclusion

There are three broadly defined categories of integration – economic, market and energy market integration. The economic integration has five different stages by 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. The ASEAN Free Trade Area (AFTA) is the only economic integration in the region at the moment. The ASEAN Energy Market Integration (AEMI) can be considered another economic integration. Market integration can be accomplished if prices among different markets exhibit similar patterns in the long-run. The benefits of market integration are that there would be economies of scale among market energy firms and market firms become efficient and innovative. The AEMI would be a kind of the market integration in the region, which will bring the convergence in prices in the long-run and make the economy of scale viable and firms be efficient and innovative. The 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 countries comparative advantages in primary energy products. The AEMI, a kind of energy market integration, will provide more efficient energy product prices through reallocation of resources from less efficient energy product providers to more efficient ones and hence bring 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 counties.

The experiences of the European Union (EU) in energy market integration present valuable lessons for promoting the AEMI. The strategies used in the EU were to integrate the energy markets and make them competitive. The lessons drawn from the EU experiences are as follows: the completion of energy market reform, balancing regulatory governance between national regulatory agencies and an EU-wide one, avoiding slow decision process, an agreement on the structure of future integrated energy market, adapting future challenges and reflecting non-market considerations into the integrated energy market. Apart from the EU experiences, there have been strong movements in integrating electricity markets in West Africa. One of the two key lessons for the ASEAN to make successful AEMI is establishing an appropriate institution consisting of national power utilities and the other is creating a regional operation regime for power transmission are the key lessons a successful reality. There are other lessons learnt: harmonization of environmental and social rules and regulations, implementation of utility-led institutional framework, a power pool arranged as an arrangement between two or more interconnected electric systems, a practical mechanism of interconnected power system and a strong legal basis for regional interconnection.

The AEMI will help the ASEAN Economic Community (AEC) function well by making energy products and service flow freely, which in turn make energy product prices converge and stable and firms more efficient and innovative. When the ASEAN has an integrated energy market in the region, there will be various benefits such as economic, energy and environmental benefits. Higher welfare, measured in equivalent variation (EV), and increases in GDP among member countries are suggested as the main economic benefits of the AEMI. The welfare benefits range from 58.66 million USD for Laos to 8,856.67 million USD for Indonesia. An equivalent valuation approach presents an increase in real GDP for the ASEAN member countries could reach about 1 to 3 percentage of real GDP. Specifically, the real GDP would be 0.89% larger for Cambodia and 3.46% larger for Malaysia. Other economic benefits are converging and stable prices, higher foreign direct investments into the region and more elastic demand that gives the consumer more choices.

Apart from the economic benefits, the AEMI would bring energy benefits such as improvements in energy security, higher energy efficiency, lower energy system costs, higher level in energy diversification and improvements in energy development indicators. By linking energy deficient countries to energy abundant countries in the region, the AEMI enhances the level of energy security for the countries. It also reduces energy intensity of the countries and hence increases energy efficiency. With the integrated energy market, the energy intensity level is expected to 452 tons of oil equivalent in 2030 due to more diversified fuel mix and higher availability of efficient and cleaner fuels. The integrated energy market is expected to decrease energy system costs by 3% if up to 20% of each country's demand is allowed to be imported while 3.9% if up to 50% is allowed. The AEMI will enable energy diversification among the countries and hence they can be more resilient to exogenous energy shocks. The AEMI will raise energy development indicators by making access to modern energy and producing less amounts of pollution.

Along with economic and energy benefits, the AEMI would bring environmental benefits to the countries. The key environmental benefits are lower levels in carbon dioxide emissions. A simulation study of power trade between two countries shows that the power trade via the integrated energy market could decrease carbon dioxide emissions by 2% compared to a base case.

The various benefits of the AEMI support the necessity of integrating energy markets in the region. These benefits are well materialized under the AEC where energy products and services are freely flowing. The AEMI is surely a path towards the AEC.

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III. AEMI and ASEAN Energy Poverty

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Abstract

127.4 million people in Southeast Asia lack access to electricity and at least 228 million still rely on traditional biomass for cooking and lack access to clean and modern cooking facilities, with dire consequences on peoples' quality of life and human development. Discussions for an integrated ASEAN energy market cannot overlook this energy poverty situation in the region. In fact, the overall goal of AEMI for a balanced and equitable economic growth and development for all countries in the region cannot be realized with people suffering from energy poverty. This background paper maps the energy poverty situation in the region, reviews the links between energy access and economic and human development, and draws connection between AEMI and reducing energy poverty or attaining universal energy access, in terms of benefits and strategies, including particularly mapping of investment requirements and making inventory of financing options. It concludes with some recommendations for near-term actions.

1. Introduction

International Energy Agency (IEA) defines energy poverty as lack of access to modern energy services. Modern energy services mean access to electricity and clean cooking facilities. Reddy and Reddy (1994) as cited in Masud et al (2007), said that energy poverty can be defined as "the absence of sufficient choice in assessing adequate, affordable, reliable, high-quality, safe and environmentally benign energy services to support economic and human development". This definition of energy poverty also implies the strong link between access to modern energy services and economic and human development.

In Southeast Asia or the ASEAN region, more than 127 million people lack access to electricity and at least 228 million still rely on traditional biomass for cooking and lack access to modern cooking facilities. IEA projects that in the absence of concerted efforts, 9% or 63 million people of the ASEAN population would still lack electricity in 2030, despite more widespread prosperity and more advanced technology (IEA, 2009).

The discussion on the ASEAN Energy Market Integration (AEMI), building on ongoing ASEAN Energy Cooperation, cannot ignore the issue of energy poverty if its ultimate goal is the balanced and equitable economic growth and development of all countries in the region. Indeed, the objectives of AEMI cannot be achieved with people suffering from energy poverty. Thus, among other targets, AEMI should aim for universal access or energy access for all by 2030.

This background paper examines the issue of energy poverty in ASEAN with four objectives: (1) map out energy poverty across ASEAN; (2) analyze whether AEMI could provide a framework for

eliminating energy poverty by 2030 (the so called universal access to energy); (3) identify the policy components and infrastructure needs for AEMI to deliver such a promise; and (4) spell out the design elements needed within AEMI to allow the realization of such an objective. The paper is organized into seven sections. After this introduction, section 2 maps out the energy poverty situation in ASEAN. Section 3 reviews the links between energy access and development and how the issue of energy poverty is addressed in the ASEAN. Section 4 discusses how AEMI could provide a framework for eliminating energy poverty. Section 5 continues to enumerate the design elements of AEMI strategy towards eliminating energy poverty. Section 6 provides an indication of the investment requirements to achieve universal access and discusses the financing options. The final section provides a summary of this paper, reiterating the severity of energy poverty in the region and what AEMI should do about it, and concludes with some recommendations for near-term actions.

2. Energy poverty in ASEAN

Worldwide, roughly 1.3 billion people continue to lack access to electricity and 2.6 billion rely on traditional biomass stoves and open fires for cooking and heating (IEA, 2012 in REN21, 2013). In the ASEAN region the total number of population without electricity is about 127.4 million and about 49% of them are in Indonesia, while 42 million people also lack electricity access in Myanmar and the Philippines (see Table 1). Only four countries, that is, Brunei Darussalam, Malaysia, Singapore, and Vietnam, have electrification rate and urban electrification rate of about 100%. In Indonesia 128 million people also still rely on traditional biomass for cooking or lack access to modern and clean cooking facilities, while it is close to 100 million in the Philippines and Vietnam (see Table 2). Rural population without electricity access is much higher than in urban area. Cambodia and Myanmar are two countries with the lowest rural electrification ratio. Thus, looking at the electricity access among the 10 ASEAN member-countries, improving rural electrification ratio is still a major challenge at the national and regional levels. This challenge is compounded in populous and archipelagic countries like Indonesia and the Philippines.

Table 1 Electricity access in ASEAN (2010)

Region	**Population without electricity** millions	**Electrification rate** %	**Urban electrification rate** %	**Rural electrification rate** %
Brunei Darussalam	0.0	100	100	99
Cambodia	10	31	91	16
Indonesia	63	73	94	56
Laos	2.2	63	88	51
Malaysia	0.2	99	100	98
Myanmar	26	49	89	28
Philippines	16	83	94	73
Singapore	0.0	100	100	100
Thailand	8	88	98	82
Vietnam	2	98	100	97

Source: IEA (2012), *World Energy Outlook 2012*.

Table 2 Population relying on traditional biomass for cooking

Regions and selected countries	Percent of population	Millions
Developing Asia	51%	1,814
India	66%	772
Bangladesh	91%	149
Pakistan	64%	111
Indonesia	55%	128
Philippines	50%	47
Vietnam	56%	49
Rest of developing Asia	54%	171
All developing countries	49%	2,558
World	38%	2,588

Source: REN21 (2013), *Renewables 2013 Global Status Report*.

There are supply and demand side and institutional reasons why some countries can increase electrification ratio more rapidly than others. First, the growth of electricity production is relatively lower than economic growth. Electricity production depends on several factors such as availability of investment fund, availability of primary energy source, investment climate in electricity sector, roads infrastructure, and geographical lock (land lock). Second, due to large connection fee to power grid or expensive monthly tariff, poor households cannot obtain benefits from the power grid extension. Third, rural electrification programs are not sustainable. Due to the low capacity to manage and adoption of inappropriate technology, many households in rural areas are back to darkness after obtaining electricity for only several months.

The Asian economic crisis in 1997/98 negatively affected the growth of electricity production across the ASEAN countries (see Table 3). Between 1991 and 1996, or just before the crisis, six countries recorded double digit growth; Cambodia showed the highest growth while Philippines indicated the lowest. Thailand, which had been the most affected country by the crisis, had electricity production growth below 1%, while Indonesia still managed about 7.4% electricity production growth. On the other hand, countries such as Vietnam, Singapore, and Philippines even showed higher growth during the crisis. This indicates that the economic crisis affected the countries differently. Surprisingly, post -crisis, the growth of electricity production was lower than before the crisis except for Vietnam. This indicates bad sign for countries that still have relatively low electrification ratio. For example for Cambodia with the lowest electrification ratio, the growth of electricity production decreased from 26.8% between 1991 and 1996 to 9.7% between 1999 and 2010. It was similar for Indonesia that had 63 million people without electricity and 44% of rural household without electricity access.

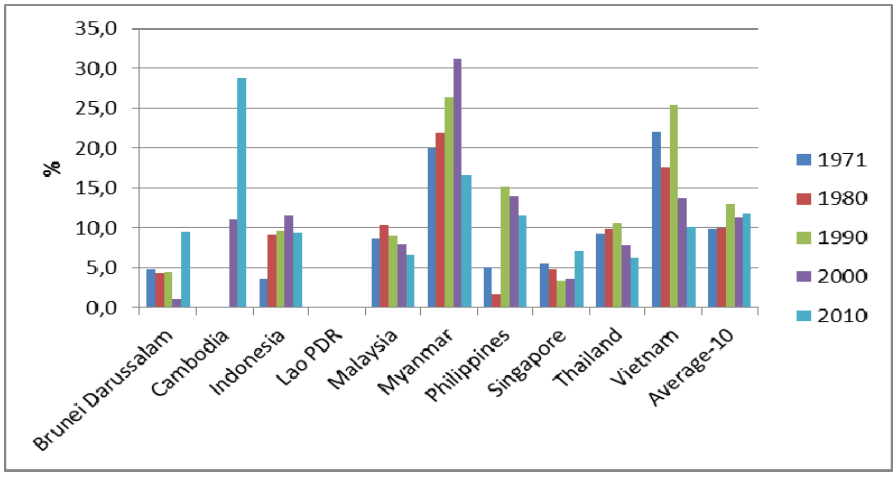
Table 3 Average annual growth of electricity production (%)

Country	Before crisis (1991-96)	During crisis (1997-98)	After crisis (1999-2010)
Brunei Darussalam	10.47	8.70	3.79
Cambodia	26.77	22.94	9.67
Indonesia	12.94	7.38	6.71
Lao PDR	NA	NA	NA
Malaysia	14.37	8.73	6.32
Myanmar	8.20	2.90	5.25
Philippines	5.87	6.42	4.20
Singapore	7.40	8.55	4.01
Thailand	12.56	0.18	4.91
Vietnam	11.91	13.14	13.12

Source: calculated from World Development Indicators

Improving electricity access cannot be fully developed if the transmission and distribution (T&D) losses are also high. High T&D losses indicate high level of inefficiency. This affects the quality of power supply. Low T&D can improve reliability of power supply and increase service area. Countries with low level of electrification ratio tend to have high level of T&D loss such as Cambodia and Myanmar (see Figure 1). Surprisingly however, countries with high level of electrification ratio such as Vietnam, the Philippines, and Brunei have higher T&D loss than Indonesia in 2010. In the context of the10 ASEAN countries, the average T&D losses tend to increase; even in Singapore, the T&D loss in 2010 was higher than in 2000.

Figure 1 Electric power transmission and distribution losses (% of output)

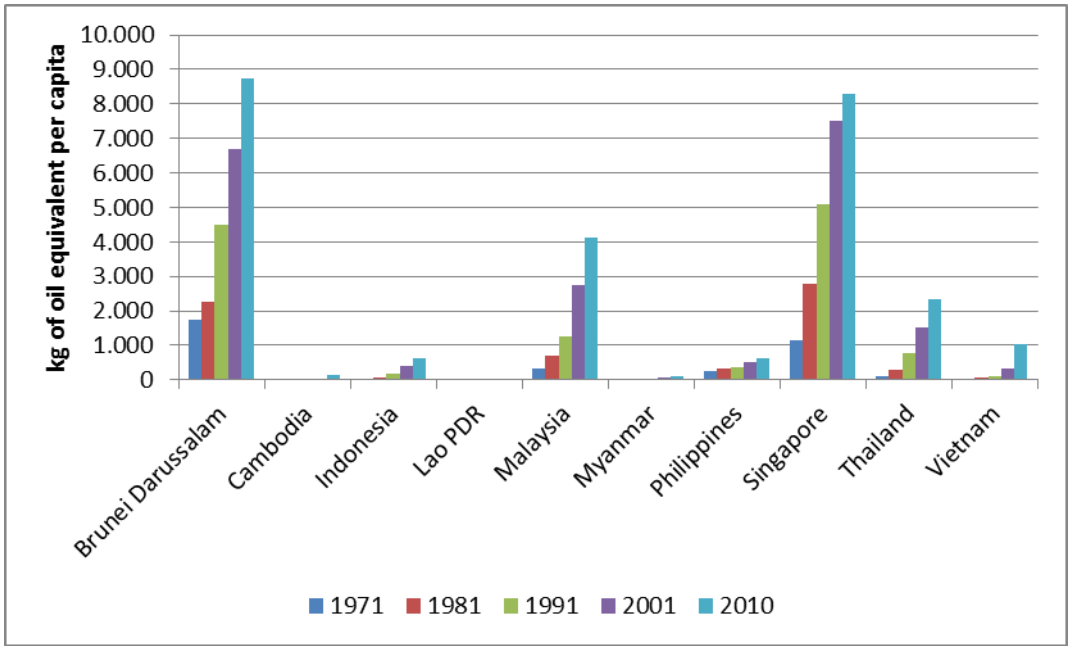


Source: World Development Indicators

Looking at energy poverty broadly, it seems that there is imbalanced situation across the countries. As seen from Figure 2 and Table 4, there is a huge gap in terms of energy use per capita among ASEAN countries. Energy use per capita in Brunei Darussalam and Singapore was above 8,000 kg of oil equivalent while Malaysia and Thailand were above 4,000 and 2,000 kg of oil equivalent respectively. Energy use per capita for other countries was below 1,000 kg of oil equivalent. Table 4

also shows that stage of economic development (alongside energy policy) determines intensity and efficiency of energy use. While other countries show increasing GDP per capita, Brunei Darussalam indicates the opposite direction. Because energy use increased between 1995 and 2010, it seems that energy intensity (ratio energy use to GDP) in Brunei Darussalam tended to increase. Other countries that also indicate increasing level of energy intensity are Malaysia and Thailand. On the other hand, in Cambodia, Indonesia, Singapore and Vietnam, energy intensity tended to decrease as the respective growth of GDP per capita was higher than the growth of energy use per capita. In the Philippines energy use per capita decreased while GDP per capita increased. Thus, it seems only the Philippines was successful to use energy more efficiently. The links between energy access and development are reviewed further in the next section.

Figure 2 Energy use



Source: World Development Indicators

Table 4 Energy use per capita vs GDP per capita in ASEAN

	Energy use per capita (kgoe)			GDP per capita (constant 2005 USD at PPP)		
	1995	2010	growth per annum	1995	2010	growth per annum
Brunei Darussalam	7,838	8,274	0.36%	50,304	45,319	-0.69%
Cambodia	263	350	1.92%	841	1,937	5.72%
Indonesia	674	864	1.67%	2,785	3,873	2.22%
Malaysia	1,635	2,569	3.06%	9,496	13,767	2.51%
Philippines	482	433	-0.71%	2,515	3,554	2.33%
Singapore	5,337	6,456	1.28%	32,880	52,314	3.14%
Thailand	1,050	1,768	3.53%	5,755	7,987	2.21%
Vietnam	304	681	5.52%	1,231	2,875	5.82%

Note: No data available for Lao PDR and Myanmar
Source: World Development Indicators

3. Energy and development

Providing access to modern energy services enhances countries' attainment of the Millennium Development Goals (MDGs). Figure 3 reviews the links between energy and the MDGs. Winkler et al. (2011) said that improvement of electricity access and affordability are important. Kanagawa and Nakata (2008) showed the relation of energy with poverty indicators such as health, education, income, and environment. Kanagawa and Nakata (2008) indicated that access to electricity depends on infrastructure conditions, capacity of supply, government policy, and international cooperation. However, AGECC (2010) argued that the current energy systems are inadequate to meet the needs of the world's poor and are jeopardizing the achievement of the MDGs. AGECC (2010) suggested two goals. First, ensure universal access to modern energy services by 2030. In this regard, AGECC (2010) agreed with the IEA suggestion for a minimum threshold of about 100 kWh of electricity and 100 kgoe of modern fuels (equivalent to roughly 1,200 kWh) per person per year. Second, reduce global energy intensity by 4 per cent by 2030.[10]

Figure 3 A snapshot of energy linkages to the MDGs

MDG	Energy Linkages
1 Eradicate extreme poverty and hunger	Energy inputs such as electricity and fuels are essential to generate jobs, industrial activities, transportation, commerce, micro-enterprises, and agriculture outputs. Most staple foods must be processed, conserved, and cooked, requiring energy from various fuels.
2 Achieve universal primary education	To attract teachers to rural areas electricity is needed for homes and schools. After dusk study requires illumination. Many children, especially girls, do not attend primary schools in order to carry wood and water to meet family subsistence needs.
3 Promote gender equality and empower women	Lack of access to modern fuels and electricity contributes to gender inequality. Women are responsible for most household cooking and water-boiling activities. This takes time away from other productive activities as well as from educational and social participation. Access to modern fuels eases women's domestic burden and allows them to pursue educational, economic, and other opportunities.
4 Reduce child mortality	Diseases caused by unboiled water, and respiratory illness caused by the effects of indoor air pollution from traditional fuels and stoves, directly contribute to infant and child disease and mortality.
5 Improve maternal health	Women are disproportionately affected by indoor air pollution and water—and food-borne illnesses. Lack of electricity in health clinics, lack of illumination for nighttime deliveries, and the daily drudgery and physical burden of fuel collection and transport all contribute to poor maternal health conditions, especially in rural areas.
6 Combat HIV/AIDS, malaria, and other diseases	Electricity for communication such as radio and television can spread important public health information to combat deadly diseases. Health care facilities, doctors, and nurses, all require electricity and the services that it provides (illumination, refrigeration, sterilization, etc.) to deliver effective health services.
7 Ensure environmental sustainability	Energy production, distribution, and consumption has many adverse effects on the local, regional, and global environment; these effects include indoor, local, and regional air pollution; local particulates; land degradation; acidification of land and water; and climate change. Cleaner energy systems are needed to address all of these effects and to contribute to environmental sustainability.
8 Develop a global partnership for development	The World Summit for Sustainable Development (WSSD) called for partnerships between public entities, development agencies, civil society, and the private sector to support sustainable development, including the delivery of affordable, reliable, and environmentally sustainable energy services.

Source: UNDP (2005)

[10] Energy intensity is measured by the quantity of energy per unit economic activity or output (GDP)

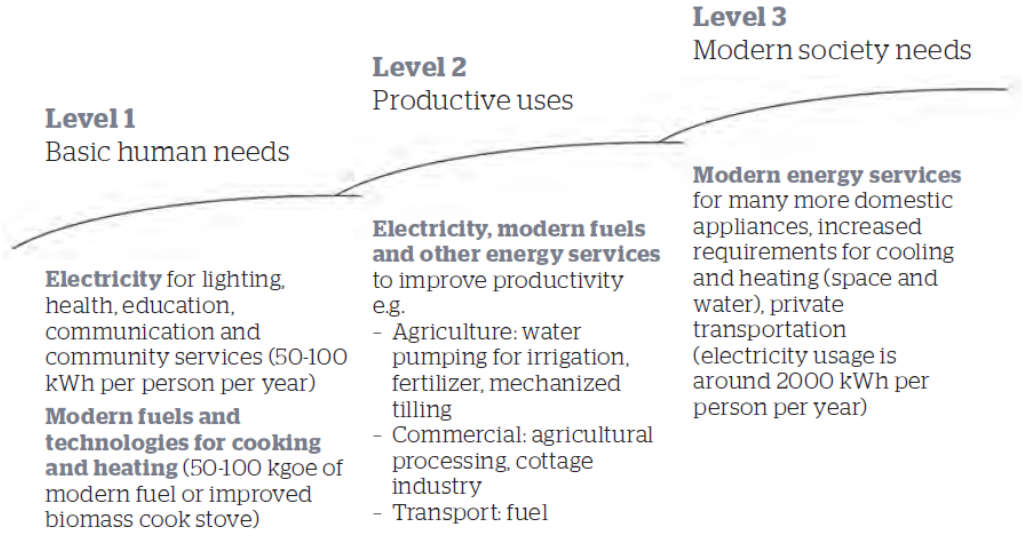
As seen from Table 5, Myanmar has the lowest electricity consumption per capita in ASEAN, while Brunei Darussalam has the highest. Following the minimum threshold of 100 kWh, in 2010 nine ASEAN member-countries were above the standard (no data was available for Lao PDR at this writing). In the context of modern society needs as indicated by Figure 4, only Brunei, Malaysia, Singapore, and Thailand had electricity consumption per capita that are above the standard. Thus to obtain 2,000 kWh per capita consumption per year, most of ASEAN countries need to increase electricity production. Interestingly, Vietnam has shown impressive results because between 2000 and 2010, electricity consumption increased more than 350%.

Table 5 Electric power consumption (kWh per capita)

Country Name	1971	1980	1990	2000	2010
Brunei Darussalam	1,754	1,699	4,355	7,577	8,723
Cambodia	NA	NA	NA	33	144
Indonesia	14	47	165	395	639
Lao PDR	NA	NA	NA	NA	NA
Malaysia	310	657	1,146	2,720	4,136
Myanmar	20	34	43	73	121
Philippines	236	373	361	502	641
Singapore	1,155	2,718	4,983	7,575	8,307
Thailand	120	291	709	1,462	2,335
Vietnam	41	55	98	295	1,035

Source: World Development Indicators

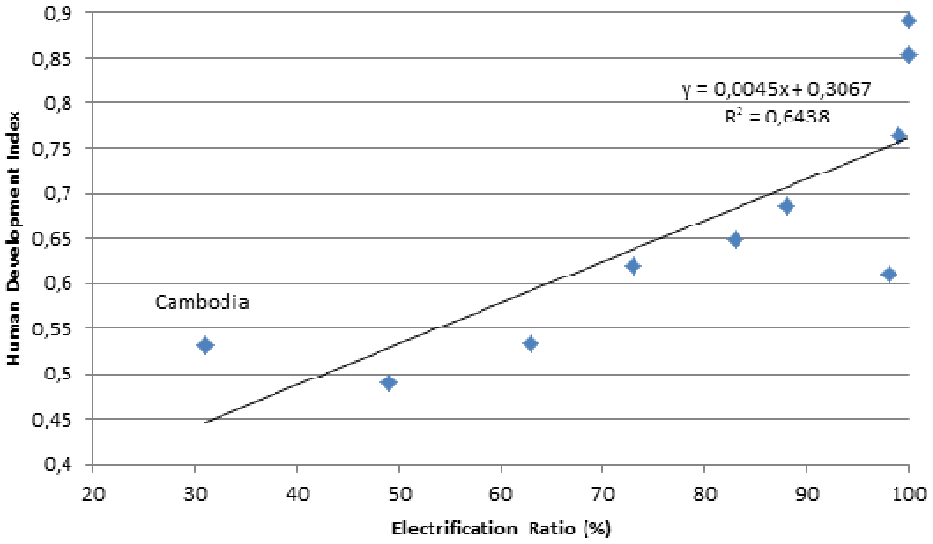
Figure 4 Incremental levels of access to energy services



Source: AGECC (2010)

Figure 5 plots positive correlation between electrification ratio and human development index (HDI). In the case of Indonesia and Vietnam, although electrification ratio in Vietnam was higher than in Indonesia, Indonesia has higher HDI than Vietnam. Similar result is obtained between Cambodia and Myanmar. This indicates that access to electricity is a necessary condition for improving quality of life, but it is not sufficient. Countries need to develop other basic services for improving people's welfare.

Figure 5 Electrification Ratio and Human Development Index in 2010



Source: World Development Indicators and HDRO calculations based on data from UNDESA (2011), Barro and Lee (2011), UNESCO Institute for Statistics (2012), World Bank (2012) and IMF (2012).

4. AEMI and energy access

Though not directly mentioned, the need and commitment to address energy poverty are already visible in both the ASEAN regional energy cooperation framework and in the concept of East Asia energy market integration. In the ASEAN Plan of Action for Energy Cooperation (APAEC) 2010-2015, the approaches to achieve the APAEC objectives include "strengthening coordination, participation in all program areas **to narrow development gap, improve energy access, and to facilitate economic integration of the ASEAN region**" (ASEAN Centre for Energy, 2010; emphasis ours).

The commitment "to accelerate the implementation" of the APAEC 2010-2015 by aiming "to strengthen coordinating efforts between ASEAN Member States" was reiterated in the 22nd ASEAN Summit held on 24-25 April 2013. The same summit, with the apt theme "Our People, Our Future Together", also reiterated commitment of the ASEAN members "to narrowing the development gaps by implementing the IAI Work Plan (2009-2015) and the ASEAN Roadmap towards realizing the Millennium Development Goals (MDGs) with special focus on achievable goals and possible

scenarios and priorities beyond 2015," including "addressing cross-cutting issues of the MDGs." These "scenarios and priorities beyond 2015" should very well include energy market integration and "cross-cutting issues of the MDGs" should include energy poverty. Indeed, the 22nd ASEAN Summit "noted the importance of realizing a truly People-Centered ASEAN as a central element of a post-2015 vision of ASEAN."[11]

On the other hand, energy market integration in the East Asia region was recognized as a desirable objective during the Second East Asia Summit in 2007. In the Cebu Declaration on East Asian Energy Security signed on January 15, 2007, the East Asian member states specifically declared that they will "encourage the open and competitive regional and international markets geared towards **affordable energy at all economic levels**" (East Asia Summit, 2007; emphasis ours). The Cebu Declaration specifically called for gearing the energy markets towards affordable energy for all, including the poor.

The proposed ASEAN energy market integration (AEMI) takes off from the existing efforts toward greater ASEAN energy cooperation. But AEMI is much more than regional energy cooperation as it involves integrating markets. The kind of integration within the larger East Asia Summit framework is expected to take a long time; so the AEMI is proposed to be a more gradual approach towards regional energy market integration.

Inasmuch as AEMI shall involve the liberalization of the flow of energy products and investments across ASEAN and the interconnection of physical infrastructures in certain parts of the region, the policy requisites shall include energy trade and investment liberalization, reforms in domestic energy market structures, harmonization of energy standards and regulations, and coordination of energy sector planning and development.

The benefits from the implementation of these policy reforms may impact energy poverty through channels such as price effect, productivity and wealth effects, and knowledge dissemination. The expected lower real prices of energy as a result of trade and investment liberalization can make the prices of energy products and services more affordable to the poor. Structural reforms in energy markets have the potential to improve the total factor productivity and raise the overall economic development of a country. These productivity and wealth effects will redound to the whole population and will make more resources available for programs, such as rural electrification programs, that aim to deliver energy services to the unserved population. Formulating and implementing domestic investment programs to address energy poverty can also benefit from the knowledge to be gained from region-wide harmonization of energy standards and regulations and coordinated energy sector planning and development.

An estimation of benefits from AEMI was not yet available at the time of writing this study, but an estimation of benefits from energy market integration (EMI) in the East Asia Summit (EAS) region by Bhattacharya et al. (2010) demonstrated the price, productivity and wealth effects. (The EAS region considered in the study is comprised of 16 countries—the 10 ASEAN members plus China,

[11] Chairman's Statement of the 22nd ASEAN Summit, "Our People, Our Future Together" URL: http://www.asean.org/news/asean-statement-communiques/item/chairmans-statement-of-the-22nd-asean-summit-our-people-our-future-together, accessed 7 August 2013.

Japan, Korea, Australia, New Zealand, and India.) The results showed that the EAS region as a whole will gain although the distribution of economic benefits is not balanced across the region.

Notwithstanding the unbalanced distribution and as a rising tide lifts all boats, the positive impacts of EMI on economic growth and development will have beneficial effects in terms of raising access to goods and services, including energy access. A study that examined the impact of EMI on equitable economic growth (Sheng and Shi, 2013) showed that EMI is likely to promote the economic growth of individual countries as well as to facilitate equitable growth within a region. Using panel data regressions, the study adopted a convergence analysis, in which two concepts of convergence were employed--one, the dispersion of real per capita income across countries falling over time, and two, a poor country or region growing faster than a rich one. To measure EMI, an energy trade index and a competition index were defined and measured. The EMI indexes were then used in the regressions. The results provide support for convergence in economic growth as EMI tends to increase the rate at which income per capita in developing countries catches up with that of their more developed neighbors. The authors also concluded that developing countries would gain more than the developed countries from active involvement in EMI.

5. AEMI strategy

In a more direct way, AEMI can address energy poverty by specifically incorporating this in the AEMI agenda up to 2030. The following are what we think the key design elements of AEMI strategy towards removing energy poverty or achieving universal access by 2030:

1. AEMI is promoted among developed and less developed economies in the region.
2. AEMI must make sure energy goods and services are covered in the trade and investment agreements under AEC.
3. Mitigation measures for fossil-fuel subsidy reforms are in place.
4. International standards on technologies (products and systems) that address energy poverty or increase energy access are adopted.
5. Regional cooperation on renewable energy distributed generation and off-grid systems, including especially micro- and mini-grids, are continued and enhanced.

1. AEMI is promoted among developed and less developed economies in the region.

One of the potential benefits of energy market integration is the reduction in income disparity across countries in the region (Sheng and Shi, 2011). A more integrated energy market help poor countries catch up with their rich neighbors. “Energy market integration tends to increase the rate at which income per capita in developing countries catches up with that of their more developed neighbors (Sheng and Shi, 2013).” Thus, AEMI “should be promoted more confidently and positively, not only among developed countries but also involving LDCs...(In fact,) developed countries can also play an important role by helping LDCs to overcome difficulty through capacity building programs (Sheng and Shi, 2011, p. 24).”

2. AEMI must make sure energy goods and services are covered in the trade and investment agreements under AEC.

General trade and investment liberalization is covered in the existing bilateral and multilateral free trade agreements. Following Bhattacharya et al., 2010, the remaining task under AEMI is to make sure energy goods and services as well as investments in the energy sector are covered in the scope of these agreements. "A detailed review of energy trade and investment in the current regional agreements and frameworks will provide background for policy discussions and potential areas for improvement in the existing agreements (Bhattacharya et al,, 2010, p. vi)."

3. Mitigation measures for fossil-fuel subsidy reforms are in place.

"The development of a comprehensive long-term road map, which integrates economic, political and social issues, so as to achieve market-oriented energy pricing mechanisms, is crucial for progress in regional energy market integration (Bhattacharya et al., 2010, p. viii)." A key feature of energy market integration, including the envisioned AEMI, is energy pricing reform, particularly reform of fossil-fuel price subsidies. However, fossil-fuel subsidy reforms have mixed impacts on energy poverty.

Overall, subsidy reforms are necessary because of their positive or desirable impacts on the economy as well as health and environment (IMF, 2013). Households can have improved energy access due to expanding distribution and improved quality of services as a result of reduced subsidies or subsidy reforms.

On the other hand, subsidy reforms could increase energy poverty by increasing risk of reduced energy access through income and price effects. "Effective incomes would be expected to go down in the short term, as price increases push up costs, and…the poor struggle to adapt. Some households can suffer from reduced energy access if energy becomes expensive and there are no affordable alternatives (Beaton and others, 2013, p.45)." For example, kerosene is often important for low-income households particularly those that do not have access to electricity. Reforming, if not removing altogether, subsidies on kerosene have high income effects on the poor. In the Philippines, diesel-fired generating sets (diesel gen-sets) provide electricity to small islands, including those with small distribution networks. The gradual removal of subsidies on fossil fuels would have had income and inflationary impacts on the households living in these communities.

AEMI should therefore include measures that mitigate the impact of energy pricing reforms. For fossil fuel subsidy reforms, these mitigation measures include infrastructure programs (e.g. rural electrification programs that extend utility distribution networks or install decentralized systems) and facilitation of investment on energy access (e.g. private sector micro- and mini-grids) (Beaton and others, 2013). For example, rural electrification programs mitigate the income and price effects of energy pricing reforms by contributing or having positive impacts on poverty reduction.[12] Navarro (2013) found "a positive relationship between rural electrification and poverty reduction in the Philippines." This same study demonstrated that increased access to electricity of households in Philippine rural areas as a result of various rural electrification programs was associated with substantial increase in per capita income and per capita spending (Navarro, 2013).

Energy access programs should include providing affordable alternative energy source that can mitigate impact of subsidy reform on low-income groups (IMF, 2013). In the Philippines the

[12] See Navarro (2013) for an overview discussion on the impact of rural electrification on poverty.

USAID-AMORE[13] program has designed schemes so that solar home systems and solar lanterns become affordable substitutes to kerosene that had been deregulated. In fact, the basis for pricing these cleaner alternatives for providing lighting to poor households in Mindanao was the price at which households were procuring kerosene (AMORE, 2011).

"Well-targeted measures to mitigate the impact of energy price increases on the poor are (also) critical for building public support for subsidy reforms (IMF, 2013, p. 30)."

4. International standards on technologies (products and systems) that address energy poverty or increase energy access are adopted.

Market integration is often accompanied by harmonization of international product and systems standards in order to facilitate cross-border trade and investments, which is one key feature of market integration. Standards benefits customers and end-users primarily by ensuring quality and safety of products and systems or installations. They also benefit enterprises. One benefit of standards to enterprises providing energy access goods and services is sustainable growth deriving from customer satisfaction, resulting in repeat sales and referrals (Ngigi, 2013). With market integration, another benefit of standards, that is, harmonized standards through the adoption of international standards for example, to consumers is access to quality goods and services. Another benefit to enterprises is increased access to markets beyond national borders and thus also increased sales.

Solar PV systems, for example, have been the most economical way of providing basic electricity services, such as lighting and clean drinking water, to individual households in very remote rural areas. With the cost of solar panels decreasing, solar PV is becoming competitive compared to mini-hydro and biomass to serve community or village demand, or for mini-grid application. Indeed, solar PV has proven itself cost-effective in many off-grid applications (IEC, 2010).

The Technical Committee (TC) 82 of IEC (International Electrotechnical Commission) has developed international standards for solar PV systems that maybe adopted by countries in ASEAN, for example, Indonesia, Myanmar, Philippines, and Lao PDR that have big portion of their respective population still without access to electricity and modern fuels. TC 82 "Solar photovoltaic energy systems" prepares International PV Standards for systems that convert solar energy into electrical energy and for all the elements in the entire PV energy chain, including off-grid lighting systems. IEC TC 82 standards are used by qualification testing laboratories throughout the world in testing product submitted by manufacturers who wish to enter the PV market place. But included in users are teaching and research universities and colleges, government laboratories, and others with an interest in the PV technologies. Standards are also written for balance of systems components—such as inverters and charge controllers—and for grid safety when operating dc to ac inverter systems connected to the utility grid. Systems standards are also written for use by systems integrators in commissioning of small and large photovoltaic generating systems. Technical specifications are also written for use in specifying, commissioning and operating PV and hybrid stand-alone systems or micro-grids in developing countries. Customers here are systems integrators, system owners, utilities, World Bank and governments that provide funding for such systems.

[13] United States Agency for International Development-Alliance for Mindanao and Multi-Regional Renewable Rural Electrification and Development Phase III

IEC has also released TS (Technical Specification) IEC/TS 62257-9-5 for solar-powered light-emitting diode (LED) lighting devices, such as solar lanterns. “Part of the effort to expand access to modern off-grid lighting among low-income households in developing countries, the new specification represents an important step in aiding governments to harmonize their national standards, paving the way for market expansion for quality-assured devices (IEC,2013).

On the other hand, EVN and ICASEA (2013) list the IEC standards that govern the selection and design of off-grid system components and procedures for system sizing. These include standards for mini-grids that offer a means of providing electricity from renewable and other sources to those who do not have access to electricity as they live in remote or rural areas, or on islands not connected to the main grid. Mini-grids are expected to supply 40% of new capacity by 2030 (IEC, 2013).

Table 6 IEC Standards for off-grid systems

Standards	Features
IEC 62257-1:2003:	Contains recommendations for small renewable energy and hybrid systems for rural electrification specifically Part 1: General introduction to rural electrification.
IEC 62257-8-1:2007:	Contains recommendations for small renewable energy and hybrid systems for rural electrification specifically Part 8-1: Selection of batteries and battery management systems for stand-alone electrification systems - Specific case of automotive flooded lead-acid batteries available in developing countries.
IEC 62257-7-3:2008:	Contains recommendations for small renewable energy and hybrid systems for rural electrification specifically Part 7-3: Generator set - Selection of generator sets for rural electrification systems.
IEC 62257-3:2004:	Contains recommendations for small renewable energy and hybrid systems for rural electrification specifically Part 3: Project development and management.
IEC 61427:	This standard is about secondary cells and batteries for renewable energy storage, general requirements and methods of test. This IEC specifies the particular operating conditions experienced by secondary batteries in photovoltaic applications during their use.
IEC 62124:	This standard is about photovoltaic (PV) stand-alone systems and design verification. This standard verifies system design and performance of stand-alone PV systems.

Source: EVN and ICASEA (2013), pp. 63-64

5. Regional cooperation on renewable energy distributed generation and off-grid systems, including especially micro- and mini-grids, are continued and enhanced.

In many remote rural areas in ASEAN that have not been reached by electricity grids, particularly Indonesia, Myanmar, and Philippines, as well as in fact Vietnam and Thailand, access to electricity can only be made economically and technically possible by development of off-grid and distributed generation systems, including micro- or mini-grids and stand-alone individual households systems (e.g. solar home systems or SHS). AEMI should continue the national efforts and build on them to

further ASEAN regional cooperation in this regard, including those by HAPUA and RE-SSN. In fact, ASEAN could learn from successful experiences within these countries and present these as model approaches in the framework of existing regional cooperation to boost national efforts. Besides knowledge sharing and dissemination of best practices, another area for regional cooperation is the harmonization of national standards on off-grid systems through the adoption of recognized and applicable international standards (e.g. those by IEC as shown earlier).

Monitoring progress[14]

Part of AEMI strategy should be monitoring progress of energy poverty reduction target or attainment of universal energy access.

The IEA has devised an Energy Development Index (EDI) in order to better understand the role that energy plays in human development (IEA, 2010). EDI tracks progress in a country's or region's transition to the use of modern fuels. By publishing updates of the EDI on an annual basis the IEA hopes to raise the international community's awareness of energy poverty issues and to assist countries to monitor their progress towards modern energy access. Indeed, a robust set of indicators for measuring energy poverty is needed to provide a rigorous analytical basis for policy-making. Indicators:

- Improve the availability of information about the range and impacts of options for action and the actions that countries are taking to increase access to energy;
- Help countries monitor actions they take to meet their agreed target;
- Enhance the effectiveness of implementation of such policies at national and local levels.

The EDI is calculated in such a way as to mirror the UNDP's Human Development Index and is composed of four indicators, each of which captures a specific aspect of potential energy poverty:

- *Per capita commercial energy consumption* serves as an indicator of the overall economic development of a country;
- *Per capita electricity consumption in the residential sector* serves as an indicator of the reliability of, and consumer's ability to pay for, electricity services;
- *Share of modern fuels in total residential sector energy use* serves as an indicator of the level of access to clean cooking fuels;
- *Share of population with access to electricity*.

A separate index is created for each indicator, using the actual maximum and minimum values for the developing countries covered. Performance in each indicator is expressed as a value between 0 and 1, calculated using the formula below:

$$\text{Indicator} = \frac{\text{Actual value} - \text{minimum value}}{\text{Maximum value} - \text{minimum value}}$$

[14] This section derives heavily from IEA (2010), pp. 29-35.

The EDI is then calculated as the arithmetic mean of the four values for each country.

An EDI maybe calculated specifically for ASEAN as part of the AEMI, considering only the maximum and minimum values of each component indicator for this region.

A correlation can also be drawn between EDI for ASEAN and the energy market competition index (EMCI), which was proposed as a measure of energy market integration (see Sheng and Shi, 2013). Using principal components analysis (PCA), EMCI is a function of energy consumption productivity (GDP/energy consumption) and electricity share (electricity consumption/total energy consumption). Increasing energy access should increase energy consumption productivity and electricity share, and thus the energy market competition index.

Another important component of AEMI strategy towards eliminating energy poverty is a mapping of investment requirements and an inventory of options to finance those investments.

Investment requirements and financing options

Investment requirements

No comprehensive data on investment requirements for eliminating energy poverty in ASEAN is available but two issues of the International Energy Agency (IEA)'s *World Energy Outlook* provided aggregate estimates for Developing Asia, which can give us clues on the likely size of ASEAN investment requirements. Developing Asia includes all the ASEAN member-countries.[15]

In the *World Energy Outlook 2010*, the IEA estimated that the bulk of the investment for electrification by 2015 would be incurred more rapidly in developing Asian countries than in Sub-Saharan Africa even though the latter has a lower electrification rate. As of 2009, the electrification rate in Sub-Saharan Africa was 31% whereas in Developing Asia, it was 78%. The investment requirements from 2010-2015 was expected to be US$80 billion in Sub-Saharan Africa and US$127 billion in Developing Asia. Investment for electrification would grow more rapidly in Developing Asia primarily because economic growth was expected to be more rapid in these countries than in Sub-Saharan Africa.

In the *World Energy Outlook 2011*, the IEA estimated the investments required to achieve the goal of universal access to electricity and clean cooking facilities by 2030, which was referred to as the "Energy for All Case" in the projections. Access to electricity was defined not only as first supply connection to a household but also as involving minimum consumption of 250 kilowatt-hours (kWh) per year for a rural household and 500 kWh per year for an urban household. The IEA report also projected investment requirements in the "New Policies Scenario", which was a scenario based on broad policy commitments and plans that had been announced by countries around the world to address energy security, climate change and local pollution, and other pressing energy-related issues. (The interested reader may refer to Annex B of the *World Energy Outlook 2011* for an enumeration of these commitments and plans.) However, the IEA explained that the projected investment levels in the New Policies Scenario would not be enough to achieve universal access to modern energy services by 2030.

[15] Developing Asia as categorized by the IEA includes: Bangladesh, Brunei Darussalam, Cambodia, China, Chinese Taipei, India, Indonesia, the Democratic People's Republic of Korea, Malaysia, Mongolia, Myanmar, Nepal, Pakistan, the Philippines, Singapore, Sri Lanka, Thailand, Vietnam and other non-OECD Asian countries (Afghanistan, Bhutan, Cook Islands, East Timor, Fiji, French Polynesia, Kiribati, Laos, Macau, Maldives, New Caledonia, Papua New Guinea, Samoa, Solomon Islands, Tonga, and Vanuatu).

In the Energy for All Case, the additional investments between 2010 and 2030 in Developing Asia would total US$241 billion (see Table 7). On a global scale, achieving the end of universal access for all would require a total investment of US$641 billion, which implied investments of more than 5.3 times the investments on electricity access in 2009.

Table 7 Additional investment required to achieve universal access to electricity (billion in 2010 US dollars)

	2010-2020	2021-2030	Total
Africa	119	271	390
Sub-Saharan Africa	118	271	389
Developing Asia	119	122	241
India	62	73	135
Rest of Developing Asia	58	49	107
Latin America	3	3	6
Developing Countries*	**243**	**398**	**641**
World	**243**	**398**	**641**

*Developing countries total includes Middle East countries.
Source: IEA (2011), *World Energy Outlook 2011*.

India accounted for 46% of total population without electricity access as at 2013, based on REN21 (2013), and for 56% of additional investments required to achieve universal access by 2030, as indicated in Table 7. The ASEAN accounted for 20% of total population without electricity access. If the additional investments required to achieve universal access by 2030 were proportional to population without electricity access, then it would be about USD48 million for ASEAN.

However, the IEA arrived at the above estimates by first determining the regional cost per megawatt-hour (MWh) from estimates of regional costs and consumer density. It then assessed the necessary combination of on-grid (grid extension), mini-grid, and isolated off-grid solutions. Mini-grids provide centralized generation at a local level and use village-level distribution networks. Off-grid solutions are stand-alone systems that do not entail transmission and distribution costs. The cost per MWh of delivering electricity through the grid is lower than through mini-grids or off-grid solutions, and the IEA estimated that grid extension was the most suitable option for all urban zones and around 30% of rural areas. The remaining 70% of rural areas were projected to be connected through mini-grids (65%) or stand-alone off-grid solutions (35%).

Financing options

In meeting energy poverty reduction targets, defining the sources of financing in part depends on the types of technical solutions that are best suited for the types of demand—for example, on-grid connection extensions, mini-grid distribution system, and off-grid electrification. ASEAN countries would benefit from a bottom-up approach in defining the suitability of technical solutions and the corresponding financing requirements and strategies. The financing options for putting these technical solutions in place are government budget, multilateral and bilateral official development

assistance, and private sector financing. These options can be pursued individually or as a combination of two or more options. The *World Energy Outlook 2011* (IEA, 2011) describes that the global demand for universal access can be financed using these options depending on the level of household energy expenditure, as outlined in Table 8 below.

Table 8 Financing options for pursuing universal access to electricity

	Level of household energy expenditure	Main source of financing	Other sources of financing
On-grid	Higher	Private sector	Developing country utilities
	Lower	Government budget	Developing country utilities
Mini-grid	Higher	Government budget, Private sector	Multilateral and bilateral guarantees
	Lower	Government budget	Multilateral and bilateral concessional loans
Off-grid	Higher	Multilateral and bilateral guarantees and concessional loans	Private sector, Government budget
	Lower	Multilateral and bilateral concessional loans and grants	Government budget

Note: Adopted with modifications from IEA (2011), *World Energy Outlook 2011*.

For on-grid electrification, the investment requirements of higher energy expenditure households can be primarily financed by the private sector, with supplemental financing from developing country utilities. The investment requirements for on-grid electrification of lower energy expenditure households, on the other hand, can be financed by government budgets, supplemented by the budgets of developing country utilities.

For mini-grid electrification, higher energy expenditure households can be given electricity connection mainly through government budgets and private sector financing, and secondarily through multilateral and bilateral guarantees. The multilateral and bilateral guarantees can serve as credit enhancements for private sector financing. Connecting lower energy expenditure households to mini-grids, on the other hand, can be primarily through government budgets, which can be supplemented by multilateral and bilateral concessional loans.

Off-grid electrification is a technical solution that can justify soft financing as this solution is usually for the very remote rural areas. For higher energy expenditure households, the presence of multilateral and bilateral guarantees is very important for any private sector financing that may be feasible; multilateral and bilateral concessional loans can be the primary financing source and

government budgets can provide supplemental financing. For lower energy expenditure households, off-grid electrification can be mainly financed by multilateral and bilateral concessional loans and grants, with government budgets providing support.

An emerging financing option for increasing energy access is carbon finance. In carbon finance, projects that help reduce greenhouse gas emissions earn carbon credits that are then sold within the Clean Development Mechanism (CDM). The CDM is a mechanism for emissions trading defined in the Kyoto Protocol to the United Nations Framework Convention on Climate Change in 2007. IEA (2011), however, warned that substantial obstacles to using carbon finance for increasing energy access must first be overcome. Such obstacles include the long, uncertain and expensive process for determining the emissions baseline, assessing and registering projects, and monitoring and certifying the carbon credits. Nevertheless, procedural improvements are emerging and the World Bank Carbon Finance Unit has been developing methodologies such as the standardized approach in small scale CDM methodology for grid rural electrification, that is, the replacement of stand-alone rural power generation and traditional fuels with more efficient grid extensions and new local mini-grids (Spors, 2011).

6. Conclusion

AEMI and ASEAN energy poverty

The strong connection between AEMI and energy poverty has been established at both macro and energy sector levels. At the macro level, energy market integration can contribute to national economic growth and development by facilitating the catching up of less developed economies to those more developed. But this will not be possible without addressing the issue energy poverty or increasing energy access, as "(l)ack of access to modern energy services is a serious hindrance to economic and social development and must be overcome if the UN Millennium Development Goals (MDGs) are to be achieved (IEA, 2010, p. 8)."

At the energy sector level, integration of energy markets would allow national governments to more easily address the energy policy challenges that face any country, including security of energy supply and/or demand; economic efficiency of the energy sector; social equity, particularly access to affordable energy; and reduced emissions of pollutants (Andrews-Speed, 2011). Energy security has been the first priority among these policies, and energy security itself rests on three pillars: the adequacy and reliability of physical energy supply, environmental sustainability, and affordable access (ADB, 2013).

Indeed, AEMI cannot come about without addressing the situation of more than 127 million people in the region without access to electricity and at least 228 million people without access to modern cooking fuels and technologies. To be sure, the ASEAN recognizes the severity of the energy poverty situation in the region and is committed in closing the gap on energy access through energy cooperation, which for all intent and purposes is the precursor to energy market integration.

Recommendations for future action

This paper recommends some actions that need to be taken within or alongside AEMI to accelerate energy access on one hand and to mitigate the possible impacts of AEMI on the other hand. This is addressed to the various ASEAN energy sector bodies, including particularly the SOME, AMEM, the relevant subsector networks, HAPUA, and ACE,

Estimate the direct and indirect impacts of energy prices subsidy reform on the poor. Assessing the impacts of fossil-fuel subsidy reform is "an important foundation for persuasively communicating the necessity for reform and for designing policies to reduce the impact of higher fuel prices on the poor (IMF, 2013, p. 26)." Beaton and others (2013) discuss the qualitative and quantitative approaches to assessing the impacts of subsidy reform.

Disseminate and share knowledge and experiences on fossil-fuel subsidy reform and mitigating impacts. "Southeast Asian countries have a wealth of experience in reducing and reforming fossil-fuel subsidies and can learn from one another's experiences. Opportunities for increased policy dialogue and sharing case studies would help replicate successes and share the lessons that have been learned (Beaton and others, 2013, p. 94)."

RE-SSN and HAPUA should continue and expand cooperation on off-grid and decentralized renewable energy systems and perhaps coordinate with each other to accelerate elimination of energy poverty. Knowing that off-grid systems that are fuelled by renewable energy sources, whether decentralized stand-alone systems or micro- and mini-grids, are the most economical solutions to providing electricity access in still many cases (because of the non-viability of grid or line extension), RE-SSN and HAPUA should put this as priority topic in their respective work programs, including the possibility of joint-discussions.

A potential area for joint-discussion is the adoption of regional and national standards on off-grid and decentralized systems, including micro- and mini-grids, based on existing international standards.

Estimate investment requirements for achieving universal energy access by 2030 and study of financing options. In cooperation with IEA/OECD, it is recommended that ACE determine the investment requirements needed for achieving universal energy access by 2030 in ASEAN or among ASEAN member-countries. This undertaking should not be limited to estimating the investment requirements in dollar terms, but perhaps more important the technological options behind such investments. Equally important are the potential sources of financing for those investments. This is to put real value on and stress the urgency of the tasks ahead. Above all, insofar as AEMI is concerned, such undertaking should point to areas of cooperation in the area of energy access. For AEMI cannot be realized if some people in the region are without access to clean energy.

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IV. Addressing national constraints, energy pricing and subsidies

Maxensius Tri Sambodo, Adoracion Navarro, and Tran Van Binh

Summary

The analysis in this section focuses on national constraints that we divide into two main parts namely institutional challenge especially energy pricing policy and infrastructure constraints in the case of ASEAN Power Grid (APG) and Trans-ASEAN Gas Pipeline (TAGP). We found five main findings. **First**, exit strategy on energy subsidies have not discussed deeply at ASEAN Minister of Energy Meeting (AMEM). As a result, most of ASEAN countries still provide energy subsidies with different degree. This condition is paradox with the ASEAN Energy Market Integration (AEMI) objectives and the targets itself because subsidies on fossil fuels do not only cause over-consumption of such fuels but also reduce the incentives for investment in energy efficiency and renewable energy. **Second**, there is still a high national resistance for conducting institutional reform for energy market. This is due to a specific set of procedures or criteria for deciding energy cooperation is subject to national political institution that relatively unstable because of high cost on political market. **Third**, APG can well developed if each country do their best to develop grid connections close to the border, to harmonize technical standards, to minimize environmental impact, and to reduce transmissions and distribution loss. However, we are worried with sustainability of power trading if country can increase its national capacity. **Fourth**, while investing in pipeline is important for supporting the TAGP, it is important to prepare a trading hub, to promote a competitive natural gas market, and to develop national gas infrastructure. AEMI has three major roles to measure national constraints. **First**, AEMI can endorse countries to eliminate fossil fuel subsidies. This indicates that countries share of responsibility in promoting a more competitive and efficient energy market. **Second**, AEMI can prepare a specified procedures or criteria before countries decide to provide energy subsidies. **Third**, AEMI can promote innovative financing that can promote infrastructure connectivity in the context of ASEAN + 3. Finally, we suggest developing energy security framework in analyzing the phase of national interest and AEMI's interests. We note that there are two possibilities to investigate relationship between national constraints and regional objectives. If common interest at national level similar with regional level, national constraints should disappear. However, if common interest at national level is conflicting with regional level, national constraints remain exist.

1. Introduction

ASEAN is the region relatively rich in energy resources, even though only a few countries are genuinely self-sufficient. Oil, gas, coal, hydro, geothermal and biomass are available in Indonesia. There are oil, gas and coal reserves in Malaysia and Thailand. Brunei has quite large reserves for oil and gas. There are potential reserves of oil, gas and hydro in Myanmar, while oil and hydro are found in Cambodia. Laos has quite large hydro potential. Vietnam has oil, gas, coal, hydro and biomass; the Philippines has oil, gas, coal, hydro and geothermal. Singapore has no indigenous energy resources, but the country is very important as a major processing center for oil and petrochemical, and oil bunkers.

Due to variety in energy supply and demand conditions, energy cooperation in ASEAN has been initiated in the 1970s when Thailand and Lao PDR was adversely affected by the oil crisis in 1970s. ASCOPE (ASEAN Council on Petroleum) was established in 1975. In 1981, Heads of ASEAN Power Utilities/Authorities (HAPUA) was established. Energy cooperation within ASEAN is challenged by its individual member's energy priorities, bilateral trade partners and development dynamics beyond the borders. Indonesia delivers natural gas through a pipeline to Singapore and Malaysia. Laos sends electricity to Thailand, Vietnam and Cambodia, while Cambodia also imports electricity from Thailand and Vietnam. A joint development area for energy resources development was established between Malaysia and Thailand. ASEAN crude oil is sent to Singapore for refining and parts of the products are sent back to the producing countries.

Energy Market Integration (EMI) is characterized by flow of trade and investment. Institutional dimension and infrastructure connection determine degree of market integration. Pursuing EMI is not only about economic decisions but also political decisions. Even energy sovereignty tends to be overlooked than the economic objectives. For example, according to the Energy Law of the Republic of Indonesia No 30 Year 2007, Part 7 consists of "International Cooperation". Article 10 said that "International cooperation in energy sector can only be conducted to": (i) guarantee the nation's energy resilience; (ii) guarantee the availability of domestic energy; and (iii) improve the nation's economy. Further, the law also indicates that any international agreement in the field of energy that has wide-raging and fundamental impacts on people's life associated with the state financial burden and/or requiring the amendment to or the making laws is subject to approval of the House of People's Representative.[16]

After more than four decades, the energy cooperation has been promoted, progresses have been made, but there are still abundant of tasks that need to be done. For example, ASEAN is still struggling with regulatory framework for LNG export, harmonization of regulatory framework and

[16] According to the Government Regulation of Indonesia No 42 Year 2012, there are 6 criteria before conducting electricity's import: (i) local demand cannot be fulfilled (if reserve capacity less than 30% of peak load); (ii) complementing local need; (iii) no negative impact on national interest such as sovereignty, security, and economic development; (iv) improving quality of local supply; (v) development of national capacity should go first; (vi) it will not be trapped into energy dependency. On the other hand, in terms of export, there are three criteria: (i) local need has been fulfilled; (ii) no subsidy in price; (iii) it will not have impact on quality of local supply. Thus, it seems that import's criteria are more complex than the export.

technical standards for the operation of APG.[17] Institutional reform such as liberalizing, privatization, deregulation, and restructuring is still under progress. This indicates that there is still a challenge to harmonize between national interests and regional objectives. We argue that the key success ASEAN Energy Market Integration (AEMI) depend individual efforts from each member countries to follow up and implement the commitments. Thus it is necessary to understand the national constraints in terms of institutional and infrastructure challenge. This can provide better way in order to bring the AEMI forward.

2. Institutional Challenge – Pricing Policy

Institutional dimension has been discussed in the first meeting of the ASEAN Economic Ministers on Energy Cooperation in Bali in 1980. At that meeting, the framework of energy cooperation that consist of exchange information on policy planning, programming and financing and the strengthening of institutional arrangement was considered by delegations. The entire ASEAN members also agree that they need to create a more competitive and efficient energy sector in the region. ASEAN also needs partners to realize commitments.

However, the acceleration of institutional reform is moved slowly. For example, energy pricing reform policy is one of determinant factor on how the energy efficiency and promoting new and renewable energy can be achieved. Energy subsidies by ASEAN member states are likely indirect subsidies as the Institute for Energy Research assessed that developing countries provide indirect subsidies by artificially lowering energy prices to their citizens and paying the difference from their government resources. In contrast, the United States and other developed countries offer direct support to energy production in the form of tax credits, loan guarantees, or use mandates (Institute for Energy Research, 2013). Beaton et al. (2013) also describes that governments in Southeast Asia subsidize fuels to varying extents: Indonesia subsidizes mostly petroleum products and electricity; Thailand subsidizes all energy types; Malaysia has subsidies for all fuel types except coal; Vietnam's subsidies mostly go to the electricity sector; and the Philippines has largely removed all energy subsidies but uses preferential taxation for some petroleum products.

Most of ASEAN countries still provide energy subsidies with different degree; even some countries provide subsidies above the world's level.[18] Table 1 and Table 2 indicate pre-tax and post-tax subsidies for petroleum products, electricity, natural gas, and coal. Post tax subsidy is higher than pre-tax subsidy.[19] Subsidy on petroleum products is higher than others energy commodity. In the

[17] Joint ministerial statement of the 30th ASEAN Minister of Energy Meeting (AMEM) on 12 September 2012 in Phnom Penh, Cambodia.

[18] IMF (2013) conducted study that cover 19 countries with 22 country case studies and 28 major subsidy reform episodes from Sub Sahara Africa, Asia, Middle East, North Africa, Latin America, Caribbean, Central and Eastern Europe and the CIS. Out of the 28 reform episodes, 12 were classified as a success, 11 as a partial success, and five as unsuccessful[18]. This indicates that not the all subsidy reform is successful. IMF (2013) indicated that subsidy reform (fuel) in Indonesia in 2008 was partially successful, while fuel and electricity reform in Philippines were successful.

[19] The definition and terminology refer to IMF (2013). Pre-tax subsidy = PW – PC; PW = international price appropriately adjusted for transport and distribution cost; PC = the price paid by consumers. In the case of electricity the benchmark price is taken as the cost recovery price (e.g. the cost of generation, transmission, and distribution of electricity). The pre-tax subsidies only exist in countries where the price paid by consumers is below the international or cost recovery price. Post-tax subsidy = (PW + t*) – PC, t* = adjustment for efficient taxation (t*>0) to reflect both revenue needs and

case of pre-tax subsidy, Brunei Darussalam allocated 3.32% of GDP for total energy price, while Indonesia was about 3.24% of GDP. However, in terms of government GDP, the Indonesian government allocated the highest that was about 18.2% of government revenue while Thailand and Malaysia allocated about 9.59% and 8.57% respectively. In the case of post-tax subsidies, Malaysia reached the highest in terms of its share to government expenditure.

Table 1. Pre-tax Subsidies for Petroleum products, electricity, natural gas, and coal in 2011

	Petroleum products		Electricity		Natural gas		Coal	
Country	% of GDP	% of Gov't Rev.	% of GDP	% of Gov't Rev.	% of GDP	% of Gov't Rev.	% of GDP	% of Gov't Rev.
Brunei Darussalam	2.34	3.77	0.98	1.57	0.00	0.00	0.00	0.00
Cambodia	0.00	0.00	n.a	n.a	n.a	n.a	n.a	n.a
Indonesia	2.58	14.51	0.66	3.69	0.00	0.00	0.00	0.00
Lao P.D.R	0.00	0.00	n.a	n.a	n.a	n.a	n.a	n.a
Malaysia	1.24	5.67	0.33	1.49	0.31	1.41	0.00	0.00
Myanmar	0.54	9.35	n.a	n.a	n.a	n.a	n.a	n.a
Philippines	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Thailand	0.15	0.66	1.64	7.24	0.14	0.61	0.25	1.08
World	0.30	0.91	0.22	0.64	0.16	0.48	0.01	0.03

Source: IMF (2013)

a correction for negative consumption externalities. In the case of electricity the benchmark price is taken as the cost recovery price (e.g. the cost of generation, transmission, and distribution of electricity). When the refined petroleum product is imported, the benchmark price is taken as the international fob price plus the cost of transporting the product to the country's border plus the cost of internal distribution. When the product is exported, the benchmark price is the international fob price minus the cost of transporting the product abroad (since this cost is saved when the product is consumed domestically rather than exported) plus the cost of internal distribution.

Table 2 Post-tax Subsidies for Petroleum products, electricity, natural gas, and coal in 2011

	Petroleum products		Electricity		Natural gas		Coal	
Country	% of GDP	% of Gov't Rev.	% of GDP	% of Gov't Rev.	% of GDP	% of Gov't Rev.	% of GDP	% of Gov't Rev.
Brunei Darussalam	5.92	9.51	1.37	2.19	1.12	1.81	0.00	0.00
Cambodia	0.00	0.00	n.a	n.a	n.a	n.a	0	0.01
Indonesia	3.87	21.74	0.72	4.04	0.30	1.67	0.47	2.62
Lao P.D.R	0.00	0.00	n.a	n.a	n.a	n.a	n.a	n.a
Malaysia	5.12	23.39	0.56	2.54	0.79	3.36	0.74	3.38
Myanmar	0.97	16.93	n.a	n.a	n.a	n.a	n.a	n.a
Philippines	0.20	1.18	0.00	0.00	0.08	0.43	0.46	2.65
Thailand	1.40	6.16	1.76	7.77	0.72	3.19	0.84	3.73
World	1.26	3.77	0.26	0.77	0.43	1.28	0.77	2.31

Source: IMF (2013)

Subsidies on fossil fuels do not only cause over-consumption of such fuels but also reduce the incentives for investment in energy efficiency and renewable energy. On the other hand, ASEAN member states also agreed to reduce energy intensity at least by 8% by 2015 based on 2005 level and to achieve collective target of 15% of renewable energy in the total regional power installed capacity by 2015.[20] This reflects contradiction between the regional objectives and the national behavior.

When there are no pricing mechanisms for the negative externalities of energy consumption on the environment, public health and traffic congestion, the presence of subsidies exacerbate these externalities by promoting overconsumption due to the artificially low price. Energy subsidies also puts pressure on the fiscal space of governments as these subsidies represent government revenues that are foregone and could have been made available for social services. Moreover, the volatility of international fossil fuel prices also translates to volatility in subsidies, thereby complicating budget management.

The intention by developing country governments for offering subsidies is often good to improve overall social welfare by making energy more affordable to the poor.[21] However, the Asian Development Bank (ADB) argued that this is not happening given that many of the poor in Asia

[20] Joint ministerial statement of the 27th ASEAN Minister of Energy Meeting (AMEM) on 29 July 2009 in Mandalay, Myanmar.

[21] In the case of Indonesia, the Energy Law said that "energy prices shall be determined on the basis of a fair economic value".[21] The Energy Law also said that "government and regional government shall provide subsidy fund for less wealthy community group". However, the Indonesian government still provides energy subsidy. Because it is open subsidy both poor and rich people enjoy the subsidy. This indicates that reducing energy subsidies always becomes hard decisions.

lack electricity and gas connections, few of them own vehicles, and most of them transport sparingly. Therefore, the main beneficiaries of the subsidies are not really the poor. Citing International Energy Agency (IEA) data, an ADB report stated that of the nine Asian countries and two African countries surveyed by IEA in 2011, only 15% of the benefit from kerosene subsidies and only 5% of the benefit from liquefied petroleum gas subsidies went to the poorest 20th percentile (ADB, 2013).

Similarly, the IMF (2013) found that energy subsidy depress growth through four channels. First, subsidies can discourage investment in the energy sector. Second, subsidies can crowd out growth because subsidies can reduce fiscal space that can be used for public health and education, and other productive public spending. Third, subsidies diminish the competitiveness of private sector over the longer period. Fourth, subsidies create incentives for smuggling. The IMF's report (2013) also indicates the implications of energy subsidies to other dimensions. First, the balance of payment of energy-importing countries is vulnerable to international energy price. Second, subsidies can cause over consumption on energy and this can negatively affect the environment such as global warming and local pollution. Third, energy subsidies are mostly benefited the rich than the poor and subsides will also divert public spending for the poor.

IMF (2013) identify six barriers for energy reforms: (i) lack of information regarding the magnitude and shortcomings of subsidies; (ii) lack of government credibility and administrative capacity; (iii) concern regarding the adverse impact on the poor; (iv) concern regarding the adverse impact on inflation, international competitiveness, and volatility of domestic energy price; (v) opposition from specific interests groups benefiting from the status quo; and (vi) weak macroeconomic conditions. However there are six elements that can increase the likelihood of successful subsidy reform (IMF, 2013): (i) a comprehensive reform plan; (ii) a far-reaching communications strategy, aided by improvements in transparency; (iii) appropriately phased energy price increases, which can be sequenced differently across energy products; (iv) targeted mitigating measures to protect the poor; and (vi) depoliticizing energy pricing to avoid the recurrence of subsidies.

The IMF study illustrates the impact of subsidies on global warming and local pollution by estimating the effects of raising energy prices to levels that would eliminate tax-inclusive subsidies for petroleum products, natural gas, and coal. Eliminating the subsidies suggests that CO2 emissions could be reduced by 4 1/2 billion tons, representing a 13% decrease in global CO2 emissions. Moreover, the results suggest local pollution reduction in the form of 10 million tons of SO2 emissions reduction and a 13% reduction in other local pollutants, which imply that significant health benefits could be generated at the local level (IMF, 2013).

Energy subsidy reforms can be pursued at different paces, depending on country-specific factors. As suggested by Beaton et al. (2013), the framework for pacing can be referenced using two extremes the "gradual" pace or the "big bang" approach. The latter approach is defined as a reform that literally produces a significant shock to the economy and the citizens, that produces a "bang" so to speak, and an extreme example would be an elimination overnight of all energy subsidies (Table 3 provides a comparison of these two reference approaches).

In reality, reforms seldom adhere to either of these extremes but instead are likely to tend toward one approach than the other. For instance, the subsidy reforms in Eastern Europe following the collapse of the Soviet regime tended toward the big bang approach. Beaton et al. (2013) report that a quick withdrawal of subsidies and a fast move to market-based pricing were instituted in Eastern European countries as several rounds of significant price hikes. This type of reform had been politically feasible because it was part of much bigger political and economic transformations. The fossil-fuel subsidy reform in the Philippines, on the other hand, tended toward a gradual approach although there is one significant drastic step. There used to be an Oil Price Stabilization Fund (OPSF) in the Philippines. It was created in 1984 as a measure to protect the domestic consumers from debilitating global oil price shocks, like what happened in the 1970s. In 1996, the Philippines launched a partial deregulation of the downstream oil industry and introduced a regulator-approved automatic pricing mechanism that operated concurrently with the continued OPSF operations. In 1998, with the passage of the Downstream Oil Industry Deregulation Act, both the OPSF and the automatic pricing mechanism was abolished a significant drastic step but one that was guided by transition pricing for a few months before prices were fully floated.

Table 3 Comparison of Gradual and "Big Bang" Approaches

Performance criteria	Gradual	"Big bang"
Macroeconomic		
Reduction of costs	Gradual	Instantaneous
Impact on inflation and GDP	Low with each price increase, but risk of creating long-term expectations of inflation—"anticipatory inflation."	High, but over a short period.
Microeconomic and social		
Negative social impacts on households and businesses	Low to moderate. Easy to manage by adapting reform plan. Households and businesses have longer to adjust.	High. May lack capacity to promptly change reform strategy. No time for households and businesses to adjust.
Political		
Added risk of political instability	Low, but gives opposition time to organize against reforms.	High.
Use of political capital	High. Each price increase requires political capital. Increases risk of deferrals.	Medium. Only one price increase, but at the cost of a large economic shock.
Administrative		
Added risk of poorly designed reform strategy	Low to moderate. Actual impacts can feed into subsequent plans.	High. It is difficult to predict the impact of large economic shocks.
Added risk of poor implementation	Low. Allows for ongoing adjustment of reform strategy.	High. Requires very good projections of impacts and preparations.
Energy markets		
Reduced energy demand	Gradual	Instantaneous
Added risk of hoarding	High. Varies if schedule of price increases is known in advance.	Low. Varies if date of price increase is known in advance.

Source: Beaton et al. (2013) *A Guidebook to Fossil-Fuel Subsidy Reform for Policy-Makers in Southeast Asia*.

3. Infrastructure Constraints

In the 27th ASEAN energy ministers Meeting held in Myanmar, The ASEAN Plan of Action for Energy Cooperation (APAEC) 2010 – 2015 was approved with the main content: ASEAN Power Grid (*APG)*; Trans-ASEAN Gas Pipeline (TAGP); Coal and Clean Coal Technology (CCCT); Energy Efficiency and Conservation (EE&C); *Renewable Energy* (RE); Regional Energy Policy and Planning (REPP) and; Civilian Nuclear Energy (NEC). There are seven working groups within the framework of the ASEAN Energy Cooperation, including: ASEAN Council on Petroleum (ASCOPE)*;* ASEAN Power Utilities/Authorities (HAPUA); ASEAN Forum on Coal (AFOC); Energy Efficiency and Conservation Sub-Sector Network (EE&CSSN); Renewable Energy Sub-Sector Network (RE-SSN)*;* Regional Energy Policy and Planning Sub-sector Network (REPP-SSN) and*;* Nuclear Energy Cooperation Sub-Sector Network (NEC SSN). However, from concept to reality is long way with difficulties, constraints, and challengers that countries should overcome. The road to developing TAGP, ASEAN Power Grid, and other energy cooperation projects, however, has been quite slow, due to financial constraints, technical difficulties, differences in the industry regulatory frameworks among ASEAN countries, and some other factors.

3.1 ASEAN Power Grid (*APG)*

Thought the idea of power network interconnection has developed since 1978, it was approved by ASEAN's governments in 1997 in "ASEAN vision 2020". The aim is to set up energy security system for ASEAN region by common power network, based on that the members can share the ability of supply, transmission. Therefore, the lack of electricity supply of one member can be fulfilled by the others through electricity trading. The interconnection among 10 countries in ASEAN will bring a huge economical efficiency for both investors and users. It will also promote the development of power market, investment and ensure energy security for each country. It plays an important role in the process of meeting high energy demand during ASEAN modernization as the primary energy demand of the region are expected to increase approximately 3 times the from 2005 to 2030.

However, Bannister et al., (2008) pointed out five barriers to the energy market integration in electricity sector as follows: (i) managing risks and security; (ii) need to recognize the financial impacts may differ from economic benefit cost analysis; (iii) need to clarify and agree on the scope of ASEAN Power grid / APG trade; (iv) competitive; structure and open access and pricing; (v) rules and procedures for trade.

Transporting and delivering gas, electricity, and others energy equipment from one country to another are similar to the trading of commodities. So they will be subject to national, regional and/or international regulations. These could be pipeline permits, territorial boundaries, other licenses, taxation, quality standards, environment regulations, etc. Each country has its own power market, tariff system that is different from others. Besides, the difference among technical standards

of power system is also a barrier. In fact, the power grid of each ASEAN country is far different, while power transmission of ASEAN 6 is better than the ASEAN 4 is almost backward and unstable.

For a cross-border power project, technical standards are essential throughout both the construction and operation if it aims to maintain operational integrity. Differences in standards and procedures may contribute to the unreliability of interconnected power grids. For example: unstable voltage, frequent power outages and unguaranteed power level at 220kV could seriously affect the overall power grid. Further, as seen from Table 4, although the electric power transmissions and distribution loss tends to decrease, for most of countries it was above the OECD standard. This indicates that at the national level, each country needs to improve efficiency and promote investment for transmissions and distribution to minimize the losses.

Table 4. Electric power transmission and distribution losses (% of output)

Country Name	2000	2010
Brunei Darussalam	1.14	9.53
Cambodia	11.16	28.77
Indonesia	11.51	9.40
Lao PDR	NA	NA
Malaysia	8.00	6.54
Myanmar	31.30	16.61
Philippines	14.01	11.52
Singapore	3.64	7.05
Thailand	7.91	6.34
Vietnam	13.77	10.11
High Income: OECD	6.81	5.86

Source: World Development Indicators

There is a need of investment for infrastructure development, and technical capacity enhancement. But to promote Energy Market Integration (EMI), it is necessary to introduce competition in domestic energy markets, which often requires the restructuring of vertically integrated energy utilities into separate functional companies. However, monopoly status of the national energy companies in most of the ASEAN countries is a major obstacle in attracting private investment and foreign investment for energy infrastructure development in the region (see Box 1).

Box 1

In 2002 the government issued a new law on the electricity sector. Electricity Law No 20/2002 aims at creating a more competitive environment for the power-generating business in the short term and in the future in the selling area. Thus consumers will have many options to select from electricity sellers who can provide electricity with good quality and services. Based on Electricity Law No 20/2002, competition and transparency will improve efficiency in the electricity industry. Thus, there is a need to provide equal opportunity for all parties to participate in providing electricity utilities. Supporting electricity utilities means any activities that are related to consultation, development, and installation, testing, installation operation, research and development, education and training, and any activity that is directly related to electricity.

However on 15 December 2004, Electricity Law No 20/2002 was canceled by the Constitutional Court because it is violated the constitution. Electricity is very important and strategic for achieving national goals, thus it should be controlled by the state and cannot be liberalized. Thus, the electricity was regulated again by Electricity Law No 15/1985. On 16 January 2005 the government issued Government Regulation No 3/2005 that replaced Government Regulation No 10/1989. Generally speaking, there are two reasons the government issued Government Regulation No 3/2005. First, Government Regulation No 10/1989 was based on Electricity Law No 15/1985, which was very centralized. On the other hand, in 2004 the government issued Law No 32/2004 on Local Government. Thus, there is a demand for decentralizing electricity authority to local governments. Second, the government needs to enhance the participation of cooperatives, state-owned enterprises, local government-owned enterprises and the private sector to supply electricity.

Source: Sambodo (2012)

A typical example of bilateral and regional cooperation in ASEAN in the field energy is grid connection among Greater Mekong Subregion countries (GMS countries). In 2000, with the support of ADB (ADB, 2000)[22], Master Plan on Power Interconnection has been developed for the period 2000 to 2020 and then adjusted in 2010 within the framework of the Technical Assistance Project TA 6440-REG (ADB, 2007)[23].The proposal to develop power trade in the GMS is anchored on the principle that integration should proceed in four well-defined stages, as follows: (i) bilateral cross-border connections through power purchase agreements (PPAs); (ii) grid-to-grid power trading between any pair of GMS countries, eventually using transmission facilities of a third regional country; (iii) development of transmission links dedicated to cross-border trading; and (iv) most of the GMS countries have moved to multiple sellers–buyers regulatory frameworks, so a wholly

[22] Technical Assistance for the Regional Indicative Master Plan on Power Interconnection in the Greater Mekong Subregion. Manila (TA 5920-REG, $900,000, approved on 10 July 2000, financed by the TA Special Fund and the Government of Norway).

[23] Technical Assistance for Facilitating Regional Power Trading and Environmentally Sustainable Development of Electricity Infrastructure in the Greater Mekong Subregion. Manila (TA 6440-REG, $5 million, approved on 19 December 2007, financed by the Government of Sweden). A small component of the Technical Assistance for GMS Regional Power Trade Coordination and Development (TA 6304-REG) also undertook some simulations to update the regional indicative master plan.

competitive regional market can be implemented. Grid connection process among the countries in the GMS is promoted from high-demand countries such as Thailand, Vietnam through investment projects of building power plants (mainly hydropower exploitation) together with the power purchase agreement among the countries. The investment project is being implemented in phases up to 2020.

Table 5. Investment Project in GMS

Project	Location	Market	Type	Capacity (MW)	Completion Date
Xekaman 3 (IPP)	Lao PDR	Lao PDR/ Viet Nam	Hydro	250	2012
Theun–Hinboun Expansion (IPP)	Lao PDR	Lao PDR/ Thailand	Hydro	220 + 60	2012
Xekaman 1 (IPP)	Lao PDR	Lao PDR/ Viet Nam	Hydro	322	2014
Sekong 3	Lao PDR	Lao PDR/ Viet Nam	Hydro	205	2015
Xekaman 4	Lao PDR	Viet Nam	Hydro	80	2016
Hongsa Lignite (IPP)	Lao PDR	Lao PDR/ Thailand	Coal	1,878	2015
Nam Ngum 3 (IPP)	Lao PDR	Lao PDR/ Thailand	Hydro	460	2017

Note: IPP = independent power producer, Lao PDR = Lao People's Democratic Republic, MW = megawatt.
Source: (4).

However, a contradiction of the few countries in the ASEAN region, such as border conflict between Thailand and Cambodia or the debate between Vietnam, Cambodia and Laos, Thailand in the construction of Xayaburi hydropower around the impact of hydroelectric dams to the lower Mekong environment, is the obstacle in the negotiation process of establishing cooperation among these countries (Lee, 2013). Similarly, Hebertson (2012) pointed out that developing the Lower Mekong dams would bring significant social, economic and environmental cost. Development of Xayaburi Dam causes two pole of opinions, such as Laos and Thailand who pro and Cambodia and Vietnam who cons. Further, Hebertson (2012) pointed out three lessons learn from the Xataburi dam. First, energy planning should not take place behind close doors. Second, strategic environmental assesments should become a regular part of energy planning. Third, when somone says that hydropower is "renewable" be sure to ask more questions. These conflicts will delay the whole process of forming the ASEAN power grid.

We also found that sustainability of power trading will become a challenge in the future. It seems that power trading is happened due to lack in power supply, but if country can increase electricity production, power trading may decrease in the future (see Box 2). This may waste investment fund that has been allocated by one country. This condition needs to be discussed seriously among the member, especially when industrial, commercial zones tend to develop in the future. Fair competition among the power companies in the countries also need to be promoted.

BOX 2[24]

According to PT.PLN's business plan 2009-2018, in the area of Kalimantan, PT.PLN plans to buy (import) electricity from SESCo. Interconnection between Sarawak and West Kalimantan will be constructed with transmission at 275 kV. The transmission is designed to supply electricity at capacity 200 MW. SESCo is connected with Benkayan's system in Indonesia and Mambong in Sarawak-Malaysia. Indonesia has responsibility to construct 180 km transmission line between Benkayan and Malaysia's cross border and inter bus transformer (IBT) at 250 MVA. The Power trading or energy exchange will be started in 2015. From the Indonesian's perspective, there are two benefits of power trading. First, it can support the steam coal (peat steam) – Pontianak 1, if the project (Pontianak 1) is delayed due to environmental constraints. Second, power trading can increase power reserve that is important to improve system security. Furthermore, Indonesia can also sell electricity to SESCo. Electricity trading will be promoted under the independent power producer (IPP) scheme. The document indicates that power trading will be started in 2015 with capacity 50 MW until 2018. As seen from the table in 2015, West Kalimantan will buy about 34% of total electricity balance from SESCo. However, the share tends to decrease and it is below 10% between 2019 and 2021.

Energy Balance in West Kalimantan (GWh)

Year	PT.PLN	SESCo	Total	Share of SESCO to total (%)
2012	1,374	0	1,374	0
2013	1,725	0	1,725	0
2014	1,993	0	1,993	0
2015	1,443	733	2,176	34
2016	1,798	727	2,525	29
2017	1,970	737	2,707	27
2018	2,141	738	2,879	26
2019	2,833	227	3,060	7
2020	3,162	142	3,304	4
2021	3,250	317	3,567	9

Source: PT.PLN (2012)

[24] This section is part of ERIA Research Project 2012 Working Group on "Energy Market Integration in East Asia"

3.2 Trans-ASEAN Gas Pipeline (TAGP)

The implementation of Trans-ASEAN gas pipeline (TAGP) also is still constrained by regional and national conditions. IEA (2013) raised two main issues that need to be addressed at regional level. First, there is lack in trading hub to facilitate the exchange of natural gas and Singapore seems the candidate best suited to develop not only a trading hub in the medium term but also a competitive natural gas market. Second, there is a need to develop a transparent price signal to steer investment in natural gas infrastructures. According to IDA (2013), the off shore East-Natuna natural gas field is critical factor of TAGP, but the East Natuna Gas has very high carbon dioxide content. This has driven up the cost to develop the resource and consequently push back the start-up date (IEA, 2013).

The bilateral connection has been established such as among Malaysia, Thailand and Singapore (see Table 6). Singapore is also connected with Indonesia. Malaysia has been connected to Thailand and Thailand is also connected to Vietnam. Thailand technically have been connected to Myanmar and in 2013, Myanmar will be connected with China. There are two main challenges that need to be addressed such as improving the transit capacity and promoting LNG regasification terminals while waiting for pipeline distribution to be materialized (IEA, 2013). IEA (2013) suggest two market models for promoting more competitive pipeline infrastructure: (i) the pipeline-to-pipeline competition model; and (ii) the mandatory third party access to the network model[25].

At the national level, constructing the national pipeline infrastructure for domestic market is still a problem. Thus it is relevant to argue that negotiation on AEMI need to be started by to solve infrastructure bottle neck at the national level. Promoting regional pipeline and forgetting the national pipeline will become a political economic challenge in the medium term. It is important to keep a balance between the regional pipeline's target and national's pipeline target. It is important that government allow markets to determine natural gas prices with minimal interference from short term political considerations. It is also important to separate transportation activities from commercial activities, price deregulation at the wholesale level, sufficient network capacity and non-discriminatory access, and a competitive number of market participants with the involvement of financial institution.

[25] In the case of pipeline model, competition is organized between suppliers who build the infrastructure to deliver to customers (IEA, 2013). In the second model, a distinction can be made between a market with wholesale competition and a market with full retain competition; in the latter case, competition is introduced into the final part of the value chain, while wholesale competition stop short of the retail segment (IEA, 2013).

Table 6. Intra and interregional pipeline(s) in Asia Pacific

Intraregional	Pipeline	Operational (year)	Capacity (bcm/yr)
Myanmar-China	Myanmar-China Pipeline	2013	12.0
Myanmar-Thailand	Yadana-Export Pipeline	1998	5.4
	Yetagun-Export Pipeline	2000	2.0
Thailand-Vietnam	PM3-Ca Mau Pipeline	2007	2.0
Thailand-Malaysia	Trans-Thailand-Malaysia Gas Pipeline (TTM)	2005	7.7
Malaysia-Singapore	Peninsular Gas Utilisation Pipeline System (PGU)	1991	1.5
	Peninsular Gas Utilisation Pipeline System (PGU)	2007	1.1
Indonesia-Singapore	West-Natuna Transportation System	2001	3.4
	Grissik-Singapore Pipeline	2003	3.6

Source: IEA (2013)

4. Way Forward

The 3rd ASEAN Energy Outlook indicates three major findings: (i) degree of dependency on fossil fuel especially oil tends to increase; (ii) the region has become net importer of oil; and (iii) increasing use of coal. In response on the energy supply security and global environmental stability, the outlook offers promoting cleaning coal technology, improving energy efficiency, developing renewable and alternative energy, improving energy investment climate, and sharing best practices. However, exit strategy on fossil fuel subsidy is still missing, even it has not clearly mentioned in the joint press statement ministers on energy meeting. Majority of ASEAN members implement pre-tax and post-tax subsidies above the world average. It seems that ASEAN left this issue at national level, but it has huge impact on regional level. Price distortion is one of the reasons why although energy cooperation has been established since the 1970s, the progress moves slowly. AEMI can endorse countries to eliminate fossil fuel subsidies. This indicates that countries share of responsibility in promoting a more competitive and efficient energy market.

The nature of EMI requires several conditions. Kimura and Shi (2010) pointed out two elements: (i) improving domestic energy access and use efficiency in developing countries; and (ii) encouraging the free flow of foreign direct investment to the energy sector. Sheng and Shi (2013) argued that that eliminating obstacles and monopolies in domestic energy markets seems to be a more important factor in contributing to the ability of poor countries to catch up with rich countries. Thus, energy price reform needs to be done simultaneously with energy market integration. There are two options in dealing with market reform the "gradual" pace or the "big bang" approach. The key point to choose the right reform is to understand the nature, conditions and assumptions from the two approaches. We suggest AEMI can prepare a specified procedures or criteria before countries decide to provide energy subsidies.

The Asian economic crisis in 1997/98 has substantial impacts on joint collaborative efforts in energy sector, particularly the Trans-ASEAN Gas Pipeline and the ASEAN Power Grid. Due to financial difficulties, there was no substantial investment at the national level. ASEAN as a region

and country's member needs to reserve fund for infrastructure connections. Electricity company such as PT.PLN in Indonesia has three major sources of fund for new power investment namely state budget, PT.PLN's self financing and other funds. Other funds obtain from issuing obligation (bonds), multilateral loan such as IBRD and ADB while bilatereal loan obtain from JICA, AFD, and China. Further ASEAN also provide financing modalities such as ASEAN Infrastructure financing mechanism. PT.PLN has utilized green fund from the Clean Development Mechanism and voluntary carbon mechanism.

Innovative financing need to be promoted for infrastructure connectivity and ASEAN + 3 can provide more resources for investment. The rationality of ASEAN + 3 needs to be expanded not only for managing a high energy prices and addressing several issues such as energy security, oil market, oil stockpiling, natural gas, renewable energy, energy efficiency and conservation; but also how to assist the ASEAN countries in promoting cross border investments.

ASEAN has established channels to harmonize regulatory practice and technical standard such as the ASEAN Energy Regulators Network to support the APG (collaboration with ADB as well as with UNEP) and a common regional framework to facilitate more oil and gas trading and marketing within the region[26]. ASCOPE also learns the US' LNG export regulatory framework. [27] ASEAN-Russia Energy Cooperation Work Programme (2010-2015) focuses on three areas such as capacity building programs, peaceful use of nuclear energy, and coal, oil, and gas exploration.[28] These kinds of collaboration need to be promoted in the future.

It is important the AEMI can measure the financial constraints, technical difficulties, differences in the industry regulatory frameworks among ASEAN countries. It is also important that AEMI can improve the level of efficiency in providing electricity such as in reducing transmissions and distribution loss. Thus the efficiency gap among the countries can be reduced. Enhancing energy market competition at national level can provide positive feedback in accelerating energy market integration. Further, it is also important that promoting EMI will not harm the environment, on the other hand it should protect the nature. Thus nature and human life have positive feedback (Lee, 2010). Promoting green energy in the context of AEMI needs support from developed countries. AEMI in the context of ASEAN + 3 also need to develop technological capability for all countries. Institutional setting to smooth the market reform also need to be shared.
Finally we suggest that energy security analysis can be a framework in analyzing relationship between national constraint and regional objectives. We can prepare several scenarios or policies such as consider only national effort and combination between national and regional level. We analyze how AEMI change direction of energy security indicator at the national level. We can develop Savacool's framework (2012). As seen from Table 7, dimension of energy security cover five elements such as availability, affordability, technology development and efficiency, environmental sustainability, regulation and governance.

[26] Joint ministerial statement of the 29th ASEAN Minister of Energy Meeting (AMEM) on 20 September 2011 in Jerudong, Brunei Darussalam.

[27] ASEAN also promotes the energy efficiency through education in collaboration with the United States.

[28] Joint media statement of the 28th ASEAN Minister of Energy Meeting (AMEM) on 23 July 2010 in Da Lat, Viet Nam.

Table 7. Energy Security Dimension and Component

No	Dimension	Component	Metric	Unit
1	Availability	Security supply	Total primary energy supply per capita	BOE per capita
2		Production	Average reserve to production ratio for the three primary energy fuels (coal, natural gas, and oil)	Remaining years of production
3		Dependency	Self sufficiency	% of energy demand by domestic production
4		Diversification	Share of renewable energy in total primary energy supply	% of supply
5	Affordability	Stability	Stability of electricity price	% change
6		Access	% Population with high quality connections to the electricity grid	% electrification
7		Equity	Households dependent on traditional fuels	% of population using solid fuel
8		Affordability	Retail price of gasoline/petrol	Average price in US$PPP for 100 liter of regular gasoline/petrol
9	Technology development and efficiency	Innovation and research	Research intensity	% of government expenditures on research and development compared to all expenditures
10		Energy efficiency	Energy intensity	Energy consumption per dollar of GDP
11		Safety and reliability	Grid efficiency	% electricity transmissions and distribution loss
12		Resilience	Energy resources and stockpiles	Years of energy reserves left
13	Environmental sustainability	Land use	Forest cover	Forest area as percent of land area
14		Water	Water availability	% population with access to improved water
15		Climate change	Per capita energy-related carbon dioxide emissions	Metric tons of CO2 per person
16		Pollution	Per capita sulfur dioxide emissions	Metric tons of SO2 per person
17	Regulation and governance	Governance	Worldwide governance rating	Worldwide governance score
18		Trade and connectivity	Energy export	Annual value of energy exports in 2009 US$ PPP – (billions)
19		Competition	Per capita energy subsidies	Cost of energy subsidies per person (2009 US$ PPP)
20		Information	Quality of energy information	% of data complete

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V. Institutional and Governance Dimensions of ASEAN Energy Market Integration

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1. Introduction

All energy markets require to be governed and this governance is provided by a range of public and private actors and by institutions (e.g. treaties, laws, regulations and contracts). The governance of energy markets at a national level provides many governments with severe challenges, but the promotion and governance of multi-national regional energy market integration such as ASEAN energy market integration (AEMI) is an ever greater challenge.

The aim of this paper is to evaluate the current institutions of energy governance in ASEAN for their suitability to promote and govern energy market integration, and to identify steps that need to be taken to address any deficiencies.

Section 2 provides a general survey of the challenges of energy governance and of a selection of theoretical approaches which have been employed to understand transnational energy governance. The next section applies a public goods approach to regional energy market integration in order to elaborate why certain activities are more difficult than others and require more rigorous governance. Section 4 draws lessons from three international case studies. The final two sections draw on the earlier observations in order to evaluate the governance of energy market integration in ASEAN and to recommend actions that could be taken to enhance ASEAN's ability to pursue energy market integration.

2. Energy governance

The aims of this section are to demonstrate and explain the complexity of transnational energy governance and the inadequacy of current governance institutions, and to introduce the main theoretical ideas. The section 2.1 highlights the distinctiveness of energy and the following section presents a selection of theoretical understandings of transnational energy governance today.

2.1 The distinctiveness of energy

The energy industry is distinct from any other sector of the economy. It is a key input to all economic activity, especially in a modern economy, and is a key determinant of standards of living in all societies. Its distinctiveness as a commercial activity arises from the large capital costs, the long-lead times, the economies of scale, the technical sophistication and the relatively high degree of risk involved. The energy sector may play a very important role in the economy of a nation with respect to the gross domestic product, to the balance of trade, to the availability of foreign exchange, to whether the country is a net importer or a net exporter of energy, and to the alleviation of poverty.

As a consequence of the distinctiveness and importance of the energy sector, a responsible government cannot avoid becoming involved in the governance of the energy sector, regardless of the nature of the economy and of the system of national governance. Markets alone cannot satisfactorily address a number of key challenges. It is difficult to promote competition due to the natural monopoly characteristics of energy networks, the role of potential monopolists and cartels, and the high barriers to entry. The production and use of energy can and does cause harm to wider society and to the environment ('negative externalities'). Finally, governments have the obligation to manage finite national natural resources, and to gather and provide market information. It is also necessary to manage those elements of energy which have aspects of a "public good", such as security of supply, access to basic energy services, and energy efficiency.

2.2 Transnational energy governance

Though the effective governance of energy at a national level continues to be of crucial importance, it is no longer sufficient because the energy industry, the energy markets and the impacts of energy production and use have become transnational, regional and even global in scale. Energy companies are internationalizing, oil markets are global, gas markets are regional and growing in scale, energy supply networks span great distances, and environmental damage affects whole regions and even the entire globe. Therefore the governance of energy must also take place above the national level, at regional, trans-regional and global scales.

The transnational governance of energy at regional or global levels has to address a wide range of issues, such as: investment, trade, technology transfer, the construction and regulation of transboundary infrastructure, the management of transboundary resources, safety, environmental protection, and access to energy. Three types of functions of transnational institutions can be identified (Goldthau and Witte. 2010): correcting market failures, lowering transactions costs, and setting standards and rules for market transactions.

Transnational governance can take a number of forms (Kahler and Lake, 2009):

- *Ad-hoc* cooperation between states which are acting in a mainly unilateral manner;
- Supranational governance by pooling or sharing sovereignty in a collective agency that can make authoritative and binding decisions (e.g. the European Community);
- Supranational governance by delegating authority for certain tasks to an agency (e.g. the International Energy Agency and the World Trade Organization);
- Governance through a hierarchy whereby a dominant state sets standards or rules which are followed by others (e.g. currency dollarization);
- Networks of public and/or private sector actors which lack formal authority.

The nature of the governance institution chosen by a group of nations will, to a great extent, depend on the nature of the national governance institutions in that group of countries as well as on the power of veto actors to prevent the pooling of sovereignty or the delegation of authority (Kahler and Lake, 2009).

The idiosyncratic nature of the creation and evolution of transnational institutions has led to a complex and fragmented system of global energy governance. This complexity has been exacerbated by the proliferation of numbers and types of actor in international energy markets. As a consequence the framework of global energy governance is characterised by gaps, overlaps, tensions and conflicts which impede effective governance and raise the risks of governance failure (Florini and Sovacool, 2011; Dubash and Florini, 2011; Meyer 2013a,b). Tensions are particularly prominent between the institutions governing energy, environment and trade (Gosh, 2011).

Of particular concern is the need to span different levels of energy governance (global, regional, national, sub-national and local) and to allow the effective participation of the growing range of actors (state, firms, civil society). Such "polycentric governance" is intended to draw on the advantages of global or regional governance and those of national and sub-national governance. Of particular importance is the need to match innovation and flexibility at the local level with consistency and equity at the global level (Brown and Sovacool, 2011).

The challenges facing international energy governance are not unique to the sector, and can be found in the wider resources and environment arena, as well as in many other areas of activity. In many sectors the proliferation of the number and types of actor (Abbott and Snidal, 2009) and of international institutions (international regimes and international organizations) has led an increasing degree of "institutional interplay" (Stokke and Oberthur, 2011). Such interactions may be 'vertical' between institutions at different levels in a hierarchy, or may be 'horizontal' between institutions at the same level. Both types provide challenges to ensure that the interplay does not create tensions or contradictions and does not leave important governance gaps (Oberthur and Gehring, 2011).

As the systems of international governance become more diverse and complex, the management of the interactions between institutions is becoming progressively decentralized and less formal groups, such as expert networks and civil society organisations, are playing an increasingly important role (Jungcurt, 2011; Oberthur and Stokke, 2011). Theories relating to "complexity" and to "complex adaptive systems" have been invoked in order to improve understand of global governance in general (Jervis, 1997; Hartzog, 2004; Duit and Galaz, 2008) and of the governance of natural resources and the environment in particular (Stark, 2009; Hoffmann, 2011). The key implications of these analyses are that the links between actors in a system are just as important as the actors themselves, that governance systems are always potentially unstable and open to change, and that the consequences of institutional change are unpredictable.

One theoretical approach which encapsulates elements of all these concepts relating to transnational energy governance is that of regional public goods theory. This theory not only provides a method of identifying the benefits to be derived from regional cooperation, but also gives insights into the obstacles to cooperation as well as the options for overcoming these constraints. In this way, regional public goods theory forms a useful framework for developing strategies to promote and develop AEMI. This paper will apply a public goods approach as the principal theoretical concept to the analysis regional energy market integration, in general, and to AEMI in particular, but will also draw on the other theoretical approaches.

3. Regional public goods and application to regional energy market integration

The aim of this section is to show how regional public goods theory can provide insights into regional energy governance and regional energy market integration. This account draws heavily on Andrews-Speed (2011). This section begins by explaining the terms "public good" and "regional public good", before examining issues relating to the design and delivery of public goods, and the nature of regional organisations.

3.1 Public goods

A public good is a service or a resource which provides benefits which are non-excludable and non-rival. Non-excludability arises from the impossibility or impracticability of excluding users. This results in over-use, especially by 'free-riders' who have not contributed to the production of the public good. Non-rivalry arises from the marginal cost of supplying another user being zero. Additional users do not reduce the quantity of the good available to other users, and thus it is not worth spending the money excluding these users. The combination of non-excludability and non-rivalry generally results in over-use and under-supply of a public good. In contrast a private good is fully excludable and fully rival, and supply will, in theory, be efficient.

A range of goods exist which are intermediate between purely public and purely private. Common goods are rival and non-excludable, and these are greatly prone to over-use. Impure public goods may be partially rival or partially excludable. They can take different forms and, like pure public goods, are liable to suffer from under-supply and over-use. Club goods are fully excludable, with a membership fee, and are often supplied efficiently. Though they are usually intended to be non-rival, they can easily become partially rival if the fee is not set sufficiently high or if too many parties are allowed to participate. A joint product is an activity which produces more than one benefit, of which at least one is a public good (Sandler, 2006).

3.2 Regional public goods

A regional public good is one which can be provided by and shared by the countries of a region, and which provides benefits to individual countries and to the region as a whole (Ferroni, 2002; Hettne and Soderbaum, 2006). In principle, collective action by governments in the region should create positive spill-over effects across the region which are greater than those which could be generated by individual governments acting alone (Ferroni, 2002; Sandler, 2007).

Most regional public goods fall under one or more of six headings, though a degree of overlap exists between them: knowledge, infrastructure, environment, health, security, and governance. Infrastructure is not in itself a public good, but rather it provides services which have elements of a public good (Rufin, 2004). Governance is an intermediate public good which is essential in order to generate the desired final public goods and will include establishing and implementing shared standards, best practices and policy regimes, setting up regimes to address cross-border problems, and creating networks of regulatory agencies. Examples of how elements of regional energy market integration can be classified under these different headings (excluding governance) are shown in Table 1.

Table 1. Selected services which have features of regional public goods for a regional integrated energy market, grouped by field of activity

Category	Service	Type of good	Aggregator
Knowledge	Dissemination of research results	Pure PG	Weighted sum
	Joint public pronouncements	Pure PG	Weaker link
	Best practice laws, procedures and rules	Pure PG	Better shot
	Early warning systems	Pure PG	Best shot
	Market and reserves data	Impure PG	Weaker link
	Analysis of data	Impure PG	Better shot
	Technological research and development	Impure PG	Better shot
	Benchmarking data	Impure PG	Threshold
	Capacity building and training	Club G	Better shot
	Events and meetings	Club G	Weighted sum

Table 1. (continued)

Category	Service	Type of good	Aggregator
Infrastructure	Network construction	Club good	Weighted sum
	Construction of shared infrastructure	Club good	Weighted sum
	Maintaining network integrity, security and access	Pure PG	Weakest link
Environment, natural resources, and health	Providing clean energy to cities and households	Pure PG	Weighted sum
	Effective husbanding of natural resources	Pure PG	Weaker link
	Reducing acid rain	Impure PG	Weighted sum
	Cleaning up after polluting event	Impure PG	Better shot
Peace and security	Construction of emergency stocks	Pure PG	Better shot
	Emergency stock sharing system	Club G	Weighted sum
	Sea-lane security	Pure PG	Better shot
	Network security	Pure PG	Weakest link
	Emergency response team	Club G	Threshold

3.3 Aggregation technology

For any public good, the key to designing effective delivery of the good is to understand the 'aggregation technology'. The aggregation technology encapsulates the general nature of the institutions and instruments which must be created in order to deliver the public good, and the nature of the aggregator depends on the nature of the good to be delivered. The purpose of the aggregation technology is to provide the incentives for collective action to ensure sufficient supply of the public good. The challenge for policy-makers is to design the institutions and instruments so as to address the weaknesses of the aggregation technology or to manipulate the technology (Barrett, 2006; Sandler, 2006, 2007; UNIDO, 2008).

Seven types of aggregation technology may be identified for regional public goods (Table 1). The most basic one is 'summation', by which the total supply of the good is the sum of the contributions regardless of how much each party contributes. All contributions are perfectly substitutable. 'Weighted summation' resembles summation, except that in this case the relative importance or weight of the different contributions is variable. For such types of public good, it is very difficult to ensure that all parties contribute. The likelihood of under-provision is high, not least because marginal costs tend to rise as the amount provided by a particular party grows. Examples in the energy sector include the construction of networks and shared infrastructure, some environmental actions, and the dissemination of research results.

The supply of a good with 'weakest link' aggregation technology depends on the supply of the smallest contributor, just like the weakest link in a chain. Every contribution is important, but the failure by just one country to supply an adequate quantity of the good undermines the collective effort and renders the efforts of others wasted. 'Weaker link' technology is similar but implies that there is a gradation of 'weakness' among contributors. The risk exists that every country contributes only as much as the weakest country or countries, and that greater effort is expended on addressing the anticipated failure to provide the public good than on providing the good. This outcome can be avoided if the parties share common interests and goals, and if the wealthier or more competent countries help the weaker states through the provision of money, skills or other resources. Examples of weakest and weaker link goods include the maintenance of the security and integrity of infrastructure networks like pipelines and power grids, and the provision of market and reserves data.

At the other extreme is 'best shot' technology, through which the total supply of the public good is determined by the success or actions of just one country. 'Better shot' technology is similar to best shot, except that the impact of each contribution is proportional to the size of that contribution. In principle, such aggregators avoid many of the challenges facing other technologies, but require coordination among the countries in the region to ensure that resources are not wasted by those countries which are unlikely to make the best shot contribution. Problems may arise if no country is willing or able to deliver the good, if a country fails to deliver on a promise to deliver to good, or if two or more countries are vying to be the provider. Best and better shot goods in the energy sector include fundamental research, early warning systems, the construction of strategic oil stocks, and capacity building.

The final type of aggregation technology is 'threshold' which requires a certain level of contribution to be made from the parties collectively before any benefit is realized. If the total contribution falls below this threshold, no benefit accrues to any party, only costs. Free-riding can only occur once the threshold has been reached. Examples include many forms of emergency response teams and facilities.

3.4 Incentives for supply

The nature of the incentives which will be required to provide the public goods will depend on the nature of the service and of the aggregator. Coordination and cooperation between nation states is a prerequisite for the provision of all regional public goods. What will vary is the extent to which rights, obligations and sanctions must be embodied in a formal treaty. Certain goods with summation or weighted sum aggregators are likely to require treaties, for example the construction of networks, a sharing system for emergency stocks, and the reduction of acid rain. In the case of club goods, those parties who do not wish to participate can easily be excluded and the agreement can be concluded without excessive difficulty. The provision of best shot or better shot goods such as early warning systems, research and development, pollution clean-up and the construction of emergency stocks only needs key parties to be willing to provide the service and to cooperate in its provision.

Weakest and weaker link goods are constrained by the inability or unwillingness of parties to collaborate in supplying the good. Inability can be addressed through financial or technical support, for example in maintaining network integrity. But unwillingness to provide may be rooted in the political culture or in national attitudes towards sovereignty. The provision of data on national energy markets and energy reserves, and the management of primary energy resources are likely to be liable to such a constraint. Of more fundamental importance will be the inability or unwillingness of certain governments to open their energy sectors to foreign investment, to reform their systems for energy pricing, to remove the monopoly rights of the national energy champions, and to provide third-party access to energy infrastructure. These constraints to AEMI are illustrated in the case of the European Union in the next section.

Of particular relevance to regional energy market integration is the need for leadership from one or more nations and for a common world view relating to economics and politics. This arises from the profound relationship between energy, on the one hand, and national sovereignty and national security, on the other. The full integration of energy markets requires governments to cede ownership over their state-owned energy enterprises, to promote inward investment in the exploitation of primary energy resources, and to relax their control over domestic energy markets. Even less ambitious forms of collaboration will require changes to national laws, structures and systems relating to energy. Rivalry between those nations which should be providing regional leadership and the need for cross-subsidies between nations may also prove important barriers to progress.

3.5 Regional organizations for delivering public goods

No regional organization will have the authority of a national government because sovereignty lies with individual nations (Matthews, 2003). A supra-national approach to regional governance in which the regional body has real authority over member states is only possible if the individual states are willing to cede a significant amount of sovereignty to this body, as is the case with the European Union, or to delegate authority to the body, as is the case with the International Energy Agency. Such an approach to regional cooperation is often not acceptable. Rather, most regional cooperation is relatively *ad-hoc*, with each state retaining veto power, a secretariat and subordinate committees which coordinate but have no authority, and a range of formal and informal networks which help to share information and build trust.

The approach taken in building regional collaboration also depends on the extent of integration envisaged. At one end of the spectrum lies full market integration which will require a sophisticated system of rules and incentives in order to break down trade barriers and to ensure the free flow of goods and services. At the other extreme, states can agree to cooperate in certain sectors to deliver specific regional public goods. In between these two extreme lies policy coordination, or even policy harmonization, which may accompany either market integration or sectoral cooperation (Matthews, 2003).

As mentioned above (section 2.2), transnational cooperation organizations are designed to fulfil one or more types of function: correcting market failures, lowering transactions costs, and setting standards and rules for market transactions. They may be formal organizations or informal networks, and both types may be either uni-dimensional, focusing on a single function or sector, or multi-dimensional (Hettne and Soderbaum, 2006).

Whatever combination of organizations is developed to promote the supply of public goods across a region, a number of general principles should be held in mind. First, policy research and operational management should not be considered as separate activities, but should be integrated in the same organizations. Second, the long-term aim of the regional organizations and institutions should be to encourage the emergence of new behavioural norms that support the delivery of regional public goods, not just to enforce them through rules. Finally, all regional organizations should be linked effectively both horizontally to other regional organizations in the same geographical area, and vertically to global and national organizations providing public goods ("polycentric governance"). It may also be desirable to build links to regional organizations in adjacent regions in order to deliver trans-regional public goods (Hettne and Soderbaum, 2006; Sandler, 2007; UNIDO, 2008).

3.6 Applying regional public goods theory to ASEAN and AEMI

ASEAN was created to deliver two fundamental regional public goods: regional security and regional economic development. Regional economic development is also the prime objective of the ASEAN Economic Community (AEC) and regional energy market integration (AEMI) should be a component of AEC. However, energy market integration is not just about promoting the free movement of energy products, services and capital, but should also deliver a range of other benefits which support and complement the free movement of these factors. These benefits have the character of regional public goods.

This account of how regional public goods theory can be applied to regional energy cooperation and market integration provides insights into the benefits to be derived from AEMI, the approaches to building AEMI, and the governance institutions required. Before going on to apply these insights to AEMI, it is useful to examine two international examples of energy market integration.

4. Lessons from international experience

The aim of this section is to draw some lessons from the international experience of energy cooperation and market integration in the light of regional public goods theory and other theories. Pineau et al. (2004) conceptualized three types of integrative development required to move to regional electricity market integration: infrastructure inter-connection, progression towards regional regulation, and commercial integration (Fig.1). Although their analysis focused on electricity, it is

also relevant to other components of energy market integration. In our analysis of the international experience, we have chosen two examples which illustrate different degrees of energy market integration:

- The European Union which displays a high degree of energy market integration, lying somewhere between the third and fourth stages (Table 2).
- MERCOSUR where energy market integration lies between the first and second stages.

Table 2. Integration continuum for regional electricity markets along infrastructural, regulatory and commercial integration

	No Regional Integration → Full Regional Integration			
	First Stage	*Second Stage*	*Third Stage*	*Fourth Stage*
Infrastructural integration	Isolated national power systems	Cross-border transmission capabilities	Coordinated effort in transmission investment	Fully integrated regional system operation
Regulatory integration	Independent national regulation	Compatible regulation	Coordination of Regulatory agencies	Regional regulatory agency
Commercial integration	National markets with local ownership	Cross-border trade and ownership	Regional spot market	Regional secondary/futures market

Source: Pineau et al., 2004

These two cases illustrate different approaches to regional energy market integration covering large populations started at different times, and both have made more progress than ASEAN.

4.1 The European Union

Formal collaboration between European countries in the field of energy began in the early 1950s with the establishment of the European Coal and Steel Community and the European Atomic Energy Community. The first of these was created with the express ambition of building a common market for coal, then the most important source of energy. The next significant step taken was progressive development from 1968 onwards of emergency response mechanisms to react to disruptions to oil supplies, including the construction of oil stocks (Matlary, 1997).

A key feature of the EU is that the member states cede partial sovereignty to the institutions of the EU: to the Council of Europe which comprises the heads of government of each member state, to the European Commission which is a large and powerful civil service, and to the European Parliament which has members directly elected from the member states. Of these three bodies, it has

been the Commission which has been the most active in promoting the single European energy market.

It was in 1986 that the Council of Europe first agreed on the need for greater integration of national energy markets and in 1988 it was resolved to introduce a single internal energy market. A decade of proposals, drafting and negotiating then took place, including the Directive on Hydrocarbons Licensing which was issued in 1994 (Cross et al., 2001). Legally-binding directives relating to price transparency and to electricity and gas transit were issued, and Common Rules were drafted covering the removal of monopoly rights, the unbundling of vertically-integrated utilities and third-party access to transmission infrastructure (Lyons, 1996; Cameron, 2002).

Despite all these formal measures, little was achieved towards building a single energy market until 1996 and 1998 when the Electricity and Gas Directives respectively were adopted. This breakthrough was assisted by the progressive emergence of competitive energy markets at national level, for example in the United Kingdom, Germany, the Nordic countries, the Netherlands and Spain (Egenhofer, 1997).

In 2007, the Council of Europe issued an 'Energy Policy for Europe' which showed renewed political commitment at the highest level to the single European energy market. A so-called 'Third Energy Package' of proposed measures was published in 2009 and took effect from March 2011. The overall aim was to complete the single European energy market by 2014 with a particular emphasis on the need to improve economic competiveness. The main components were (Stanic, 2011): unbundling of transmission from production and supply activities; allocating stronger powers and independence of national regulators; issuing new rules to harmonize market and network operations across Europe; setting higher standards of public service obligations and consumer protection; establishing new institutions to promote cooperation between regulators and between transmission system operators. Four years after the package was published, progress is behind schedule through a combination of delays in passing national legislation, a continuing focus on national policy priorities and a shortfall of investment cross-border infrastructure connections, among other factors (European Commission, 2012; European Commission, 2013).

Despite numerous obstacles to achieving a true single European energy market, nearly sixty years of effort have succeeded in building the world's largest integrated electricity and energy markets, national markets have been liberalised and cross-border connections have been developed (Vasconcelos, 2013). The gradual development of smaller regional energy markets *within* the EU has been supported by the Commission and by the regulators since 2004. These markets take advantage of proximity between nations and of existing network links. These sub-regional networks have allowed local economic benefit to be realised by the participating states and can provide the building blocks for later integration to form a Europe-wide market once the necessary infrastructure has been built (de Jong, 2008). In addition, a wide range of regional public goods have been provided through shared policy formulation and implementation. Such benefits include information, energy security, energy efficiency, technological development and environmental protection.

A key component of energy market integration is the harmonisation and eventual removal of energy subsidies. Whilst energy subsidies in the European Union are low by international standards (International Energy Agency, 2010), they have persisted through to the present day. These subsidies take many forms including direct payments to energy producers and consumers, low-interest loans to producers, research and development subsidies, tax breaks, and export credits (European Environmental Agency, 2004; van Gelder et al., 2009). The aims of these subsidies range from the promotion of renewable energy and supporting poor households, to protecting national industries, notably the coal and nuclear power industries. Despite years of rhetoric concerning the need to reduce and abolish energy subsidies, the European Union does not even have a coherent approach to measuring and reporting these subsidies, except in the case of state aid to the coal industry (World Bank, 2010).

But this brief history shows that much remains to be achieved 25 years after the first formal declaration of the need to develop a single energy market in 1988. National interests relating to the support of national champions and the management of domestic energy markets still act to constrain progress on key issues, as do differing energy policy priorities such as the relative importance given to energy security and emissions reduction. A small number of powerful interests have colluded to block progress for many years, and great determination and persistence has been required on the part of the Commission to sustain forward movement. In the field of energy, national interests appear to over-ride the collective interest (Eikeland, 2004), despite the relatively high degree of commonality in customs, norms and values across the member states with respect to culture, politics and economics.

4.2 MERCOSUR

Created in 1991 by the Treaty of Asuncion, MERCOSUR (Mercado Comun del Sur or Common Market of the South) is currently the world's fourth largest trading block after the European Union, the North American Free Trade Agreement (NAFTA) area, and ASEAN. This regional bloc was initially conceived to be a custom union before evolving into a common market comprising of Argentina, Brazil, Uruguay and Paraguay. Venezuela joined as a full member in 2012, and Chile, Bolivia, Colombia, Ecuador and Peru are associate members (Klonsky et al., 2012). In its original conception, MERCOSUR involved a number of defined stages involving elimination of import duties and trade barriers along with the growth of regional trade (Baer et al 2002). Without the EU's supra-national role and authority, MERCOSUR has no permanent institutional organisation that represents the bloc in external affairs, nor does it have a long-range plan for political integration like the EU.

An important precedent of energy cooperation among countries in the Southern Cone emerged in 1966 with the signing of the Iguaçu Act by the governments of Brazil and Paraguay to build the Itaipú dam. Other bilateral (or bi-national) electricity integration projects followed suit in the 1970s with the construction of hydroelectric dams such as Salto Grande connecting Argentina with Uruguay and Yacyretá linking up Argentina and Paraguay (Lara, 2006). Governed by stable bilateral treaties, these bi-national dams contribute to almost all of the region's electricity trade (Pineau et al 2004). As a consequence MERCOSUR is characterised by a high degree of physical

electricity interconnection, though market integration has been constrained by national policies and regulations (Burgos, 2007). A number of gas pipelines have also been built (Bailey, 2013).

Concomitant with the spread of free market reforms in MERCOSUR member states was the privatization and deregulation of their electricity, oil and gas markets. The bloc members' varying speed and form of energy reforms, in combination with their different energy resource endowments have created a complementarity matrix of surplus and deficit countries. This in turn creates a natural incentive for energy market integration among MERCOSUR members. Argentina for instance liberalised its electricity sector to cater for Chilean energy challenge by setting up a wholesale spot market operator CAMMESA (Hira and Amaya, 2003). Bolivia now is a major exporter of natural gas to Brazil after completing a pipeline over 2000 km long.

Nevertheless, these forms of market integration are mainly bi-national and are not truly regional. Institutionally at the regional level, the MERCOSUR executive body, the GMC (El Grupo Mercado Comun), established the Subgrupo de Trabajo No. 9 de Energia, a working group that consist of national level government officials who meet occasionally to deal with energy issues. In October 1999, this group drafted a memorandum on gas integration which was signed by Argentina, Brazil, Uruguay, and Paraguay. The memorandum promoted non-interference in the gas markets by states, called for protection against monopolistic practices, and advocated the harmonization of standards and anti-trust measures (Hira and Amaya, 2003). The progress so far in implementing these market-driven solutions has been haphazard at best due to regional regulatory and infrastructure gaps (Pineau et al, 2004; Hira and Amaya, 2003). For instance, in electricity trading, each MERCOSUR country still operates different regulatory mechanisms, which translate to dissimilar ways how transmission is set up, different system for establishing contracts and how the wholesale market functions. These are serious impediments to market integration, as are wider political differences within the group and increasingly protectionist policies (Klonsky et al., 2012).

MERCOSUR may also be progressively overshadowed by the continent-wide Union of South-American Nations (UNASUR). Although UNASUR was formally established by treaty in 2008, the member nations had already set up the Initiative for the Integration of Regional Infrastructure in South America (IIRSA) in 2000. In 2010 UNASUR replaced IIRSA with the South American Council on Infrastructure and Planning (COSIPLAN) a ministerial level body to promote and coordinate continent-wide infrastructure development in energy, transport and communications. COSIPLAN's Strategic Action Plan for 2012-2022 sets out criteria for the selection of projects and methodologies for implementation. It also recognises the need to harmonise laws and regulations (Editorial Committee, 2012). Despite these initiatives, fiscal, legal, pricing and regulatory differences remain key obstacles to energy market integration in Latin America (de Oliviera, 2010; Bailey, 2013)

4.3 Lessons from these experiences

This examination of energy market integration in the European Union and MERCOSUR reveal a number of lessons which are relevant to AEMI. Whilst a wide range of benefits from energy market integration are clearly recognised, obstacles to full integration can persist for decades. These obstacles arise principally from national differences. Differences in energy mix, in energy balance, in economic wealth, in openness to investment, in pricing and fiscal policies, and in energy policy priorities. Corporate or political actors may also seek to undermine integration if they see their interests threatened. These factors weaken the political will of national leaders to pursue energy market integration beyond rhetoric, except in cases where short-term economic gains are obvious.

Whilst some measures such bilateral energy transmission connections can be undertaken on an *ad hoc* basis, sustained moves towards a regional energy market requires delegation of authority or pooling of sovereignty to an agency charged with implementation in order to overcome the national obstacles. Such a supranational body with the capacity and authority to enforce collective policy agreements can greatly accelerate the process of regional energy market integration. Nevertheless, individual countries can still greatly constrain the pace of integration and the process of full energy market integration can take several decades. The period of gradual integration is marked by the progressive build-up of trust, liberalisation of domestic energy markets, and harmonisation of polices, regulations and standards.

The case of the European Union shows that energy subsidies can be one of the last issues to be fully addressed. That is not to say that all ASEAN should not continue to reduce the level of energy subsidies, but rather that the existence of subsidies should not form an insurmountable obstacles to pursuing AEMI.

In a region with a large number of countries and especially where there are significant economic disparities as in ASEAN, progress towards energy market integration may best be pursued at a sub-regional basis. In this way, countries with shared interests and policy approaches and geographic proximity move ahead with energy market integration without waiting for others.

Whilst bilateral arrangements are relatively easy to implement, in the case of transboundary infrastructure for example, they form only small steps towards regional market integration. Not only do such interconnections often not require any regulatory harmonisation, but if the energy is sold under long-term contracts then these contracts may actually inhibit the later development of an integrated energy market as the pricing mechanism will have been fixed the contracts.

Whilst integration with energy markets outside the region is clearly desirable, given the nature of international energy markets, the case of Canada (not described here) illustrates a potential danger. The North American Free Trade Agreement (NAFTA) contains a ‘proportionality clause’ specifying that Canada (for the clause only applies to Canada) must maintain the share of exports in energy goods as a proportion of total energy supply (Laxer and Dillon, 2008). In other words, Canada cannot reduce its exports of oil or gas to the USA unless its total production also declines.

In the case of oil, this prevents the government from reversing the flow of oil in its pipeline system in order to transport oil from the oil-rich west to oil-poor east. Instead, it must maintain exports of oil from western Canada to the USA and continue to import oil to eastern Canada. The proportionality clause also constrains the federal government from pursuing certain policy courses such as retaining more gas in Canada in order to build up a petrochemical industry or from reducing production and exports in order to conserve resources for the future (Laxer and Dillon, 2008). In these ways NAFTA, a treaty with external parties, is preventing deeper energy market integration between Canada's provinces and is constraining the available policy choices for resource management and industrialisation.

5. ASEAN energy governance

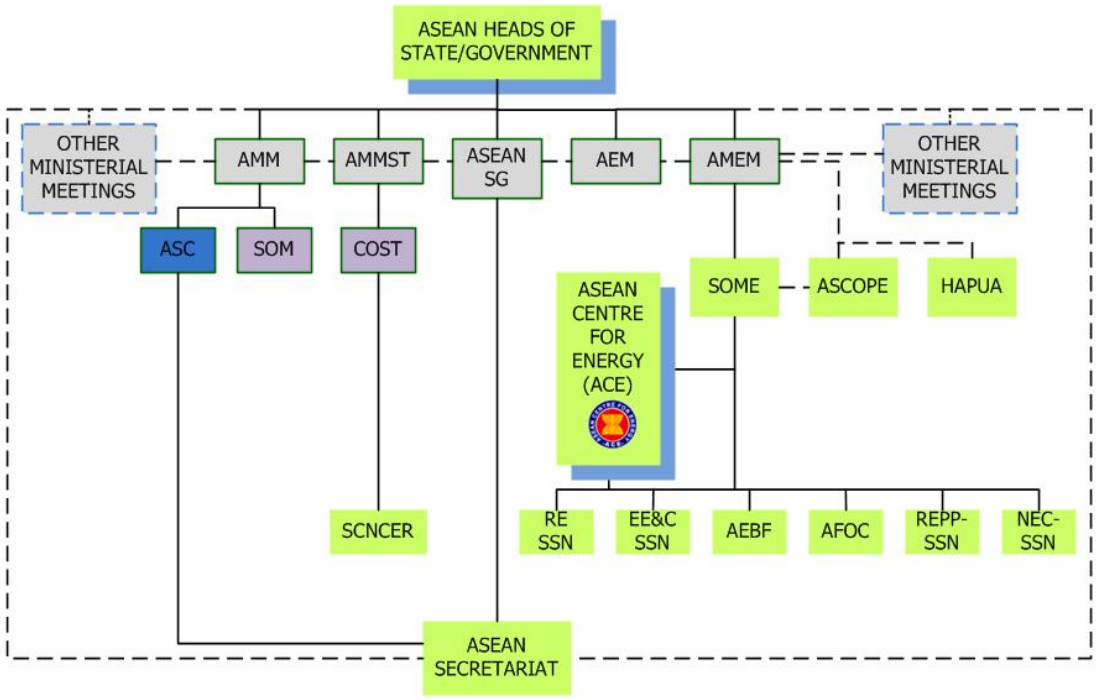
The aim of this section is to assess the adequacy of ASEAN's institutions of governance to energy market integration.

5.1 General features of governance in ASEAN

The central axis of ASEAN governance is formed by the Heads of State or Government, the ASEAN Secretary-General and the ASEAN Secretariat (Figure 1). The ASEAN Chairmanship is rotated on an annual basis among the Heads of State/Government, following the alphabetical order of the English names of member states. The member state assuming the Chairmanship "will chair the ASEAN Summit and related summits, the ASEAN Coordinating Council, the three ASEAN Community Councils, relevant ASEAN Sectoral Ministerial Bodies and senior officials, and the Committee of Permanent Representatives."[29] The arrangement of a rotating Chair sometimes results in a lack of continuity and momentum of policies, when initiatives introduced by the previous Chair are not accorded the same priority by the in-coming Chair.

[29] "ASEAN Chair", ASEAN, available at http://www.asean.org/asean/asean-chair (accessed 3 July 2013).

Figure 1. ASEAN organizational structure for energy



ENERGY STRUCTURES HIGHLIGHTED IN GREEN – ACRONYMS AS FOLLOWS:

AEBF	:	ASEAN Energy Business Forum
AEM	:	ASEAN Economy Ministers
AFOC	:	ASEAN Forum on Coal
AMEM	:	ASEAN Ministers of Energy Meeting
AMM	:	ASEAN Ministerial Meeting
AMMST	:	ASEAN Ministerial Meeting on Science & Technology
ASC	:	ASEAN Standing Committee
ASCOPE	:	ASEAN Council on Petroleum
COST	:	Committee on Science & Technology
EE&C SSN	:	Energy Efficiency and Conservation Subsectoral Network
HAPUA	:	Heads of ASEAN Power Utilities/ Authorities
NRSE SSN	:	New & Renewable Energy Source of Energy Subsectoral Network
SG	:	Secretary General
SOM	:	Senior officials Meeting
SOME	:	Senior Officials Meeting on Energy
REPP-SSN	:	Regional Energy Policy and Planning Sub Sector Network

The actual leadership of ASEAN tends to move around the different members, often depending on the issue. Indonesia can be seen as one country which has been at or near the forefront of initiatives at many times, as have Malaysia and Thailand. Singapore has been a strong player in the push for economic integration (Severino, 2006). Decision-making is by consensus. This does not necessarily mean that all decisions are unanimous, rather that no one seeks to block the decision. The "ASEAN Minus X" principle (also referred to as "Two Plus X"), developed in 1992, allows sub-groups of two or more ASEAN member states to move ahead with agreed implementation measures on economic integration ahead of others (Severino, 2006).

As a consequence of the principles of non-interference and respect for sovereignty, ASEAN lacks a supranational administrative organization. It has been argued that the ASEAN Secretariat has been intentionally kept weak as member states have been reluctant to cede any authority to the regional organization (Kurlantzick, 2012). The Secretariat continues to lack the capacity and authority to carry out sophisticated policy analysis and to drive through policy initiatives. The activities of the Secretariat are also constrained by its limited operational budget which stood at US$15.76 million in 2012. This is equally funded by each the 10 ASEAN member states (Termsak, 2012). At present, there are about 260 staff, of which 70 professionals are openly recruited from member states working at the ASEAN Secretariat. The limited budget has restricted ASEAN's capacity to employ additional staff and in turn affected its capability to drive the regional integration process.

The Secretary General is appointed by the member state governments, on an alphabetical rotation between the member states. The two Deputy Secretary Generals are also political appointments. Efforts to professionalise the Secretariat have been slow. The work of the Secretariat and of ASEAN is overseen by the ASEAN Standing Committee. Proposals to create a Supreme Council of ASEAN, composed of the Heads of Government of the Member States, were never followed up (Severino, 2006). The High Level Task Force on ASEAN Economic Integration recommended that economic integration required the setting up of bodies and procedures to oversee implementation and compliance and to resolve disputes (Severino, 2006).

5.2 Energy governance in ASEAN

In the formal hierarchy of governance, the meetings of ministers and official representatives serve as the central forum for ASEAN cooperation. The ASEAN Ministers on Energy Meeting (AMEM) provides the issues and concerns of common interest and sets policy and programme directions for energy cooperation (Figure 1). The Senior Officials on Energy Meeting (SOME) has the overall responsibility for the supervision, coordination and implementation of ASEAN cooperation programs, projects and activities. The next tier in the hierarchy comprises the Sub-Sector Networks, sub-committees and working groups and two forums (on coal and on energy business). The Sub-Sector Networks cover:

- Energy Efficiency and Conservation
- New and Renewable Sources of Energy
- Nuclear Energy Cooperation
- Regional Energy Policy and Planning.

These networks and forums provide valuable opportunities to share information, policy ideas and plans, and they provide support to the SOME. Two other important organisations are the ASEAN Council on Petroleum (ASCOPE) and Heads of ASEAN Power Utilities/Authorities Council (HAPUA). ASEAN and its member states are also active participants in energy dialogues at a supra-regional level, for example the APEC Energy Working Group, the ASEAN+3 Natural Gas Forum, and the East Asian Summit-Energy Ministers Meeting.

At the heart of this web of organizations lies the ASEAN Centre for Energy (ACE) which provides administrative, coordinating and technical support to all the various energy-related bodies within ASEAN and plays a central role in drawing up the ASEAN Plans of Action for Energy Cooperation. Its operation is supported by generous funding from ASEAN and donor agencies from Japan, the European Union, Germany, Switzerland, and Australia. ACE also oversees an ASEAN Energy Endowment created through contributions from member countries and now worth more than $5 million.

The energy sector is governed by a number of general economic instruments in addition to the sector-specific institutions described above. Of these the most important are those associated with the ASEAN Economic Community, notably:

- The ASEAN Trade in Goods Agreement (ATIGA)
- The ASEAN Comprehensive Investment Agreement (ACIA)

Both of these agreements cover energy to certain extent, but the effectiveness of the ATIGA is constrained by persistent non-tariff barriers and the ACIA by numerous exceptions and reservations and by a scope of application which excludes utilities (see Andrews-Speed and Len, 2013).

Since its inception, ASEAN's energy cooperation has followed the 'ASEAN Way', a mode of governance characterised by a largely informal institutional cooperation, by decision making founded on interpersonal consultations and consensus among the Member States, and by agreements which are largely informal and non-binding in their effects.

5.3 Key ASEAN energy initiatives

As has been described in the case of global energy governance, ASEAN's institutions of energy governance have multiplied in a largely uncoordinated manner. ASEAN's first policy move in the field of energy was the creation, in 1976, of the ASEAN Council on Petroleum (ASCOPE) with a specific focus on oil. This led to the ASEAN Petroleum Security Agreement (APSA) in 1986, which set up a petroleum sharing scheme for periods of shortage or oversupply in member states. This mechanism has never been implemented as supply problems have been solved bilaterally between ASEAN member states, with non-ASEAN producers or through oil traders (Nicolas,

2009). A revised ASEAN Petroleum Security Agreement was signed in 2009. This revised agreement addresses both oil and gas. It provides for voluntary (not obligatory) measures in times of supply crisis including emergency energy saving measures and the sharing of oil or gas. It allows for but does not oblige member states to construct joint oil stockpiles.[30]

The signing of the ASEAN Energy Cooperation Agreement in 1986 marked the start of efforts to develop a more comprehensive approach to energy cooperation and policy coordination. The ASEAN Plan of Action on Energy Cooperation (APAEC) 1995-1999 established coordinating bodies for electricity, gas, coal, new and renewable sources of energy, and energy efficiency and conservation, as described above. The 'ASEAN Vision 2020', published in 1997, placed emphasis on the need to construct transboundary energy networks, and this priority was embodied in the ASEAN Plans of Action for Energy Cooperation for 1999-2004 and 2004-2009, and reiterated in the Plan of Action for 2010-2015.[31] At any one time, the prevailing APAEC is the key point of reference and handbook for ASEAN energy cooperation (ASEAN Centre for Energy, 2013).

The strategy for transboundary energy networks had two main components: the Trans-ASEAN Gas Pipeline and the Trans-ASEAN Power Grid. Trans-ASEAN Gas Pipeline aims to provide gas supplies across region, to raise the share of natural gas in the fuel mix as it is cleaner than coal, and to encourage investment in gas exploration. Responsibility for implementation lies with Trans-ASEAN Gas Pipeline Task Group of ASCOPE. As of the end of 2012, about 3,000 km of bilateral pipelines are in place (ASEAN Centre for Energy, 2013). These are mainly bilateral connections driven by local private and state interests with assistance from the World Bank and the Asian Development Bank (Carroll and Sovacool, 2008). ASEAN itself does not appear to have been a major driving force, on account of diverging interests and goals (Sovacool, 2009, 2010).

A further 4,500 km of gas pipeline are planned. The key connections which remain to be built are those from the East Natuna gas field in Indonesia to Thailand, Malaysia, Vietnam, Brunei and the Philippines. Not only will these links add an additional 2,000 km to the network but the central position of the East Natuna field makes them essential to the realisation of a truly regional grid. However, the development of this field continues to be delayed by commercial viability concerns (Nicolas, 2009; Doshi, 2013).

The Trans-ASEAN Power Grid aims to link the member states in a single network in order to provide access to modern energy to populations throughout the region, and to maximize the efficiency and flexibility of electricity supply. Responsibility for implementation lies with the Power Interconnection Working Group of the Heads of ASEAN Power Utilities/Authorities Council (HAPUA) which was established in 1981. Several bilateral connections exist, and a number of other projects are to be completed by 2020 (ASEAN Centre for Energy, 2013).

[30] http://www.aseansec.org/22326.pdf

[31] http://aseanenergy.org/index.php/about/apaec

Although considerable progress has been made towards the physical construction both the Trans-ASEAN Gas Pipeline and the Trans-ASEAN Power Grid, the apparent absence of ASEAN as an active player in the planning process will place constraints on the potential for these networks to deliver truly integrated energy supply systems. A number of important technical and regulatory challenges have to be addressed before a truly regional grid can be realized. These include rules concerning access to the grids by suppliers and buyers, rules governing transit through third states, systems for trading energy, technical standards, and procedures to maintain system stability in the case of electricity (Nicolas, 2009; ASEAN Centre for Energy, 2013).

The other main priority set down by successive versions of APAEC has been the promotion of renewable energy and energy efficiency. The APAEC for 2010-2015 set targets for the year 2015 of an 8% reduction of energy intensity compared to 2005 and an aggregate of 15% of renewable energy in power generation. These collective targets are non-binding and it has been left to individual member states to set their own targets. The Sub-Sector Networks for renewable energy and energy efficiency, with the assistance of ACE, are responsible for assessing progress, but no formal agreement is in place to promote these initiatives (ASEAN Centre for Energy, 2013). It is anticipated that the collective share of renewable energy will be reach 19% of installed capacity by 2015, well exceeding the target. ASEAN is also on track to reduce energy intensity by more than 12% compared to 2005 (ASEAN Centre for Energy, 2013). However, a closer look at the data provided in the ACE report (ASEAN Centre for Energy, 2013) reveals that the targets set for 2015 had already almost been reached in 2010, showing that the targets were set at far too low a level.

5.4 Assessment of ASEAN energy governance

ASEAN has proved to be strong on visions and plans, but weak on delivery. The most important components of the ASEAN's Plans of Work on Energy Cooperation have been the Trans-ASEAN Gas Pipeline and the Trans-ASEAN Power Grid. Although progress has been made on these networks, this has been driven mainly by bilateral action by member states and their enterprises (state-owned and private), with external assistance from development banks. The role of ASEAN itself has been limited. As a consequence, critical policy and regulatory tasks to ensure that these networks can indeed benefit the whole region have not been undertaken (ASEAN Centre for Energy, 2013).

ACE itself has identified a number of challenges which need to be addressed in order to more effectively pursue the objectives defined in APAEC, under the following headings (ASEAN Centre for Energy, 2013):

- Policy, institutional and regulatory framework;
- Technical standards, labelling, codes and harmonization;
- Financing instruments and schemes;
- Cross-border: tariffs and taxation; access and transit rights for infrastructure; health, safety and environmental protection; and information sharing;
- Capacity building.

The obstacles to implementing ASEAN's energy ambitions are numerous. First, is the long-standing importance to the member states of sovereignty and nationalism, which easily translate into protectionism. Second, some member states have relatively weak capacity to govern a sector as technically and economically complex as energy. Third, the degree of variability across ASEAN is much greater than across the European Union, even after the recent enlargement of the latter. Political, economic and social cultures vary greatly, as do the physical sate of the energy sector, the manner in which it is managed and the way in which energy is priced. Finally, the ASEAN region does not occupy a single, clearly bounded continental region, rather it is archipelagic in nature, spread over a wide area of peninsulas and islands.

A further deficiency relating to ASEAN Energy Market Integration (AEMI) lies in the absence within successive version of APAEC to address trade and investment. These matters are covered instead by the ASEAN Trade in Goods Agreement (ATGA) and the ASEAN Comprehensive Investment Agreement (ACIA) respectively. These two agreements form vital components of the ASEAN Economic Community (AEC). ATGA appears to successfully seek to remove trade tariffs for energy products by 2015, yet many non-tariffs barriers remain. Likewise ACIA contains many exceptions and exemptions relating to energy (Andrews-Speed and Len, 2013).

In the context of regional public goods theory (see above, section 3), these obstacles are typical of constraints to the provision of regional public goods. As a consequence individual states only undertake activities which have a low cost, such as attending meetings and agreeing plans, or which bring direct short-term benefits, such as promoting renewable energy and energy efficiency in the domestic market. Undertakings which require substantial short-term cost or sophisticated harmonization or agreements with partners are left to the wealthy and willing states. Institutions to implement collective policy decisions are weak, and national priorities nearly always trump aspirations for collective action.

ASEAN's limited success with 'hard integration' (such as TAGP and TAPG infrastructures), is compensated by its accomplishment with 'soft integration' *vis a vis* consultative meetings, databases and information sharing. Although many are dismayed by ASEAN's slow pace of energy integration, its approach has allowed the framing of incremental policies which build on past strengths without compromising the "ASEAN Way". The nascent bi-national energy trade, whether for electricity or gas, is a precursor to the considerably more ambitious aspiration to create a regional infrastructure, one of ASEAN Vision 2020's stated priorities.

6. The way forward to AEMI

6.1 Options for future governance structures for AEMI

The AEC is currently ASEAN's key collective economic objective and energy should play a more central role in this strategy. Whilst certain forms of energy cooperation and integration can be undertaken within an informal framework, full integration intended to lead to a single regional energy market with free movement of commodities, capital and services would require a sophisticated system of rules and incentives, on account of the public good nature of energy. This may, in turn, require a formal supra-national organization with powers of enforcement as is exemplified by the European Union, or at least a formal and wide-ranging treaty such as the Energy Charter Treaty. But even with such structures, the path to full energy market integration is long and tortuous.

Whilst formal supranational governance structures may be desirable in principle, arrangements which are less formal and which lack binding commitments and enforceable sanctions are more consistent with the nature of regionalism which prevails in Southeast Asia today (Dent, 2008). In these circumstances, it will prove difficult to move ahead with certain initiatives which involve substantial political and economic commitments from a large numbers of countries in the region.

Instead, effort may be best directed at making progress incrementally by either focusing on a limited number of activities which cover most or all ASEAN countries or building closer energy market integration among a sub-set of ASEAN countries which are able and willing to participate.

ASEAN already has networks and forums which cover many of the key activities related to energy, but they appear to lack the capacity and authority to effectively pursue the implementation of policy decisions. Also, issues relating to the liberalisation of trade and investment in the energy sector appear to lie outside the purview of ASEAN energy bodies. If this is the case, then the ability of ASEAN's energy leadership to pursue energy market integration will be severely constrained.

In the longer term, it is essential to enhance the authority and capacity ASEAN's energy leadership and administration (e.g. ASEAN Secretariat, AMEM, SOME and ACE) if progress towards energy market integration is to be sustained. This will necessarily involve progressive delegation of authority or pooling of sovereignty. Without this step being taken, progress towards AEMI will be tightly constrained

Two other requirements should be taken into account. First, the activity of policy research should be placed very close to where policy-making takes place. Second, the various organisations within ASEAN responsible for different aspects of energy market integration should continue to develop and maintain close links with the relevant supra-regional (e.g. EAS, APEC) and international organizations. However, it is important to ensure that the ASEAN agenda does not get captured or

distorted by external actors in a way which promotes external energy market integration at the expenses of ASEAN energy market integration.

6.2 Actions to be taken at regional and national levels

Whilst APAEC provides a strong foundation for certain forms of energy cooperation, its scope is insufficient to provide a framework for ASEAN energy market integration, AEMI. In particular, critical issues are address by separate agreements, notable AGTA and ACIA. For AEMI to be pursued in any meaningful way, the energy elements of AGTA and ACIA need to lie at the heart of ASEAN's energy strategy and be brought under the purview of the body (ACE) responsible for coordination energy strategy.

Legally-binding agreements will almost certainly be required for most of major, transboundary infrastructure projects to proceed, on account of the costs and risks involved. In the early years of energy market integration, it is likely that most legally binding agreements will be concluded at sub-regional, bi-lateral or tri-lateral levels, rather than across the entire region.

Whilst the costs and risks relating to the construction of transnational infrastructure projects are relatively easily managed, the real challenges emerge once they are commissioned, even if formal agreements are in place. On the one hand, they are open to deficient behaviour on the part of weakest link actors with respect to the operational integrity and security of the network. On the other hand, they are vulnerable to unilateral actions by one or more parties seeking to protect corporate or national interests, for example by denying access to the network. These difficulties can only be alleviated by the progressive convergence over time between the participating nations in respect of their improved competence in national governance and the openness of their national energy markets.

Indeed, openness and governance at *national level* (as well as at supra-national level) are key pre-requisites for energy market integration to proceed and to deliver significant regional benefits. States need to be open in their provision of information on energy resources and energy markets, they need to be open in their provision of investment opportunities in their energy sectors and they need to remove non-tariffs barriers to energy trade.

Effective and appropriate governance is needed in two respects. First, the domestic energy resources and industries should be regulated so as to use the available resources in as efficient and clean a manner as possible. Second, the structure and nature of the national energy industries and energy markets should be amenable to effective and efficient energy market integration. In many of the ASEAN countries, these attributes will require substantial domestic reforms. Most difficult will be the progressive reduction of energy subsidies. Without such reforms, the progress of energy market integration will be severely constrained.

Other initiatives which should be pursued provided appropriate nations emerge to take the lead (i.e. best shot and better shot public goods), include: sea-lane security, emergency response teams and pollution clean-up capacity.

A number of less tangible actions are already being taken in the ASEAN region and these will provide long-term support to the progressive energy market integration. They include: technological research and development; the establishment and harmonisation of technical standards; the development and dissemination of best practices, for example in energy efficiency or in nuclear energy safety; data analysis and dissemination, for example on issues such oil stocks, and biofuels; and capacity building and training in a range of fields including technology, management, policy and governance fields. The relative degree of success of such programmes arises from the fact that much of the cost can be borne by a limited number of nations, whereas the benefits are widespread. Efforts should be made to enhance these programmes.

6.3. Future research directions

Future research could focus on:

1. Building on ASEAN's experience, on international examples and theoretical considerations in order to draw up more detailed recommendations for enhancing institutions to promote and govern energy market integration in ASEAN.
2. Developing new policy solutions to address seemingly intractable problems such as the different approaches to and needs for energy subsidies.

7. Summary and conclusions

Effective governance is a key requirement for multi-lateral energy cooperation and for ASEAN energy market integration (AEMI). This is because the objective of AEMI is to deliver not only direct economic efficiency gains but also a range of external benefits which have the character of regional public goods.

Energy market integration in European Union and MERCOSUR reveal a number of lessons which are relevant to AEMI. These obstacles to integration arise principally from national differences and can persist for decades. Differences in energy mix, in energy balance, in economic wealth, in openness to investment, in pricing and fiscal policies, and in energy policy priorities. Corporate or political actors may also seek to undermine integration if they see their interests threatened. These factors weaken the political will of national leaders to pursue energy market integration beyond rhetoric, except in cases where short-term economic gains are obvious.

Whilst some measures such bilateral energy transmission connections can be undertaken on an *ad hoc* basis, sustained moves towards a regional energy market requires delegation of authority or pooling of sovereignty to an agency charged with implementation in order to overcome the national obstacles. The period of gradual integration is marked by the progressive build-up of trust, liberalisation of domestic energy markets, and harmonisation of polices, regulations and standards.

The obstacles to implementing AEMI are numerous. First, is the long-standing importance to the member states of sovereignty and nationalism, which easily translates into protectionism. Second, some member states have relatively weak capacity to govern a sector as technically and economically complex as energy. Third, the degree of variability across ASEAN is much greater than across the European Union, even after the recent enlargement of the latter.

Whilst formal supranational governance structures may be desirable in principle, arrangements which are less formal and which lack binding commitments and enforceable sanctions are more consistent with the nature of regionalism which prevails in Southeast Asia today. In these circumstances, it will prove difficult to move ahead with certain initiatives which involve substantial political and economic commitments from a large numbers of countries in the region. Instead, effort may be best directed at making progress incrementally by either focusing on a limited number of activities which cover most or all ASEAN countries or building closer energy market integration among a sub-set of ASEAN countries which are able and willing to participate.

In the longer term, it is essential to enhance the authority and capacity ASEAN's energy leadership and administration (e.g. ASEAN Secretariat, AMEM, SOME and ACE) if progress towards energy market integration is to be sustained. This will necessarily involve the progressive delegation of authority or pooling of sovereignty. Without this step being taken, progress towards AEMI will be tightly constrained.

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VI. The Pathway to ASEAN Energy Market Integration

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Abstract

The experience in regional energy market integration around the world presents broad elements of integration, namely, binding agreements, physical infrastructure, standardized or harmonized rules of operation, and governing or coordinating institutions. The pathway to ASEAN Energy Market Integration (AEMI) shall also involve creating these elements but this activity must be preceded by trust-building activities among ASEAN members. Trust should be built by candidly disclosing mutual gains from and shared costs and externalities in energy resource development, trading energy products, market adjustments, and regulatory reforms. The shared databases and assessments could allow ASEAN members to uncover the building blocks of an AEMI regional accord. ASEAN leaders could then forge a regional accord for AEMI through 2030 with actionable targets and timetables. The targets could include establishing or strengthening institutions for facilitating the integration efforts, removing border and behind-the-border barriers to energy trade and investments, harmonizing rules and standards, and building the physical infrastructure for regional energy trading. Since energy market integration takes place not only at the government level but also at the private sector level, ASEAN members must reckon their preparedness to join AEMI based on the business case for integration rather than merely on the availability of energy resources. Moreover, at the minimum, ASEAN members should have independent energy regulators and pursue harmonization of rules and standards.

Keywords: ASEAN, cross-border infrastructure, energy market integration, energy regulatory reforms, energy trading

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1. Introduction

Energy market integration in the East Asia region has been pursued at different levels in the history of East Asia energy cooperation. Thailand and Lao PDR concluded its first energy agreement in 1966 (Shi & Kimura, 2010). Governments in the Greater Mekong Subregion signed memoranda of understanding for bilateral power trade agreements from 1990 onwards (Zhai, 2010). The first to third ASEAN Plan of Action for Energy Cooperation (APAEC) also specified regional program areas for cooperation that can support energy market integration, such as the ASEAN power grid and the trans-ASEAN gas pipeline envisioned in APAEC 2010 - 2015. In other regions, energy market integration is also transpiring in various stages.

Valuable lessons that may be applicable to the ASEAN Energy Market Integration (AEMI) through 2030 can be learned from these experiences. Thus, this paper distills lessons from the experience of other regional energy markets such as those in the: European Union; North American Free Trade Agreement region; Mercosur region (*Mercado Comun del Sur* or Common Market of the South); and the Central Asia region. It also extracts lessons from within East Asia by examining the Greater Mekong Subregion power market. The paper also investigates specifically what types of energy markets were integrated and how the integration has been carried out thus far in these regional markets. Taking off from the assessment of regional markets, it then analyzes the options for pursuing integrative activities. The paper also analyzes the possible alternative approaches of the ASEAN members in joining the AEMI given their domestic constraints. The paper then presents the summary and conclusions to wrap up the discussions.

2. Analytical Framework

A regional public goods approach is helpful in examining the pathway to energy market integration since such integration involves delivering services that create positive spill-over effects to member-countries, effects which are greater than what could be achieved if countries provide the services on their own. Two standard properties of public goods are used in characterizing public goods in any market—non-rivalry of benefits and nonexcludability of free riders. These properties are also helpful in describing regional public goods. Non-rivalry is present when the consumption of the good or enjoyment of the good's benefits by one country in no way diminishes the consumption of such good or enjoyment of the benefits by other countries. There is rivalry when crowding or congestion reduces the countries' consumption or enjoyment of the good or benefit. On the other hand, nonexcludability of benefits is present when paying countries and non-paying countries alike gain from the positive spillovers of the regional public good. This happens when it is either impossible or prohibitively expensive to exclude non-paying countries from enjoying the regional public good.

Based on the degree of non-rivalry and nonexclusivity, the standard public goods typology consists of these four types of goods—pure public good, impure public good, club good, and joint product.

These distinctions are also applicable to regional public goods. Sandler (2004 and 2007) describes and gives examples of these four types. According to Sandler, in the provision of regional pure public goods, the dispersion of benefits are both completely non-rival and nonexludable. Adopting sound standards of regulations and practices, for example, provides completely non-rival and nonexclusive benefits. On the other hand, in the provision of regional impure public goods, the enjoyment of benefits is partially rival or partially exclusive, that is, a country's use of the good reduces the benefits available for other countries, or the good's benefits can be limited to those countries that pay for it. Examples include vigilance in surveillance (because vigilance directed to one area reduces vigilance elsewhere) and research findings which are disseminated exclusively to a specific set of countries. Regional club goods, in turn, provide benefits that are partially rival but fully exclusive, such as regional power grids, air traffic control networks, and waterways. Lastly, in joint products, a single activity gives rise to two or more outputs with publicness characteristics. An example is the late 1980s treatment program for river blindness, a disease which affected Latin America, Africa and the Arabian Peninsula. The program resulted in joint products: one, it limited potential disruption to the whole region (a pure public good), and two, it curtailed the country-specific damage to those countries that experienced the disease outbreak.

The regional public goods framework is applicable to energy market integration because there are specific services in an integrated regional energy market that have public goods characteristics. Andrews-Speed (2011) provides a preliminary list and classification of such services (see Table 1).

Table 1. Selected services which have features of regional public goods for a regional integrated energy market

Category	**Service**	**Type of Good**
Knowledge	Dissemination of research results	Pure public good
	Joint public pronouncements	Pure public good
	Best practice laws, procedures and rules	Pure public good
	Early warning systems	Pure public good
	Market and reserves data	Impure public good
	Analysis of data	Impure public good
	Technological research and development	Impure public good
	Benchmarking data	Impure public good
	Capacity building and training	Club good
	Events and meetings	Club good
Infrastructure	Network construction	Club good
	Construction of shared infrastructure	Club good
	Maintaining network integrity, security and access	Pure public good
Environment, natural	Providing clean energy to cities and households	Pure public good

Category	Service	Type of Good
resources, and health	Effective husbanding of natural resources	Pure public good
	Reducing acid rain	Impure public good
	Cleaning up after polluting event	Impure public good
Peace and security	Construction of emergency stocks	Pure public good
	Emergency stock sharing system	Club good
	Sea-lane security	Pure public good
	Network security	Pure public good
	Emergency response team	Club good

Source: Andrews-Speed (2011).

As mentioned in Andrews-Speed (2011), this preliminary identification is illustrative rather than exhaustive. Nevertheless, it is very useful in the sense that it provides important clues on which services need to be delivered and be part of the steps towards building an integrated energy market.

3. Regional Energy Markets around the World

This section aims to distill the different pathways that integration took in the energy markets of the European Union, the North American Free Trade Agreement (NAFTA) region, the Mercosur (*Mercado Comun del Sur* or Common Market of the South) region and the Central Asia region. It also examines the incipient pathway to energy market integration within ASEAN itself by describing the current efforts to deepen electricity trading in the Greater Mekong Subregion.

3.1 European Union Energy Market

The accomplishments in the integration of energy markets of the European Union (EU) member-states were facilitated by the presence of an advanced legal system for enforcing regional energy laws. The concept of mandatory and comprehensive European energy policies was implemented through this legal system. The system involves: (i) EU regulations, which are legislative acts that must be enforced by all member states simultaneously; and (ii) EU directives, which lay down goals and are transposed by member states into national laws and procedures within specified deadlines. Since the European Commission has the power to take legal actions against any EU country, the Commission can enforce EU energy regulations and directives and can refer cases of non-compliance to the European Court of Justice (European Commission, 2013a).

In the case of the EU, the types of energy markets that were integrated are the electricity and gas markets. It is generally agreed that the sequencing of steps in energy market integration has so far involved three successive waves of major reforms, called the first to third energy packages. The pathway that is visible in these energy packages is liberalization of the energy market, as described by Rokas (2009). The first energy package consisted of EU directives of 1996 and 1998 concerning common rules for the internal market in electricity and natural gas, respectively. It pushed for generation and transmission unbundling and established the minimum requirements for it, including the requisite accounting and management activities. Rokas explained that this gave rise to a long and controversial discussion on the theory of monopolies and spawned clarifications of core principles on free competition, transparency, free access to the energy networks, and security of supply. The second energy package, which was adopted in 2004, consisted of new rules for the internal market in electricity and natural gas. The rules strengthened the separation of transmission and distribution, mandated the establishment of national energy regulators, and allowed consumers to choose their energy supplier. By 2004, industrial consumers had the freedom to choose their energy supplier, and by 2007, domestic consumers were able to exercise this freedom. The third energy package, which was adopted in 2009 and had a transposition deadline of 2011 for the EU directives, aimed for "ownership unbundling" or the effective separation of supply and production activities from the operation of the transmission and distribution systems. It also established the Agency for Cooperation of Energy Regulators and the European Network of Transmission System Operators for electricity and gas. It also set binding rules for cross-border network management and additional rules to ensure the transparency of retail markets.

With respect to interconnectivity of infrastructure, the history of physical integration was highly influenced by the development of power exchanges such as the Nordic Power Exchange (Nordpool), which was formed by Norway, Sweden, Finland and Denmark, and the European Energy Exchange in Central Europe. Moreover, continental Europe has what is called a synchronous grid that includes part or all of Austria, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Denmark (western part), France, Germany, Greece, Hungary, Italy, Luxembourg, Macedonia, Montenegro, the Netherlands, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, and Switzerland (UCTE, 2008).

The Asian Development Bank (ADB) describes EU as already well interconnected (ADB, 2013a). Moreover, the ADB explains that the European Commission recognized early on the importance of infrastructure interconnection in preventing the risk of short supply as interconnection diversifies sources and facilitates the conveyance of additional generation capacity from renewable energy. At present, more reforms in the European electricity grid are in the offing. The *European Electricity Grid Initiative Roadmap* 2013-2022, in particular, proposes increasing research, innovation and investment activities to increase network capacity for grid users and pave the way for a fully decarbonized pan European electricity system by 2050 through more renewable energy production (European Commission, 2013b).

However, there are still significant barriers to competition that hinder the progress of EU energy market integration, as reported by the European Wind and Energy Association (2012). One stumbling block is the fact that EU member states are currently at different stages of implementing common electricity rules despite the adoption of the timetable for transposition of EU directives.

Moreover, nationally regulated consumer prices currently do not allow a transparent comparison between generation technologies and this presents obstacles to efficient and fair competition. The continuing high concentration in energy markets in EU member states also persists, resulting in significant market power and difficulties for small and medium-sized companies to compete.

3.2. Energy Trading in the NAFTA Region

In the trilateral trade block created by the signing of the North American Free Trade Agreement (NAFTA) among Canada, Mexico and the United States (US), energy trade is an important component. In fact, the pathway to energy market integration in the NAFTA region is basically the pathway traversed by free trade efforts.

The sequence of steps in energy market integration in the region was preceded by the gradual growth of bilateral natural gas trading between the US and Mexico and electricity trading between the US and Canada. The US-Mexico natural gas trading began in 1929 when the US started exporting gas to Mexico. Natural gas was transmitted through a pipeline constructed by a US company and distributed through the US pipeline company's subsidiary in Mexico. Over time, gas flowed in both directions across the border depending on the need and demand in each country (CBA Energy Institute, 1998). The US-Canada electricity trading, on the other hand, began in 1959 when the Canadian government came up with a national power policy that enabled the interconnection of provincial transmission systems and the export of its surplus power to the United States (Centre for Energy, 2013). In 1988, liberal energy trading provisions were formalized in the Canada-US Free Trade Agreement (CUSFTA). Most parts of the energy trade provisions in the CUSFTA were then extended to Mexico through the 1994 trilateral NAFTA (Hufbauer et al., 2005).

The free trade agreements have been less influential in harmonizing energy policies and prices but the necessity of cooperating in electricity regulation led to the creation of the North American Electric Reliability Council (NERC) in 1968 and gradual convergence of energy policies. NERC created electric reliability standards across North America and relied on peer pressure and mutual self-interests in enforcing regulations. In 2006, the NERC ceased to be a council and became a non-profit corporation, the North American Electric Reliability Corporation (the new NERC). Because Mexico's constitutional ban on foreign exploitation of its subsoil resources constrains its energy policy towards its neighbors, NERC is primarily an exercise between the US and Canada. Nevertheless, NERC members also include energy suppliers to a portion of Baja California Norte, Mexico (Hufbauer et al., 2005).

3.3. Infrastructure Investments and Energy Trade in the Mercosur Region

In the Mercosur region, the pathway to energy market integration was cleared by greater economic openness and liberalization in Latin America in the 1990s. After the politically tumultuous 1980s, the Latin America region slowly stabilized and new instruments for regional cooperation emerged, such as the Mercosur (short for *Mercado Común del Sur*, or Southern Common Market) in 1991. Mercosur, which is an economic and political agreement among six member states Argentina, Brazil, Paraguay, Uruguay, Venezuela, and Bolivia (which became the newest member in July 2013), is a customs union or a type of trade bloc that is composed of a free trade area with a common external tariff.

The liberalization in the Mercosur region facilitated not only trade but a wave of investments, including investments in natural gas pipelines and electricity transmission lines. According to Bailey (2013), seven natural gas pipelines were built between 1997 and 1999 to connect Argentina's natural gas reserves with resource-poor Chile. In 1999, a massive natural gas pipeline from Bolivia's then newly proven reserves to southern Brazil was also completed. Expansion of electricity transmission grids also happened during 1997-1999. The grid interconnection between southern Brazil and Argentina, which was built in 1999 and then reinforced with double capacity in 2002, allowed Brazil to access Argentina's thermal power capacity during periods of drought and, in turn, allowed Argentina to access Brazil's cheap hydropower during peak demand periods. Small-scale transmission links between Argentina and Uruguay and then between Brazil and Uruguay were also built to insure Uruguay's hydropower-dominated power system against drought.

Power industry restructuring activities in the region also helped and the transfer of control to private groups as well as capitalization of power companies led to greater investments. Hammons et al. (1997) explains that Chile pioneered industry restructuring in Latin America in 1982, as it unbundled the formerly integrated utilities into different business units for generation, transmission, and distribution. Argentina also embarked on restructuring in 1991 as it provided for a vertical division of activities and the establishment of a wholesale electricity market. In 1994, Bolivia adopted a structure similar to that of Argentina.

The formulation of guidelines and common energy policies under the market framework of Mercosur also facilitated the greater openness to energy trade and infrastructure investments in the region. The Work Subgroup on Energy Policy does most of the work of coordinating information and points for decision making by the Common Market Group, the executive body of Mercosur, and by the Common Market Council, where the highest level of decision-making in Mercosur takes place. Burgos (2007) describes the market framework for integration and cooperation in the energy sector as including financial stipulations, energy efficiency, environmental protection, and legal harmonization. These are particularly contained in rules such as Mercosur Decision No. 1/93, which called for the definition of basic guidelines for energy policy in the common market, and Resolution GCM No. 57/93, which stipulated the fundamentals for energy cooperation. Moreover, the Initiative for the Integration of Regional Infrastructure in South America (IIRSA), a forum for the coordination of intergovernmental actions, is helping to strengthen the physical integration of

infrastructure through a portfolio of projects financed in part by the Inter-American Development Bank (IADB, 2013). The IIRSA, however, is not only focused on energy but also on transportation and communications; it also covers a region larger than the Mercosur region.

Bilateral agreements are the norm in energy trade and integration in Mercosur. However, after the energy rationing crisis in Brazil in 2001-2002, energy supply security became a major concern and it became evident that bilateral agreements limit the scope for energy integration and preventing opportunistic behaviors. At present, a multilateral energy security reserve, which will be provided with multilateral mechanisms and legal agreements, is being proposed to prevent the opportunistic behavior of governments and energy market agents (de Oliveira, 2010).

3.4. Integrated Power System in the Central Asia Region

In the case of the Central Asia region, what were integrated were generation and transmission through the joint operation of the Central Asian Power System (CAPS). The CAPS consists of the power networks of Uzbekistan, Southern Kazakhstan, the Kyrgyz Republic, Tajikistan, and Turkmenistan. Mercados Energy Markets International (2010) traces the origins of the CAPS to the 1970s when the present national borders of the former Soviet republics were not yet defined. The integrated power system has historically relied on hydropower plants for electricity generation and some contribution from fossil fuel based generation, especially when hydropower generation is low during winter. After the disintegration of the Soviet Union, coordination failures emerged in the operation of the components of the power system such as water reservoirs and fossil fuel-based generation.

The case of Central Asia integration is not one wherein energy market integration is built from previously un-integrated national markets, but one wherein an integrated energy market is prevented from collapsing. As in the cases of gradually building up energy market integration in the EU, NAFTA and Mercosur regions, cementing and strengthening integration in Central Asia required the following steps: forging legal agreements among countries; establishing an entity to take charge of coordinating energy-related transactions; and assessing and taking advantage of trading opportunities.

Mercados Energy Markets International (2010) reports that the legal basis for joint regional power operation was forged in 1998 when senior management officials from the separate national power systems signed the “Agreement on Parallel (Joint) Operations of the Power Systems of the Republic of Kazakhstan, the Kyrgyz Republic, the Republic of Tajikistan, Turkmenistan, and the Republic of Uzbekistan.” Other agreements were signed in the succeeding years, such as the agreement on energy transit and the agreement on mutual assistance in case of power system failures. The five countries also founded the regional Coordination Dispatch Center located in Tashkent, Uzbekistan. The center, which functions as the first coordination level for Central Asia dispatch, is financed by the five countries on a cost-sharing basis. Each national power system has its own dispatching authority, which functions as a second level for dispatch operations. Data from the Coordinating

Dispatch Center cited by Omorov and Lynch (2010) show that electricity imports and exports between the countries declined in 2000-2008. During this period, national internal power systems began to fail functionally due to, among others, aging regional power infrastructure and coordination difficulties. Subsequently, self-sufficiency became the strategy of each country, seemingly unaware that there are lost economic opportunities and foregone mutual benefits from weakening trade. As argued by Omorov and Lynch, regional energy trade in the Central Asia region will result in benefits to the participating countries by ensuring that energy demand is met and surpluses are traded optimally. To carry out trade, financing infrastructure such as maintaining reservoirs, building substations, rehabilitating transmission lines, and improving transmission metering is crucial and this fact is currently being recognized, as is apparent in the project list of the member countries of the integrated CAPS.

Industry restructuring, however, is not yet a major component of the pathway to stronger integration in the Central Asia region. Mercados Energy Markets International (2010) also reports that among the member countries in CAPS, Kazakhstan is the only one that introduced electricity market restructuring, which is done by separating the transmission system operator from the generation and distribution company. The other countries still maintain vertically integrated generation, transmission and distribution.

3.5. Electricity Trading in the Greater Mekong Subregion

The Greater Mekong Subregion (GMS) consists of Cambodia, People's Republic of China (PRC), Lao People's Democratic Republic (PDR), Myanmar, Thailand, and Vietnam. Electricity trading in the GMS reached its current state through a sequence of steps that involved for the most part forging bilateral agreements. The first energy agreement between Thailand and the Lao PDR was signed in 1966, one year before the first ASEAN Declaration in 1967. From 1990 onwards, more bilateral agreements were signed between various governments in the subregion (Zhai, 2010).

Building the physical infrastructure to allow more trading was also a significant step. Beginning in 1992, projects for forging greater energy cooperation and constructing transmission interconnection were implemented with private sector participation and ADB assistance. Prior to this, the only significant transmission links in the subregion were those between the Lao PDR and Thailand. As a result of the infrastructure investments, major high voltage power interconnections now exist in the following links: Lao PDR-Thailand, Myanmar-Yunnan Province (PRC), Vietnam-Cambodia, and Yunnan Province (PRC)-Viet Nam. Medium to low voltage interconnections also exist in the following links: Lao PDR-Cambodia, Lao PDR-Thailand, Lao PDR-Yunnan Province (PRC), Lao PDR-Vietnam, Yunnan Province (PRC)-Vietnam, Thailand-Cambodia, and Vietnam-Cambodia. These interconnections allowed the following electricity trade flows: Cambodia has been importing from the Lao PDR (south) since 2010, Thailand since 2009, and Viet Nam (south) since 2008; the Lao PDR (north) has been importing from Thailand since the late 1990s and Yunnan Province (PRC) since 2009; Thailand has been importing from the Lao PDR since 1971; Viet Nam (north) has been importing from Yunnan Province (PRC) since 2004; Yunnan Province, PRC has been importing from Myanmar since 2008 (ADB, 2012).

The path that GMS interconnection pursued also involved a series of calculated steps to institute a governance mechanism for energy cooperation and trading. First, as a result of an energy sector study assisted by the ADB, a subregional Electric Power Forum (EPF) was formed in 1995 and henceforth has been meeting at least once a year. Next, the EPF facilitated the adoption of a policy statement on regional power trade in the GMS in 1999, which then led to the formulation of an inter-governmental agreement to implement the policy statement. This inter-governmental agreement served as the legal authority to implement electric power trading and was signed by all GMS countries during the first GMS summit in 2002. In the agreement, the GMS countries also agreed to create a Regional Power Trade Coordination Committee (RPTCC) to provide strategic direction and overall management of the GMS power trade. The RPTCC's major accomplishment thus far is the completion of the initial Regional Power Trade Operating Agreement, which is a set of technical and commercial guidelines to support the establishment of a regional power market in the GMS (ADB, 2012).

Zhai (2010) explains that the GMS countries committed, through successive memoranda of understanding, to embark on a roadmap towards a regional power market. In one memorandum of understanding, the roadmap is described as consisting of the following four stages:

Stage 1 - first cross-border transactions are developed; transactions between pairs of neighboring countries exist and are linked to power purchase agreements (PPAs)

Stage 2 - trading is possible through bilateral PPAs between any pair of GMS countries using the transmission facilities of a third regional country

Stage 3 - multiple buyers-sellers are allowed to enter in cross-border transactions

Stage 4 - most of the GMS countries have moved to multiple sellers-buyers regulatory framework; a regional wholly competitive market exists

ADB (2012) reports that the subregion is currently in Stage 1, wherein GMS regional power trade is characterized mainly by bilateral trade via PPAs involving independent power producers.

4. Different Options towards a Pathway to AEMI

From an examination of the experience in energy market integration in different regions across the globe, there are common elements that emerged. Broadly, these are: binding agreements, physical infrastructure, standardized or harmonized rules of operation, and governing or coordinating institutions.

With respect to binding agreements, it can be noted that all the energy markets studied in the preceding section feature regional agreements with different levels of strength in binding the member states. It can also be noted that investing in physical infrastructure, either to connect

existing infrastructure networks in neighboring countries or to create new networks that cut across countries, is a significant activity in these markets, which is to be expected because such infrastructure is the main vehicle in physically carrying out energy trade. Moreover, the formulation of new rules, such as cross-border dispatch rules that each generator, supplier, or distributor in participating countries must adhere to, is closely tied to the operation of the infrastructure. All the scrutinized energy markets also have regional institutions with varying degrees of governing powers—some can directly govern the energy market and some can only do coordination work and provide guidance to bilateral agreements.

It is also apparent that the common elements mentioned above are major building blocks of an integrated energy market and the sequencing of steps towards energy market integration can be guided by the desire to prioritize the building blocks. There are certainly other building blocks but the discussion here is not meant to exhaust the listing of all of these but only aims to identify the major ones that emerged in the specific review of literature that has been conducted in the preceding section. For example, restructuring and unbundling of the energy industry has been a building block in some cases but has not been a crucial factor in cases wherein the country's vertically integrated energy industries are still able to participate in regional energy market integration.

The features of these regional markets that hold promise for the ASEAN members' appreciation of the need for energy market integration are those that resonate well with them and are gradually emerging as sources of their vulnerabilities as a region and as individual countries. The two most prominent features are energy security and adaptability of regulations to dynamic global conditions. The ASEAN region's growing demand for energy juxtaposed with internal and external (i.e., outside ASEAN) competition for energy use brings to the fore the need to secure energy supply not only unilaterally but also as a region and in a coordinated way. The energy security objective, however, need not be pursued in a protectionist manner nor equated with advancing regional energy self-sufficiency.

The flexibility of regulations to allow countries to efficiently trade in energy products not only within the ASEAN region but also with those outside the region, especially during energy crises, is very important. Within ASEAN, the responsiveness of energy regulations to dynamic global conditions is a serious challenge that must be acknowledged by leaders of the member states. It is crucial to note that some ASEAN members do not even have independent regulators for energy (as discussed in the next section). The realization that there is a need to address these two interrelated sources of vulnerabilities—energy security and regulatory flexibility—could rouse ASEAN leaders to realize the positive spill-over effects of and mutual benefits from providing regional public goods in an integrated energy market. The decision to take advantage of mutual gains could then lead them to pursue steps to supply the regional public goods and examine the appropriate way of sequencing those steps.

4.1. Varying Emphasis on the Steps towards Integration in Other Regional Markets

The sequencing of steps towards energy market integration in other regions, however, has not been a clear-cut sequencing. Rather, it is an interrelation of big steps and small steps with varying emphasis, that is, with some steps gaining more prominence than the others simply because that is what is required by the region's environment and historical context. The options for pursuing AEMI based on the other regions' experiences can therefore be presented as options for placing emphasis on or for prioritizing the building blocks of an integrated regional energy market. The emphases, as interpreted in this paper, are as follows:

- integration of the legal structures (EU experience)
- free trade in energy (NAFTA experience)
- liberalization of infrastructure investments (Mercosur experience)
- operation of physical infrastructure (Central Asia experience), and
- bilateral agreements (GMS experience).

The EU pathway took advantage of the rules-making process set by the European Commission to liberalize energy markets and facilitate integration. In the regional legal system of the EU, member states agreed to be bound by EU regulations and transpose their national laws or regulations to conform to EU directives. In addition to the mutual pursuit of energy market integration objectives, the existence of a regional court to enforce legal agreements also prompts member states to adhere to action plans and targets. Given the legal structure, there is a relatively commodious support for creating institutions with powers rather than institutions that merely facilitate information flow and cooperation agreements. The Agency for Cooperation of Energy Regulators (ACER) is one such institution. The ACER is created not only to promote cooperation among national energy regulatory authorities in the EU but also, and more importantly, to provide the EU-level authorities a means of monitoring the activities of national energy regulatory authorities. The ACER also has decision-making powers on cross-border issues (ACER, 2013). The ASEAN, however, is far from having a regional legal system similar to that of the EU. Tracing the successive treaties that led to the current regional legal system in the EU will reveal an evolution that was initially motivated by a desire to temper extreme nationalism and intolerance witnessed during World War II. Such strong impetus for having supranational legal entities is missing in the ASEAN's historical context and it may take a while before a similar legal structure evolves in ASEAN.

The NAFTA pathway, which puts emphasis on free trade in energy products and services, may be feasible for ASEAN. The ease of implementation, however, may not be comparable given that the NAFTA case started with two countries only and then later three. Coordination in quickly implementing free trade in energy may be more difficult to handle in ASEAN wherein ten member states are involved in a free trade area. Moreover, the removal of tariff and non-tariff barriers in ASEAN, one of the primary objectives of the ASEAN Free Trade Agreement when it was signed in 1992, is still a work in progress. This is quite apparent in the efforts to have an ASEAN Economic Community (AEC) by 2015. The AEC envisioned to be in place in 2015 is an integrated economic region characterized by four pillars: single market and production base, highly competitive

economic region, a region of equitable economic development, and a region that is fully integrated with the global economy (ASEAN Secretariat, 2012). At present, it is appearing that the full achievement of AEC 2015 is not likely given that a significant number of the various AEC measures agreed upon in 2007 are not yet achieved. For instance, the ASEAN Secretariat reports that in the AEC Scorecard for Pillar 1, that is, single market and production base (which involves the free flow of goods, services, investment, and capital), the implementation rate is only 65.9% as of 2012, three years before the AEC target.

The same can be said about the option wherein liberalization of infrastructure investments is emphasized in the steps towards energy market integration, as it was done in the Mercosur region. This option may be feasible in ASEAN but significant barriers to the free flow of capital and investments still exist and removing them is turning out to be a long process. For example, measures to implement the free flow of capital and investments within ASEAN are difficult to ratify because some of them are not aligned with national domestic laws, such as restrictions on foreign equity ownership in domestic firms or limits to the land tenure of foreigners.

The emphasis on the operation of physical infrastructure as it was done in the Central Asia region is not a practical pathway at present. This is obvious because the prerequisites to such operation are not yet in place. In the GMS grid interconnection, for example, transmission regulation is the more practical objective (at least at present) than joint operation. Even in the GMS case, the prerequisites for undertaking transmission regulation are still to be attained, namely, performance standards, transmission regulation rules, metering guidelines, and a GMS Grid Code (ADB, 2013b). Moreover, even in the pursuit of the envisioned ASEAN power grid, challenges remain. The planned interconnection projects will require significant investments in marine or undersea cable interconnections, as well as inland interconnections involving the participating countries' transmission grids. Although interconnection was deemed technically feasible in the 2011 Master Plan on ASEAN Connectivity (ASEAN Secretariat, 2011), the economic viability of the planned projects are yet to be established and accepted by the participating ASEAN member states. It should be noted, however, that the Central Asia experience provides a critical lesson that is relevant to ASEAN, namely—a breakdown in infrastructure operation could lead to energy insecurity and a desire to pursue self-sufficiency, which could then lead members to be blind to the mutual gains from trade.

4.2. Possible Emphasis on and Sequencing of Steps in AEMI

The emphasis on bilateral agreements on trade and cross-border infrastructure, as currently being followed in the GMS experience, may be viewed as a natural recourse in the absence of governance mechanisms at the regional level. However, the option for AEMI should strive for something higher than this. ASEAN members should strive to forge multilateral agreements on energy trade and investments. Multilateral trade relationships could provide a stronger compulsion for the removal of energy tariff and non-tariff barriers across the ASEAN region than what could be provided by bilateral trade relationships. Energy market integration should also go beyond trading of electricity that can be transported over the wires. There are still other energy products that can be traded aside

from electricity, for instance, petroleum products, natural gas, biomass resources, and renewable energy technological equipment. The GMS experience, nonetheless, opened up opportunities for testing the building blocks of an integrated energy market in one corner of ASEAN. Given this experience, expanding the energy market integration effort in scale and scope from one subregion to the whole ASEAN region is a promising option.

In the literature, there is no estimation yet of the benefits that will accrue to ASEAN from pursuing this option of expanding the GMS regional energy market integration to cover the whole ASEAN. However, the benefits in the GMS region itself provide helpful leads on the potential benefits. In a 2010 study by the Economic Consulting Associates (2010) of the potential of regional power sector integration in the GMS, the benefits include lower tariffs for countries that have high tariffs and are dependent on high-cost generation. Countries that could benefit include Cambodia, which has extremely high tariffs due to its dependence on oil-fired generation, and Thailand, which has relatively high tariffs partly due to its dependence on gas-fired generation. Moreover, trade in an integrated energy market is driven not only by the benefits in the form of lower tariffs for end-users in importing countries but also by revenue-generating opportunities for exporting countries. In this regard, the Economic Consulting Associates explained that the demand for power export from hydro-power producing Lao PDR and Myanmar has provided these countries opportunities to earn revenues through independent power producers. There are also potential benefits in terms of carbon emissions reduction. The ADB (2009) estimated that around 3% savings in carbon emissions could be realized in a fully integrated GMS regional energy market scenario relative to the business-as-usual base scenario.

The practicable approach for expanding the energy market integration effort in scale and scope within ASEAN is "the ASEAN way." The ASEAN way is the succinct description being used by ASEAN members in their approach to unify the region on various matters. As encapsulated in the Treaty of Amity and Cooperation in Southeast Asia (ASEAN Secretariat, 2013), the ASEAN way can be characterized as being guided by non-interference, discreteness, informality, consensus building, non-use of force, and non-confrontational bargaining. It contrasts with majority vote, legalistic decision-making, litigations, and confrontational methods like sanctions and economic embargoes.

Given that the ASEAN way emphasizes building trust, the desirable first step towards AEMI is to conduct: (i) a candid evaluation of the opportunities for investments in energy resource development, with full disclosure of benefits and costs (including costs related to the environment or health); (ii) a reliable assessment of energy trading potential in the region, with emphasis on mutual gains from trade; and (iii) comparative surveys of domestic energy market structures as well as regulatory institutions, frameworks, rules and plans, with emphasis on areas for technical cooperation rather than weakness points. Of course, an important prerequisite is an agreement among senior leaders of ASEAN that the conduct of these assessments and surveys is worth undertaking. The buildup of database and assessments of resource, investment, trade, market structures, and regulations is meant to bring out the elements of an AEMI regional accord, or a set of AEMI regional accords if necessary, that balances the interests of ASEAN member states. The next step is then to forge an ASEAN regional accord for AEMI with actionable targets and timetables. A general timetable of up to 2030 may emerge given that in the vision for ASEAN 2030,

the remaining barriers to the free flow of goods, services, and factors of production will be eliminated in the coming years up to 2030. Creating a regional institution or strengthening an existing regional institution to be the repository of information and to monitor accomplishments is an important next step. The existing institution that may be strengthened in order to coordinate and monitor integration efforts is the ASEAN Centre for Energy, an entity established in 1999 and provided with core funding from an energy endowment fund consisting of equal contributions from the ten ASEAN member states. The existing group that may be strengthened in order to facilitate regulatory reforms is the ASEAN Energy Regulators' Network (AERN). The AERN is a network of regulators that has been meeting since March 2012 and was recognized in the 30th ASEAN Ministers of Energy Meeting in September 2012, wherein the network was asked to strengthen communication channels in order to promote mutual understanding of energy regulations among member states (ASEAN Secretariat, 2012).

After making the case for a more liberal trade and investments in the energy sector, ASEAN member states could agree to remove border and behind-the-border barriers to trading of energy products and investing in energy infrastructure. As a consequence, energy provisions could be written in future free trade agreements in a more concrete and explicit manner. Harmonization of rules, standards and procedures (for example, rules for resource exploration, standards for power purchase contracts, procedures for dispatch in interconnected grids, and customs clearance along borders), could also augment the removal of barriers to trade and investment. The shape of the physical interconnectivity through such infrastructures as power grid interconnection, gas pipeline network, liquefied gas shipping ports, petroleum transportation points, and regasification terminals, will be guided by resource availability, feasibility of investments, and trading opportunities. Later, the question of joint operation of physical connections or infrastructures with on and off switches will emerge and the ASEAN could be confronted with two choices—either to create a separate institution that has decision-making powers on cross-border operational issues or to agree on protocols for operations and conflict management that each national authority for infrastructure operations has to comply with. The ASEAN way that emphasizes building trust and disfavors sanctions will not necessarily be in conflict with global standards on punitive actions for operational non-compliance as long as protocols are approved by a high-level ASEAN governing body.

5. Influence of National Constraints

The ASEAN member states have different national constraints that could influence the pace at which they would be able to join AEMI. These include, but are not limited to, preparedness in exploring their own resources, subsidy policies, national laws limiting their participation, and regulatory inflexibility.

With respect to energy resources, Nicolas (2009) states that eight of the ASEAN members have proven oil and gas reserves (Myanmar, Vietnam, Philippines, Cambodia, Malaysia, Thailand, Brunei, and Indonesia) and five have substantial coal resources (Vietnam, Philippines, Malaysia, Thailand, and Indonesia); moreover, the countries in the northern region (Myanmar, Lao PDR, and

Vietnam) are rich in hydropower resource. Singapore, in contrast, does not have any natural energy resource and is heavily dependent on energy imports. Given the mapping of resource availability, the temptation to formulate a blue print for integration based on such mapping is strong. This is apparent in the vision for a trans-ASEAN natural gas network. The activities towards this vision have been pushed back due to delays in developing the Indonesian East Natuna field that has total proven reserves of 46 trillion cubic feet of gas (Global Association of Risk Professionals, 2013). It turned out that the delays are due to commercial viability issues arising from the huge cost of developing the gas field, which contains high carbon dioxide levels, without government incentives. From this experience, it is apparent that energy market integration does not only take place at the government level but also at the private sector level. Thus, an alternative approach to having integration plans based on resource mapping is planning the integration based on an indicative business case test and the preparedness of countries to develop their energy resources (through their own investments or jointly with foreign partners).

The high subsidies in other ASEAN members could also influence their pace in joining AEMI. From the IMF (2013) report on energy subsidies, it can be gleaned that most ASEAN members provide energy subsidies. The IMF report also shows that in the case of pre-tax subsidies, Indonesia provides the highest subsidy for petroleum products (2.58% of GDP), Thailand provides the highest subsidy for electricity (1.64% of GDP), Malaysia provides the highest subsidy for natural gas (0.31% of GDP), and Thailand provides the highest subsidy for coal (0.25% of GDP). Energy market integration aims to enforce market-based pricing and energy use efficiency, but the subsidy policies of some ASEAN members may run counter to these goals since subsidies understate the true price of energy and encourage over-consumption. Thus, the AEMI efforts must also include agreements to implement a gradual and coordinated phase out of subsidies or the replacement of these with energy programs that directly target the poorest of the poor.

National laws may also present limitations to the pace and level of integration. For example, in the Philippines, the liberalization of investments in energy will be limited by the 40% ceiling on foreign equity ownership of companies operating domestically. As another example, Indonesia has stricter criteria for electricity imports relative to exports. *Government Regulation of Indonesia No. 42 Year 2012* provides that these six criteria be fulfilled before contracting electricity imports: (i) local demand cannot be fulfilled (i.e., reserve capacity is less than 30% of peak load); (ii) imports complement local need; (iii) no negative impact on national interest such as sovereignty, security, and economic development; (iv) imports will improve the quality of local supply; (v) development of national capacity should go first; and (vi) the country will not be trapped into energy dependency. On the other hand, there are three criteria for contracting exports: (i) local need has been fulfilled; (ii) no subsidy in price; (iii) exports will not have impact on the quality of local supply. These rules imply that trade flows will be guided less by cost advantages and price differentials but more by the need to prioritize the national generation capacity in the dispatch even if the priority dispatch is costlier than imports. The amendments of laws like this will likely be a delicate issue among ASEAN members and at the start, as harmonization of laws is being worked out, the potential gains from energy trade and investments must still be explored while recognizing the limits set by national laws.

With respect to regulatory reforms in order to aid trade and investment liberalization, the alternatives could be to proceed under a common goal of market restructuring and private-led competition or to proceed despite the presence of vertically integrated industries and state-owned monopolies. Regulatory reform is a serious challenge given that some ASEAN members do not even have independent regulators (see Table 2).

Table 2. State of energy regulation in ASEAN member states

Country	Regulator	Independence	Structure
Brunei	Department of Electrical Services	Not independent; under the Ministry of Energy	Single Buyer
Cambodia	Electricity Authority of Cambodia	Independent; set up in 2001	Single Buyer
Indonesia	Department of Energy and Mineral Resources	Not independent; under the Ministry of Energy and Mineral Resources	Single Buyer [a]
Laos	Department of Electricity	Not independent; under the Ministry of Energy and Mines	Single Buyer
Malaysia	Energy Commission	Independent; set up in 2001	Single Buyer
Myanmar	Ministries of Electric Power 1 and 2	Not independent; under the Ministries of Electric Power 1 and 2	Single Buyer
Philippines	Energy Regulatory Commission	Independent; set up in 2001 [b]	Price Pool
Singapore	Energy Market Authority	Not independent; under the Ministry of Trade and Industry	Price Pool
Thailand	Energy Regulatory Commission	Independent; set up in 2007	Single Buyer
Vietnam	Electricity Regulatory Authority	Not independent; under the Ministry of Industry	Cost-Based Pool

Notes: [a] Partial liberalization is achieved by allowing power plants to sell capacity directly to end-users rather than to Perusahaan Listrik Negara alone. [b] But even before 2001, a regulator exists—the Energy Regulatory Board under the Department of Energy.

Source: Ruangrong, P. (2013)

Although admittedly, more work is needed in liberalizing energy markets domestically, ASEAN member states should not wait until energy industries are restructured and domestic power exchanges are established before joining AEMI. The establishment of competitive domestic energy markets should still be set as a long-term goal. However, participation in AEMI efforts could proceed in gradual steps even though the domestic markets in some member states are still dominated by state-owned enterprises or by vertically integrated industries. What is crucial in the immediate future is building trust between importer and exporter, regardless of whether the importing or exporting entities are state-owned or private, or whether these are domestic monopolies or not. Nevertheless, the establishment of independent regulators in each member state and the harmonization of rules and standards should be minimum prerequisites. This is important in formulating regional regulatory agreements that ensure that the sanctity of contracts is respected, supply interruption is avoided when political problems occur, and ownership of cross-border infrastructure or control over a resource is not used for opportunistic trade.

6. Summary and Conclusions

This background paper on the pathway to AEMI shows that countries that choose to join a regional integrated energy market can enjoy regional public goods produced in the integration process. These regional public goods create for the member countries positive spill-over effects that are greater than what could be achieved if the countries produce the goods on their own. Examples of regional public goods in regional integrated energy markets include knowledge-related services such as best practices in regulating the energy market, infrastructure such as electricity transmission network, and security service such emergency energy reserve sharing system.

In the review of the experiences of selected regional energy markets around the world, there emerged broad elements or building blocks of integration which have publicness characteristics, namely, binding agreements, physical infrastructure, standardized or harmonized rules of operation, and governing or coordinating institutions. The decision to take advantage of the positive spill-over effects of and mutual benefits from regional energy market integration can lead the ASEAN member states to take steps to supply these regional public goods through AEMI.

The sequencing of steps towards energy market integration is not clearly cut, as shown in the experience of other regional energy markets; rather, the steps are interrelated and could be given varying emphasis depending on the regional market's environment and history. As interpreted in this paper, the highlight of the EU experience is the integration of legal structures. The NAFTA experience highlighted free trade in energy. The emphasis in the Mercosur experience is on liberalization of investments that made infrastructure build-up possible. The highlight of the Central Asia experience is the operation of infrastructure interconnection. Finally, the highlight of the GMS experience is forging bilateral agreements.

In the case of the AEMI, this paper recommends that the practicable option is to expand the initiated GMS integration effort in scale and scope within ASEAN through "the ASEAN way." The ASEAN way emphasizes building trust among member states. Trust should be built by candidly disclosing mutual gains from and shared costs and externalities in energy resource development, trading energy products, market adjustments, and regulatory reforms. There is also a need to accumulate shared databases on and assessments of resource, trade, investment, market structures, and regulations in order to uncover the elements that should be part of an AEMI regional accord. ASEAN leaders could then forge a regional accord for AEMI through 2030 with actionable targets and timetables, such as establishing or strengthening institutions for facilitating the integration efforts, removing border and behind-the-border barriers to energy trade and investments, harmonizing rules and standards, and building the physical infrastructure for regional energy trading.

The ASEAN member states are currently confronted with national constraints in varying intensities and these could impact their motivation to join AEMI. One sticking point is the lack of independent regulators for the energy sector in some ASEAN members. Thus, this paper recommends that at the

minimum, the ASEAN member states should have independent energy regulators and pursue harmonization of rules and standards.

Finally, the ASEAN members should note that energy supply and demand imbalances that drive integration and create mutual gains from trade are never permanent. It is also possible that the ever-changing supply and demand outlook could lead to one or several ASEAN members being either overconfident or insecure, both of which could result in less reliance on energy market integration, the pursuit of energy self-sufficiency domestically, or more inclination to look outward the region for trading and investments. But ASEAN members must recognize that the future will always be uncertain. Moreover, it is this same dynamic nature of supply and demand within and outside ASEAN that should motivate the pursuit of energy security through an integrated energy market that has the flexibility to adjust to changing global conditions.

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VII. The Political Economy of ASEAN Energy Market Integration

Philip Andrews-Speed, and *Christopher Len*

1. Introduction

The previous contributions to this series of AEMI background papers have systematically reviewed the benefits and opportunities offered by ASEAN Energy Market Integration (AEMI), have identified national constraints, have examined the governance and institutional requirements and have mapped a pathway to AEMI.

The aim of this paper is to examine the political economy context of energy market integration in ASEAN in order to build a better understanding of the political dynamics at work, both at the ASEAN level and beyond. Such considerations are necessary in order to align the economic principles and objectives of AEMI with the political reality of energy in ASEAN.

This paper starts with a general analysis of the political economy of energy market integration and of ASEAN's capacity for collective action, before examining the progress of ASEAN energy market integration to date. In the final section, we outline the principles which could underpin strategies and pathways to achieve AEMI.

2. The political economy of regional energy market integration

The aim of this section is to outline the key political economy factors which may assist or constrain energy market integration anywhere in the world. We first highlight the importance of collective action in energy market integration, before examining the role of actors and institutions, and the importance of trust.

2.1 The need for collective action

Energy market integration is a process through which a range of infrastructure and services relating to energy are provided across a region through collective action. As explained by Andrews-Speed and Hezri (2013) through the lens of regional public goods, the provision of some goods requires a higher level of collective action that for other goods. Those that require a lower level of collective action, such as research and development or the construction of emergency oil storage, can be left to those parties which have the greatest desire for and capacity to deliver the good. In contrast, those

goods which require a high degree of collective action, such as the operation of a regional energy grid or of an oil stock sharing system, can only be delivered reliably if organizations and rules are established to oversee and ensure implementation. This is likely to require the pooling of authority of elements of energy governance, which in turn may be perceived as a loss of sovereignty.

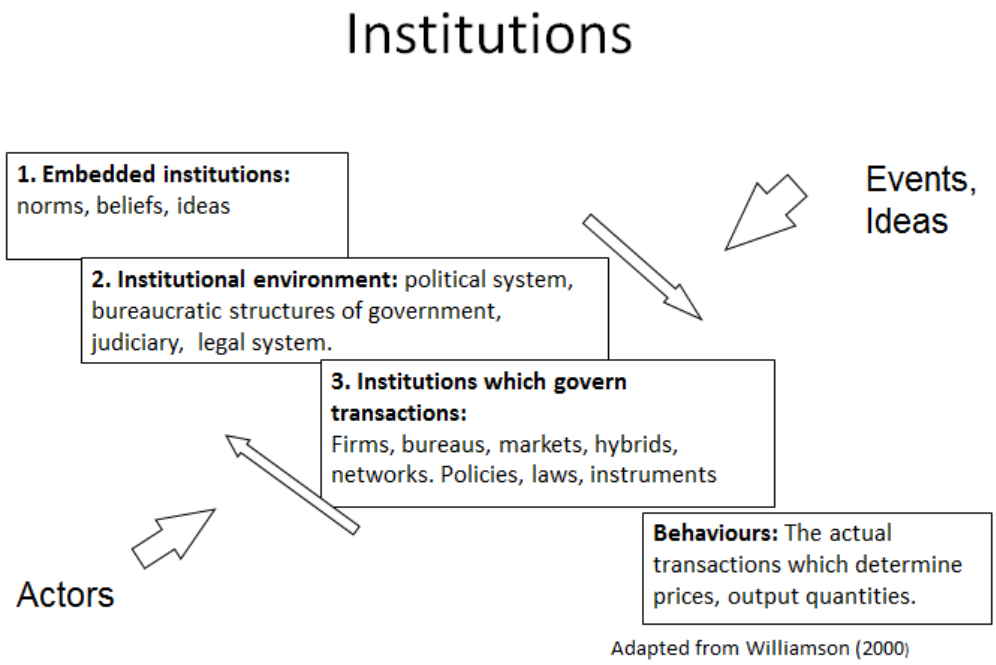
Many governments, including those in Southeast Asia, tend to regard energy security within the narrow context of national security, thus justifying heavy government control. Such a highly politicized nature of energy constrains the willingness of many governments to engage in such collective action, or market liberalisation of the national energy sectors, however beneficial it may be in principle. This politicization arises from the perceived and actual links between energy supply, on the one hand, and economic development, industrial policy, employment, social stability and national security, on the other. For this reason the national constraints to energy market integration can take on a highly political form, especially those related to the governance of the energy sector and to energy supply, both of which can shape the influence and interests of key actors in the sector.

2.2 The role of actors and institutions

Collective action to deliver a regional public good requires a convergence of interests between different actors. Given the importance of the interests of different actors (state, corporate and societal), stakeholder analysis can provide a useful tool to identify the important actors and their perceptions and interests, the resources they have at their disposal, and the relationships between actors (Reed et al., 2009). However, a focus on actors should not detract from understanding the nature of the environment in which the actors operate. This environment includes the nature of the resource and the technology applied to exploit and use it, and the formal and informal rules of the community within which the actors operate (Aligica, 2006). These formal and informal rules are referred to as "institutions" in the terminology of New Institutional Economics (North, 1992, 2005; Williamson, 2000). Analysis of these institutions can provide insights into the barriers to collective action beyond those identified by applying public goods theory.

Within a particular country or society, it is possible to identify different levels of institution (Fig.1; Williamson, 2000). At the highest level are the "embedded institutions" which include beliefs, traditions and behavioural norms. These tend to change quite slowly, over many decades or centuries. The next level of institution is known as the "institutional environment in which lie the general systems by which the economy, polity, society and the law operate. The institutional environment can change over a few decades or several years, but the pace and nature of such changes may be constrained by the embedded institutions. At the lowest level are the institutions which directly shape actor behaviour and individual economic or political transactions. These include individual laws, regulations, and contracts, as well as prices set by markets or governments. Institutional change at this level is constrained, to a certain extent, by the institutional environment. If change at this lower level of institution greatly outpaces change in the institutional environment, then the institutional framework may become unstable and open to sudden and unpredictable change. Stability is maintained by implementing change incrementally and in a coordinated manner.

Figure 1. Schematic representation of the three levels of institution



Source: Williamson, 2000

In the context of ASEAN Energy Market Integration, the study of institutions can provide insights in a number of ways:

- The perceptions, preferences and motivations of an actor (whether government, corporate or individual) will be shaped to a great extent by the embedded institutions and institutional environment within which the actor operates. Given the varied histories of the ASEAN member states, the nature of the embedded institutions and the institutional environments differ between countries. It is therefore quite understandable that their approaches to economic development, energy policy and energy market integration are highly varied.
- A sudden and radical reform of the institutions which govern a country's national energy sector is unlikely to yield the desired outcomes if the wider national institutional environment remains unchanged. Such a step runs the risk of a collapse of the energy sector and is likely to be resisted by responsible governments.
- In a system comprising several layers of governance ("polycentric governance") there must be a reasonably good degree of fit between higher and lower levels of governance. In other words, in order to gain the support of key actors and to maximize effectiveness, institutions created to govern ASEAN energy market integration should have a reasonably good fit with the relevant institutions at national level across the relevant countries.

Ostrom (2005) combined the analysis of actors and the wider environment in an Institutional Analysis and Development (IAD) framework in order to illuminate the motivations for collective action. This approach distinguishes an 'action arena', which comprises the actors and the specific 'action situation', from the exogenous variables, consisting of the material conditions, the attributes of the community and the rules. Vatn (2005) developed a similar framework but integrated 'attributes of the community' and 'rules—in-use' into a single factor 'institutions'. Such frameworks provide a systematic basis for analysing actor choices, the interactions between these choices, the outcomes of these interactions and the feedback to actor choices and to the wider institutional environment.

2.3 The importance of trust

It has long been recognised that trust is an important requirement for collective action and this led to the development of the concept of social capital (Coleman, 1988; Collier, 1998). Ostrom (2010) emphasised the importance of trust in managing the global environment, identifying the need for trust in two dimensions: between actors at the level of collective action and between these actors and the government at a higher level. Whilst the concept of social capital has no direct analogue in international relations, neo-liberalism emphases the potential for building trust between nations and places great hope on international institutions ability to create such trust and to resolve conflicts. In contrast, neo-realists argue that there are limits to the potential for trust building and cooperation because of the anarchic character of the International System. They therefore focus on self-help to ensure their own survival and as the primary means to manage and resolve conflicts they encounter (Waltz, 1979).

In the context of the governance of energy and natural resources, neo-realists identify the state as the key actor and place great importance of the need for states to control the access to energy and natural resources for strategic reasons. The liberal perspective highlights the important role of international markets in the production a flow of energy and natural resources, and the need for international cooperation to promote good governance (Dannreuther, 2013).

3. ASEAN's progressive integration

The aim of this section is to provide the general political economy background for the analysis of the political economy of ASEAN energy market integration. We examine, first, integration within ASEAN and, then, integration by ASEAN with external actors and regimes, and conclude with an assessment of the constraints to integration.

3.1 Internal ASEAN integration

The Association of Southeast Asian Nations (ASEAN) is a formal regional organization with a secretariat which was founded in 1967 through the ASEAN Declaration (or Bangkok Declaration) in 1967, by five states, namely: Malaysia, Singapore, the Philippines, Indonesia and Thailand (reference). At its foundation the principle objectives of ASEAN were nation building, economic development, solidarity against communism, and collective security.

Today ASEAN has a much wider political and economic agenda which reflects both internal and external concerns, including trade and investment, and has grown to include ten nations. In succession, Brunei, Vietnam, Myanmar, Laos and Cambodia joined ASEAN, the last of these only in 1999. In the Southeast Asian archipelago, only East Timor and Papua New Guinea remain outside ASEAN.

The Treaty of Amity and Cooperation in Southeast Asia signed in 1976 laid down fundamental norms which have subsequently underpinned the behaviour of ASEAN member nations. These included respect for the independence, sovereignty and territorial integrity of all nations and non-interference in the internal affairs of one another (Acharya, 2012). These ideas were re-iterated in the ASEAN Charter which was adopted in November 2007 and came into force in December 2008. The charter included a number of other principles, notably Article 2.2.n noting "adherence to …ASEAN's rules-based regimes for effective implementation of economic commitments and progressive reduction towards elimination of all barriers to regional economic integration, in a market-driven economy". The key factors driving the creation of the charter are first, for ASEAN to enhance its "regional resilience"; second, "for ASEAN to be more competitive as an economic unit" in response to the rapid economic rise of China and India; and third for ASEAN members to "maintain and indeed gain political influence in the wider region" (Tay, 2010).

The economic agenda started to appear from the mid-1970s, after the end of the Vietnam War, but only really gathered pace after the end of the Cold War and after the Asian financial crisis, as the member states realized the need for greater regional economic integration and closer integration with world markets. Today the formally agreed objectives of ASEAN are wider ranging and cover security, trade, investment and cultural goals. In 2003, the member states drew up an ambitious vision through the Bali Concord II and announced their aim to establish an ASEAN Community built upon three pillars, namely "political and security cooperation, economic cooperation, and socio-cultural cooperation".[34] They also agreed to pursue closer economic integration by 2020 through the creation of an ASEAN Economic Community (AEC). Key components of the AEC which are relevant to energy are the ASEAN Trade in Goods Agreement and the ASEAN Comprehensive Investment Agreement, both signed in 2009. Together these two agreements seek to promote the free flow of trade and investment within ASEAN.

[34] 2003 Declaration of ASEAN Concord II Adopted by the Heads of State/Government at the 9th ASEAN Summit in Bali, Indonesia on 7 Oct 2003, available at http://cil.nus.edu.sg/rp/pdf/2003%20Declaration%20of%20ASEAN%20Concord%20II-pdf.pdf (accessed 3 July 2013).

The AEC, together with the ASEAN Political-Security Community and the ASEAN Socio-Cultural Community, form the basis for the emerging ASEAN Community (Acharya, 2012). These ideas were consolidated in the ASEAN Economic Community Blueprint issued in 2007 which set out the measures to be implemented to create a single market for goods, services and capital by 2015.

Economic integration has also been driven by firms (state-owned and private) as they trade and invest across the region, and build international production networks which in turn may develop into sub-regional growth polygons (Dent, 2008). Where firms have the capital, and find the opportunity and incentive, they, with support from banks, are likely to be the main actors in trade and investment. In some cases, state-owned enterprises may have some advantages over privately-owned companies through their lower cost of capital and preferential access to funds from their home country banks. There is also a "political" dimension in doing business in key sectors within ASEAN countries whereby local businesses lobby their politicians to keep overseas competitors out of their local markets.[35]

Before the Asian economic crisis in 1997, civil society engagement with ASEAN was mainly through academic and business networks and associations. Since the economic crisis, civil society organisations (CSOs) and non-governmental organizations (NGOs) have increasingly appreciated the value of engaging with ASEAN. Over the same period ASEAN itself has created a number of forums for engaging with civil society such as the ASEAN People's Assembly, the ASEAN Civil Society Conference and the Solidarity for Asian People's Advocacy (Chandra, 2006). Despite these steps, active engagement of civil society with ASEAN policy making remains limited, both by the limited capacity of ASEAN itself and by the general unwillingness of some member country governments (Chandra, 2006; Acharya, 2012).

3.2 Integration with external partners

In addition to taking internal initiatives, ASEAN has become a key actor in building institutions to promote wider regional and supra-regional cooperation. Openness to international trade and investment have long been important priorities for ASEAN member states, this external engagement was further enhanced after the Asian financial crisis in 1997/8 which drew attention to the need to build external economic cooperation, especially with Northeast Asia. In the following years, ASEAN concluded a number of Free Trade Agreements both with Northeast Asian states (China, Japan, Korea and Taiwan), as well as with Australia, New Zealand and India.

The 10 ASEAN members and its Free Trade Agreement partners – Australia, China, India, Japan, South Korea and New Zealand - also launched a new economic initiative called the Regional Comprehensive Economic Partnership (RCEP). This is a 16 party Free Trade Agreement first announced in November 2011 as an ASEAN-led initiative aimed at broadening and deepening

[35] "DBS Acquisition plan 'political'", Jakarta Post, 2 April 2012, available at http://www.thejakartapost.com/news/2012/12/01/dbs-acquisition-plan-political.html (accessed 1 December 2013).

economic engagements with its FTA partners; with negotiations to be completed by the end of 2015.

ASEAN's growing interest in Northeast Asia stimulated the formation of ASEAN Plus Three (APT) that included Japan, China and South Korea. This grouping started in 1997 with a focus on financial and economic recovery, but later expanded to cover many different fields, including infrastructure, energy, the environment, food, disease control, and maritime piracy. Economic links between ASEAN and Northeast Asia are deeper than those within ASEAN, with intra-regional trade across APT amounting to 55% by 2005. But this economic integration had been driven by businesses rather than by governments, especially through the means of international production networks (Dent, 2008).

The APT soon led to the creation of yet another, even larger cluster that became known as the East Asian Summit (EAS) at facilitating confidence-building and discussions on broad strategic issues that concern the region and to develop East Asian regionalism in an inclusive manner (Desker, 2005). At its first meeting in 2005, this comprised the 13 members of ASEAN Plus Three and three additional parties Australia, New Zealand and India. The USA and Russia joined in 2011. The agenda is mainly to promote strategic dialogue and cooperation in East Asia including energy issues, but concrete progress is constrained by differences of opinion on the membership, role and objectives of EAS, and on its relationship with APT (Dent, 2008)

In addition, ASEAN participates in the Asia Cooperation Dialogue Pacific Economic Cooperation Council and in the Asia Pacific Economic Cooperation (APEC). It also has bilateral arrangements with other regional organizations such as the Gulf Cooperation Council, Mercosur, the Southern African Development Community, the Shanghai Cooperation Organisation, and the OECD, as well as a number of UN organizations.

3.3 Constraints on ASEAN integration

These forty six years of conscious effort to enhance regional security, to promote economic development and to build a sense of regional identity have met with a significant degree of success despite many obstacles, not least of which has been the high degree of diversity among the member nations. The deliberate focus on shared interests, priorities and norms has allowed a shared and distinctive sense of regionalism to emerge. This regionalism is not just inward looking, but explicitly supports external economic and political links (Severino, 2006; Acharya, 2012).

Despite this important achievement, ASEAN has fallen short of expectations in a number of ways. It shown the ability to manage or diffuse disputes but not to resolve them. Its capacity for building institutions remains weak and the implementation of policy initiatives is generally slow, except at times of crisis (Severino, 2006; Acharya, 2012).

These apparent defects are understandable for a number of reasons. Most ASEAN member states are young nations which only emerged from their colonial past after the Second World War or after the Cold War. Several have weak state capacity and are very sensitive about sovereignty. In such cases, regime survival is more important than collective action with neighbours (Nathan, 2010) and state-building more important than governance (Yu and He, 2011). Decision making has become more difficult after enlargement from seven to ten members, not least because of the low state of economic development of the new members and their differing political heritage. The result is a preference for informality and loose arrangements that is not compensated by the provision of sustained leadership by one or two countries (Severino, 2006)

The capacity for collective action is further weakened by longstanding distrust, sometimes dating back hundreds of years, others to the Cold War. Current aggravating factors include unresolved disputes over land borders and maritime demarcation, ethnic unrest in border areas and illegal migration and smuggling. Relations with great powers outside ASEAN continue to be a source of irritation. China and the Soviet Union played an important unifying role in the early years of ASEAN as the organisation was essentially anti-communist at that stage, but at the same time ASEAN did not want to get too close to USA and the West. In recent years, both the USA (with its 'Pivot and rebalancing to Asia') and China have been deepening their engagement in Southeast Asia, moves which have the potential to undermine ASEAN unity, especially in the context of the South China Sea.

Although bilateral relations between most states have improved over the last twenty years (Ganesan and Amer, 2010), tensions sometimes come to the surface during a crisis, for example Asian Financial Crisis. Yet such crises often provide the incentive for renewed efforts to build economic community (Acharya, 2012).

In addition to these largely political dimensions of inter-state relations, a number of important economic factors act to weaken the desire for or to constrain the implementation of economic integration. These include differences in levels of economic development, in economic development models and priorities, and in attitudes to environmental protection. Uneven development within the ASEAN region is likely to impede on regional economic cooperation initiatives due to the variable governance levels among the different member states. Multilateral economic integration may also be undermined by the preference of some member states to develop bilateral economic ties (internal and external to ASEAN) rather than wait on ASEAN's multilateral arrangements (Dent, 2008; Solingen, 2010).

Applying the terminology of international relations, most ASEAN governments appear to take a realist or neo-realist view of international political and economic relations and look to ASEAN as a mean to safeguard their sovereignty and prevent external interference in their domestic affairs. This constrains the pace of implementation of ASEAN economic initiatives and prevents any significant pooling of sovereignty or delegation of authority.

These factors, amongst others, have contributed to the relatively slow progress towards implementing the AEC. Although the ASEAN Secretariat provides a strongly positive view of progress (ASEAN Secretariat, 2010, 2012), other analysts have asserted that these reports exaggerate the speed of implementation and that progress has been much slower than hoped in a wide variety of fields such as free trade utilisation, competition policy and law, customs regimes, investment trade in services and non-tariff barriers to trade (e.g. Dosch, 2013).

4. ASEAN energy market integration to date

The aim of this section is to examine the progress of selected components energy market integration across ASEAN and at smaller scales within ASEAN, and to identify the obstacles to progress. This account starts with the two most important elements of energy market integration, trade and investment, before examining in turn gas and electricity networks, unresolved maritime disputes, oil stocks, renewable energy and energy efficiency, and energy market integration across the wider region of East Asia.

4.1 Trade and investment

The free flow of trade and investment lies at the heart of the AEC. This principle should apply equally to trade in energy commodities and services and to investment in energy in order to pursue energy market integration. The two key agreements in this respect are:

- The ASEAN Trade in Goods Agreement (ATIGA);
- The ASEAN Comprehensive Investment Agreement (ACIA).

The goal of the ATIGA is to reduce to zero by 2015 import tariffs all goods products. Today, only four ASEAN member states retain import tariffs for energy products such as crude oil, oil products, natural gas and coal, but these are due to be removed by 2015.[36] However, although import tariffs have been removed in most of the ASEAN member states, a wide range of non-tariff barriers were identified by the ASEAN Secretariat in 2007.[37] Many of these barriers persist today, for example state import monopolies and complex procedures for obtaining certificates of origin (Yulisman, 2013). As a result, the prospects for seaborne trade within ASEAN for crude oil, oil products and coal by 2015 are relatively good, but trade in oil and gas by pipeline and trade in LNG will require substantial investment. Despite this progress, some countries have long-standing domestic market

[36] ASEAN Secretariat, ASEAN Economic Community, Annex2, Tariff Schedules, available at http://www.asean.org/communities/asean-economic-community/item/annex-2-tariff-schedules (accessed 12 July 2013).

[37] ASEAN Secretariat, ASEAN Economic Community, Non-Tariff Barriers, available at http://www.asean.org/communities/asean-economic-community/item/non-tariff-measures-database (accessed 12 July 2013).

obligations written into their production sharing agreements for oil and gas, and both Indonesia and Vietnam are reported to be taking steps to limit the exports of coal.[38]

The ACIA appears at first sight to be, as it says, a comprehensive international investment agreement designed to promote the free flow of investment across the region by providing for national treatment and investor protection. However, this appearance is deceptive, for a number of aspects of the agreement provide it with a very regional character, reflecting its origin in the process of ASEAN decision-making and the need to achieve consistency with the values and priorities of ASEAN member states (Zhong, 2011).

The scope of application, the exceptions and the reservations of the ACIA provide the host governments with great latitude in the application of the agreement and thus to undermine the intent of ACIA in many sectors, including energy. With respect to energy, the scope of application includes the extraction of mineral and hydrocarbon resources and services incidental to this extraction, but does not include the construction and operation of energy networks and utilities, notable electricity and gas. A number of countries with oil and gas resources have listed the oil and gas industry among their reservations, and the general exceptions are wider than what is generally seen in international investment agreements. Finally, special exemption is given to the new member states, Vietnam, Myanmar, Cambodia and Laos. In general, the ACIA is a very cautious document (Desierto, 2013) which provides little support to the free flow of investment in the energy sector.

In summary, the ATIGA and to a greater extent the ACIA make only a limited contribution to supporting the development of the AEC in the energy sector and thus to the promotion of AEMI.

4.2 Gas and electricity networks

The story for network-bound energy is different. The ASEAN Power Grid (APG) and the Trans-ASEAN Gas Pipeline (TAGP) have long been seen as fundamental elements for ASEAN Energy Market Integration[39] and they are also elements of the Masterplan on ASEAN Connectivity (Das, 2013). Progress has been made on both projects, but most implementation has been pursued on a bilateral basis (Doshi, 2013). Little progress has been made to harmonise policies and standards across ASEAN, or to address third-party access or tariff and taxation issues (Nicolas, 2009; Sovacool, 2009; ASEAN Centre for Energy, 2013). One obstacle specific to the TAGP is the continued failure to develop the giant East Natuna gas field for technical reasons. This factor, combined with (1) the stated preference of the governments of Malaysia and Indonesia to save more

[38] 'Indonesia eyes coal export curbs, tax', Reuters 4 June 2012, available at http://www.reuters.com/article/2012/06/04/coal-asia-indonesia-exports-idUSL3E8H41QS20120604 (accessed 17 July 2013); 'Vietnam Clamping Down on Coal Exports as Domestic Energy Needs Rise', Wall Street Journal, 10 July 2013, available at http://online.wsj.com/article/SB10001424127887324879504578596901530238408.html (accessed 17 July 2013).

[39] ASEAN Medium-Term Programme of Action on Energy Cooperation, 1995-1999, available at http://www.asean.org/communities/asean-economic-community/item/asean-medium-term-programme-of-action-on-energy-cooperation-1995-1999, accessed 12 June 2013.

of their gas production for domestic use and (2) the rise of LNG trade, act together to steadily diminish the short-term economic necessity for the TAGP (Doshi, 2013).

The TAPG project has been further undermined by a divergence of political and economic interests among key actors such as national governments, national and international energy companies, and international agencies (Sovacool, 2010). This study by Sovacool revealed that some parties saw TAPG as a source of revenue, others as the provider of energy services. For some, the project would promote integration within ASEAN; for others the priority was integration with external markets. Most importantly, national economic and energy interests seemed to outweigh regional public good considerations (ASEAN Centre for Energy, 2013).

Funding is the ultimate constraint on both the APG and the TAGP. The combination of low end-user tariffs, unpredictable legal regimes, and divergent interests provide a strong disincentive to private investors to commit funds to large, transboundary infrastructure projects in the region (Sovacool, 2009; Nguyen, 2013). To assist address this challenge the ASEAN Infrastructure Fund was established in 2011. More work is needed to build public-private partnerships and to develop national and regional capital markets (Pipoppinyo, 2013).

4.3 Unresolved maritime disputes within ASEAN

An important component of any regional energy market is that primary energy resources are available for exploitation subject to national laws and policies and to international law. This requirement is of particular relevance to ASEAN as the region is importing progressively larger quantities of primary energy (Institute of Energy Economics Japan, 2011). A major obstacle to this exploitation continues to be the inability of a number of ASEAN member states to resolve their maritime delineation disputes or, in the absence of such resolution, establish operational joint development zones. The South China Sea which is believed to contained abundant oil and gas is such an example. Having said that, it should be noted that the notion of joint development is not new to the Southeast Asian region. There are already joint development agreements in the Gulf of Thailand between Malaysia and Thailand agreed in 1979 and more recently between Malaysia and Brunei in 2009 (Schofield, 2011).

4.4 Oil stocks

Another policy element which appears to have dropped off the agenda for collective action is the establishment of some form of strategic oil storage and sharing system. According to the US Energy Information Administration, the Singapore government maintains about 32 million barrels of crude oil and 65 million barrels of refined petroleum products in strategic petroleum reserves (Energy Information Administration, 2013). Indonesia, Thailand and the Philippines hold more modest level of stocks, whilst other ASEAN governments such as Vietnam are drawing up plans to build stocks

(Risk and Policy Analysis Ltd, 2012). A revised ASEAN Petroleum Security Agreement (APSA) was signed in 2009. It provides for voluntary (not obligatory) measures in times of supply crisis including emergency energy saving measures and the sharing of oil or gas. It allows for but does not oblige member states to construct oil stockpiles either individually or jointly. ASEAN +3 provides a wider framework for joint studies and information sharing relating to oil stockpiles. The sharing mechanism has never been implemented as supply problems have been solved bilaterally between ASEAN member states, with non-ASEAN oil producers or through oil traders (Nicolas, 2009).

4.5 Renewable energy and energy efficiency

The ASEAN Plan of Action for Energy Cooperation (APAEC) 2004-2009 set a 2010 target of 10% for renewable energy as a share of installed power generation capacity installed.[40] This target was met and a new target of 15% was set for 2015. National target setting for renewable energy is left in the hands of the member states, and coordination is provided through the Renewable Energy Sub-Sector Network. ASEAN has provided support for the deployment of renewable energy across the region through its ability to attract funding from the European Union, Germany and South Korea (ASEAN Centre for Energy, 2013).

In the field of energy efficiency, ASEAN has set an "aspirational target" of reducing regional energy intensity by 8% between 2005 and 2015. The main mechanisms it deploys in support of this goal are training, information sharing, and sharing of best practice. Japan provides support technology transfer workshops and energy audits. As is the case with renewable energy, national target setting for energy efficiency is left in the hands of the member states, and coordination is provided through the Energy Efficiency Sub-Sector Network (ASEAN Centre for Energy, 2013).

One of the objectives shared by the strategies for renewable energy and energy efficiency is to promote the development of manufacturing capacity and trade across ASEAN in the relevant technologies and appliances. Progress in this respect has been hampered by a number of factors such as weak technological capabilities and the lack of national technical standards (ASEAN Centre for Energy, 2013).

[40] ASEAN Plan of Action for Energy Cooperation, 2004-2009, available at http://www.eppo.go.th/inter/phil2004/ASEAN-apaec2004-2009.html (accessed 3 July 2013)

4.6 Energy Market Integration across East Asia

Energy market integration is also on the policy agenda of the East Asia Summit (EAS). Through the Economic Research Centre for ASEAN and East Asia (ERIA) the EAS has supported an intensive research programme on the benefits and opportunities for energy market integration across the region (Wu et al, 2013).[41]

One important initiative within a sub-region of the EAS is the proposal to enhance energy cooperation in the Greater Mekong Sub-Region (GMS). The participating states include Cambodia, Laos, Myanmar, Cambodia and Thailand, and Guangxi and Yunnan Provinces of China. Specific objectives include (Asian Development Bank, 2009):

- Improving access to energy;
- Increasing the use of indigenous low-carbon energy and reducing dependence on imported fossil fuels;
- Enhancing cross-border trade in energy, notably gas and electricity;
- Enhancing energy efficiency and conservation.

As is the case with ASEAN, one of the core projects for GMS energy cooperation is to develop an integrated regional electricity grid. Following the signing of the Intergovernmental Agreement on Power Interconnection and Trade in September 2003,

a Regional Power Trade Coordination Committee (RPTCC) was established with the first meeting held in 2004. Whilst significant progress continues to be made to connect national grids, this has tended to be on a bilateral rather than a regional basis (Zhai, 2010). As a consequence, transboundary grid connections are often tied to specific individual power plants with power purchase agreements. Although these allow for inter-state trade of electricity, such arrangements undermine the concept of an integrated regional power market (Asian Development Bank, 2013). In addition, the MOU to establish a regional power coordination centre had not been signed by all parties as of June 2013. Despite these deficiencies, the active participation of the Asian Development Bank has ensured that the programme of grid interconnection is being supported by capacity building, feasibility studies and financing.

Cooperation among such a subset of ASEAN member countries has the potential advantage that challenges and interests are more likely to be shared than across a larger grouping. The inclusion of China in a GMS regional power grid also provides the first concrete energy link between ASEAN and the northern part of the EAS region, along with the new oil and gas pipelines from Myanmar to China. Notwithstanding these limited successes, considerable differences exist between the actors in the Greater Mekong Sub-Region, not least in political culture and economic development. As a consequence of these and other factors discussed above, progress towards achieving the stated objectives has been slower than hoped (Asian Development Bank, 2013).

[41] See also http://www.eria.org/research/energy/

5. The way forward

5.1 The constraints to ASEAN energy market integration

The overall lesson from the analysis presented in this paper is simple. The general political and economic constraints on ASEAN integration (see section 2) are exacerbated by factors specific to the energy sector (see section 3), and together these act to constrain the progress towards energy market integration. Concerted collective action is generally limited to activities where the costs to the individual governments are either negligible or do not outweigh the short-term benefits. Such costs may be political or economic. Self-evidently, a supply of external funding can ease participation in certain circumstances. But such funding will be restricted to public sources unless there are profits to be made. In the meantime, the preference of member states appears to be for bilateral initiatives either with other member states or with states outsides ASEAN.

In the vocabulary of international relations, the core of the problem lies in the tension between the neo-realist outlook of many national governments and the neo-liberal aspirations and rhetoric of ASEAN energy market integration.

In the vocabulary of economics, tensions exists between the liberal market ideology that underpins the concept of energy market integration and the state capitalist or state corporatist approach of many ASEAN governments to the governance of their energy sectors. With respect to the latter, the interests of the national governments and the interests of the state-owned energy enterprises are of critical importance.

Relevant state interests include reluctance to pool sovereignty or to delegate authority to a regional supranational organ, coupled with the view that energy is a national security matter.

The state control over and ownership of the energy sector may be part of the political ideology. Such control also allows the government to use the energy sector to support other policies relating to industrialisation, employment, the redistribution of rents and social equity (through subsidised energy prices). There may also be a preference for enhancing the degree of self-reliance in energy supply rather than relying on imports. In some ASEAN countries, these state priorities outweigh the incentives for energy market integration.

The state-owned energy enterprises, both national oil companies and energy utilities, form a core part of this policy approach. But these enterprises have their own interests and in many countries they have the power to obstruct moves by the government to reform the sector.

These issues relating to state interests and to state-owned energy enterprises are not restricted to ASEAN member states, but prevail in all countries where the state has dominated the energy sector.

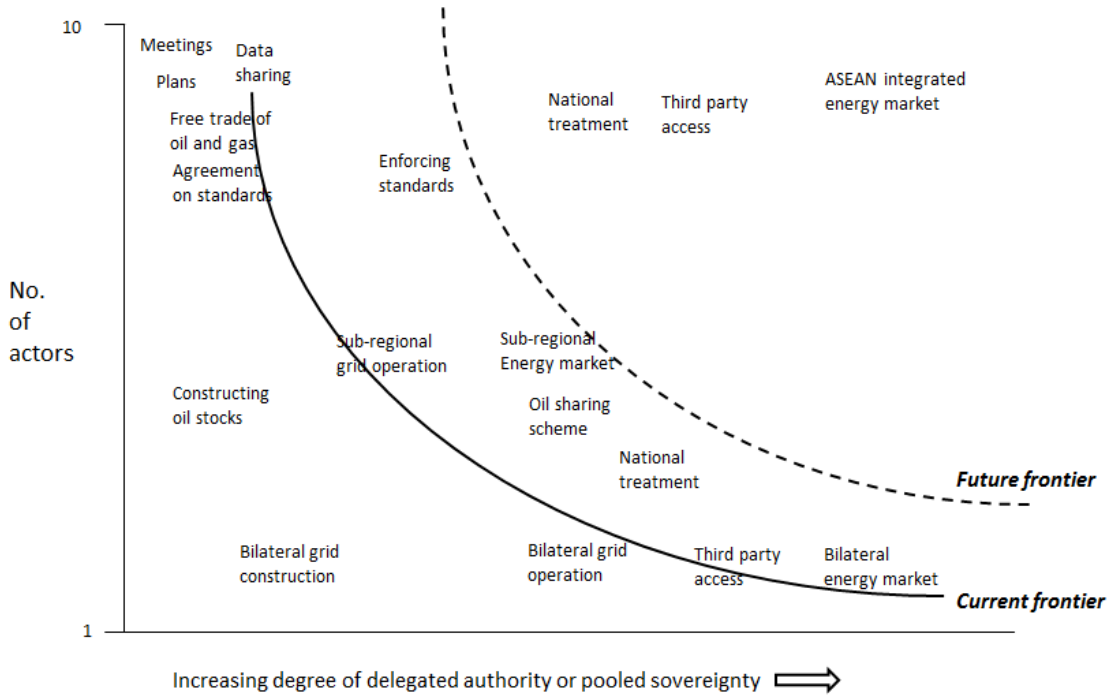
5.2 Looking ahead

The analysis presented in this paper and in previous AEMI background papers (e.g. Andrews-Speed and Hezri, 2013; Navarro and Sambodo, 2013) allows us to address two different sets of questions:

1. To identify which elements of ASEAN energy market integration should be feasible in the current political and economic situation, and then to rank further elements in order of difficulty and importance;
2. To identify what political, economic and institutional changes may be required within member countries and within the organisation of ASEAN itself in order to allow the more difficult elements to be provided.

We have conceptualised these two concerns in a single diagram which takes its approach from the diagrammatic tool of production possibility frontier theory. In the diagram (Fig. 2), the vertical axis shows the number of actors (governments) that are required to provide a given element of energy market integration and the horizontal axis shows in very general terms the degree of pooled sovereignty or delegated authority needed to provide a particular element of energy market integration.

Figure 2. Schematic representation of the current and potential future possibility frontiers elements of ASEAN energy market integration



The selection of individual elements of energy market integration shown are illustrative not comprehensive. The solid curve shows the possibility frontier today, whilst the dashed curve shows the possibility frontier at some time in the future. Those elements which lie to the left of or below

the solid curve are in place today or should be possible today. Those elements which lie to the right or above the solid curve are judged to be too difficult today, and the further they lie to the right or above the curve, the more difficult we judge them to be. Pure energy market integration across the whole of ASEAN will only be achieved when all elements are in place and functioning well.

The examples of market elements show in Figure 2 have been selected to illustrate a number of points:

- It is relatively easy for all ten countries to hold a conference or issue a non-binding plan.
- It is easier for a sub-set of ASEAN to cooperate than the whole group of ten.
- The trade of crude oil, oil products and gas between ASEAN member states will soon be free of tariffs, but the trade through networks of these energy products and of electricity is severely constrained by the shortage of network infrastructure.
- It is relatively easy for a group of 2 or 3 neighbouring countries to construct a transboundary network, but it becomes progressively more difficult to (1) jointly operate the network efficiently and safely, and (2) to create an integrated energy market around that network.
- It is easy for a small number of countries to individually build strategic oil stocks, but it is much more difficult to create and implement an oil sharing scheme.

The main challenge is to move the possibility frontier to the right in order to allow more elements of energy market integration to be implemented. In some countries a combination of low level of economic development, limited energy infrastructure, shortage of funds and weak governance capacity are important constraints on their ability to participate in some elements of energy market integration. But the more intractable constraints are to be found in the political economy factors summarised in section 5.1 of this paper – namely the priorities and perspectives of national governments and the influence and interests of state-owned energy enterprises. These factors constrain the willingness and ability of governments to undertake significant reform of their energy industries and liberalisation of their domestic energy markets and of energy prices, prerequisites for substantial energy market integration to proceed.

Whilst the full privatisation of energy industries and the full liberalisation of energy markets are unrealistic objectives for most ASEAN countries in the next 10-20 years, steps can be taken to increase the flow of energy investment, commodities and services across the region.

Policy directions for the future:

- Continue with the design and implementation of those elements of market integration across ASEAN which need little or no pooling of sovereignty or delegation of authority, for example: sharing of energy data and best practice, capacity building, constructing cross-border infrastructure, and promoting free trade in oil, gas and coal.
- Encourage “Two plus X” actions to implement elements which require significant pooling of sovereignty or delegation of authority. The membership of each can vary depending on

the element of the market being addressed. These small groupings can then be enlarged as and when other member states are ready to join. Such groups will need to be able to agree and adhere to technical and regulatory standards, among other requirements, and to have trust in the other parties in the group.

- Continue to build understanding of the need for and benefits to be derived from energy market integration in order to move the possibility frontier to the right, particularly for trade, investment and infrastructure.

In order to pursue these policy approaches it will be necessary for ASEAN to enhance its central capacity for research, technical support and administration (Andrews-Speed and Hezri, 2013).

5.3 Directions for future research

Future research could focus on:

1. Improving our empirical understanding of the political economy constraints to energy market integration in ASEAN;
2. Drawing more detailed lessons from other examples of regional energy market integration;
3. Applying a selection of theoretical frameworks to interpret (1) and (2) and to develop a more sophisticated road map for ASEAN energy market integration.

6. Summary and conclusions

Forty six years of conscious effort by ASEAN member states to enhance regional security, to promote economic development and to build a sense of regional identity have met with a significant degree of success despite many obstacles. Despite this important achievement, ASEAN has fallen short of expectations in a number of ways. It shown the ability to manage or diffuse disputes but not to resolve them. Its capacity for building institutions remains weak and the implementation of policy initiatives is generally slow, except at times of crisis. In particular, the reluctance of member states to pool sovereignty or to delegate authority has hampered the development of multi-lateral binding agreements and the formation of an authoritative supranational agency. As a result, progress towards the achievement of specific integration programmes such as AEC is much slower than hoped for.

Energy market integration is a process through which a range of infrastructure and services relating to energy are provided across a region through collective action. The aims of such integration are not limited to enhancing economic efficiency but include the delivery of external benefits which have the nature of a regional public good. Collective action to deliver a regional public good requires a convergence of interests and a high degree of trust between different actors.

The general political and economic constraints to ASEAN integration are exacerbated by factors specific to the energy sector, such as the role of state-owned energy companies, energy subsidies and the treatment of energy as national security issue. To date, concerted collective action relating to energy has generally limited to activities where the costs to the individual governments are either negligible or do not outweigh the short-term benefits. Such costs may be political or economic. Self-evidently, a supply of external funding can ease participation in certain circumstances. But such funding will be restricted to public sources unless there are profits to be made. In the meantime, the preference of member states appears to be for bilateral initiatives either with other member states or with states outsides ASEAN.

In order to move forward with energy market integration, ASEAN needs to undertake two separate sets of tasks. The first is to identify which elements of ASEAN energy market integration should be feasible in the current political and economic situation, and then to rank further elements in order of difficulty and importance. The second, and more important, is to identify what political, economic and institutional changes may be required within member countries and within the organisation of ASEAN itself in order to allow the more difficult and important elements of energy market integration to be provided.

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