EXECUTIVE SUMMARY

1. Background and Objectives

Since the inception in 2005 of the EAS ECTF Workstream on Energy Market Integration, the research has been actively promoted by East Asia Governments to better understand matters impacting on energy trade liberalization and investment, energy infrastructure, pricing reform, and deregulation of domestic energy markets.

For each EMI study, a theme is selected to provide a key focus for the study. Past EMI studies focused on the review on the regional commitment of EAS countries, the benefits from EMI, the electricity market, theories, and subsidies. The EMI 2012-13 study focuses on renewable energy (RE), particularly the deployment of the RE into the electricity grid. The objectives for EMI 2012-13 are to (i) contribute to debate on the role of RE in EMI; (ii) deepen understanding for RE penetration into electricity systems; (iii) investigate the trade barriers for RE Technologies and Commodities (RETCs); and (iv) analyze price mechanisms and impacts of fossil fuel subsidies.

For EMI 2012-13, the following topics were studied:

1. Trends and prospects for the renewable energy sector in the EAS region;
2. The integrated Nordic power market and the deployment of renewable energy technologies: Key lessons and potential implication for future EAS integrated power market;
3. Renewable energy integration in a liberalized electricity market: A New Zealand case study;
4. Toward an integrated renewable energy market in the EAS region: Renewable energy equipment trade, market barriers and drivers;
5. Renewable energy and policy options in an integrated EAS electricity market: Quantitative assessment and policy implications;
6. Facilitating the penetration of renewable energy into the power system;
7. Renewable energy development in Cambodia: Status, prospects and policies;
8. Implications of cash transfers of subsidies in the energy sector in India
9. International oil price, national market distortion and output growth: Theory and evidence from China;

10. Economic growth, regional disparities and energy demand in China: Implication for energy market integration in East Asia.

2. Key Findings

The studies found that future growth in RE in EAS countries will come from wind, solar and biofuel products, which are becoming competitive with fossil fuels due to technological breakthrough and the falling costs of RE production. In the EAS region, there is also potential for growth in geothermal power and hydropower, especially involving the hydro resources in the relatively less-developed economies such as Cambodia, Myanmar and the Laos.

EAS countries will follow a development trajectory where larger shares of variable RE will play greater role in the electricity generation mix. However, the studies found that RE electricity production is variable and uncertain, thus posing a greater challenge for RE penetration. There is a need to improve our understanding of the economics of deployment of RE electricity technologies, particularly the cost and benefits associated with the integration of renewables in the longer term and from a system perspective.

The Nordic/Europe region has, for many years, been developing and integrating their electricity (and gas) market. From the outset, functioning market institutions are a pre-requisite for an electricity market when there is a number of countries and diversity across their generation mix, their renewable energy technologies (RET) policies, and the ownership of production. In the Nordic example, the market institution combines the role of regulation, TSO and spot pool, and, this institution has provided the foundation for a well-functioning power exchange, smooth interaction with the neighbouring European power markets, and adequate levels of information and transparency in the exchange market.

Over the years, many lessons have been learnt by the Nordic market that will have parallels and will provide options that could mesh with the aspirations of the EAS region to integrate its national markets. For the Nordic region in particular, this includes the integration of RE options into their regional electricity market. The Nordic experience found that decisive policy support (in particular to overcome cost

barriers) has been essential for the development of RE sources and the deployment of renewable energy technologies (RETs) for power generation. Within this context, Feed-In Tariffs (FiT) have proven to be one of the effective support mechanisms to overcoming cost barriers and reduce financial uncertainty for the wholesale power market. In addition, indirect policy support such as carbon pricing and reduction targets for GHG emissions have also promoted a much better investment climate for RETs. Within this institutional framework and policy support, the studies also found that regional power infrastructure development has laid the foundation for power trade within the Nordic and with European neighbours.

The finding from New Zealand's case study also confirmed that FiT have been effective in supporting RE power generation projects to cope with high set-up costs and high connection costs. Carbon trading has been established under the Climate Change Response (Emissions Trading) Amendment Act 2008 and the Electricity (Renewable Preference) Amendment Act 2008: this legislation enables the RE electricity generators to effectively price the cost of carbon into the price of electricity, and thus attract investment into RE generation.

While progress has been made on increasing RE in the electricity mix in the EAS region, some countries lag behind due to trade and non-trade barriers on the deployment and utilization of the RETs and end-user appliances. One of the studies analyses the prospects of an integrated RE market in the EAS region from the vantage point of trade in Renewable Energy, Technologies and Commodities (RETC) and the, associated market barriers and major drivers. It found that the EAS region has huge potential for RETC trade which will eventually pave the way for enhanced RE use. Despite this potential, factors such as the current high tariff rates inhibit the growth of RETC trade in the region (see Table 1).

Table 1: Import Tariff Rates on RETC in the EAS Countries

Country	Tariff (%)	Country	Tariff (%)
Australia	0.8	Malaysia	4.8
Brunei Darussalam	11.7	Myanmar	1.8
Cambodia	12.5	New Zealand	1.4
China	8.5	Philippines	4.5
India	9.4	Russian Federation	11.4
Indonesia	2.6	Singapore	0.0
Japan	0.7	Thailand	6.2
Republic of Korea	6.8	United States	2.1
Lao PDR	6.7	Vietnam	6.2

Source: WTO Integrated Trade Database 2013.

Targeting the electricity mix with RETs is seen as a clear step toward abatement of GHG emissions and thus contribute to regional 'green growth'. One of the studies uses economic simulation to test the best options for FiT policy and Renewable Portfolio Standards (RPS). A Renewable Portfolio Standard is a regulation that requires the increased production of energy from renewable energy sources, such as wind, solar, biomass, and geothermal. For RPS, the study tests what percentage of RE in the total electricity supply is most cost-effective. For FIT, it tests the level of the FIT that is the optimum to ensuring RE investment and minimising the consumer burden. See Table 2 for key assumptions/parameters of the scenarios.

Table 2: Key Assumptions/parameters of the Scenarios

Scenario	Description
BAU (No Carbon Costs or EMI)	Business-As-Usual (BAU) with no carbon costs1 or EMI imposed on the power sector
BAUCC (Carbon Costs with No EMI)	This scenario assumes that carbon costs are imposed on power generation but the region has no effective EMI to allow free cross-border power trade
BAUCCEMI (Carbon Costs with EMI)	Both carbon costs and EMI are implemented in the power sector of the region
FIT10	USD 10 / MWh of subsidy provided to electricity generated from renewable energy
FIT20	USD 20 / MWh of subsidy provided to electricity generated from renewable energy
FIT30	USD 30 / MWh of subsidy provided to electricity generated from renewable energy
FIT40	USD 40 / MWh of subsidy provided to electricity generated from renewable energy
FIT50	USD 50 / MWh of subsidy provided to electricity generated from renewable energy
RPS10	The share of renewable energy in total electricity is required to be above 10%
RPS20	The share of renewable energy in total electricity is required to be above 20%
RPS30	The share of renewable energy in total electricity is required to be above 30%
RPS40	The share of renewable energy in total electricity is required to be above 40%
RPS50	The share of renewable energy in total electricity is required to be above 50%
RPS60	The share of renewable energy in total electricity is required to be above 60%
RPS70	The share of renewable energy in total electricity is required to be above 70%
RPS30 by 2030	The share of renewable energy in total electricity is required to be above 30% from 2030 onwards
FIT10 RPS10	A Combination of FIT10 and RPS10

[1] Carbon costs usually come from Cap-and-Trade schemes for carbon emissions from specified sectors. Although ASEAN has no such scheme at the moment, carbon costs from other markets such as the Europe and U.S. could be applied to reflect the environmental cost of carbon emissions from power generation activities. Importantly, as our model is a sector model, it is not possible to endogenize carbon costs which are derived from multi-sector markets.

The results of the simulation show that, under the BAU scenario, RE will make moderate progress in the region, mostly driven by hydropower. The results also suggested that the costs-benefits optimization of implementing RPS30 by 2030 could be a low-hanging fruit to achieve moderate improvements in carbon emissions reduction and RE development while incurring negligible increases in the total cost of electricity.

A similar study has carried out using "trilogy approaches" to analyze the RE penetration into a power system. The first approach analyses the Diversity Index which has often been used by policy makers to understand the energy mix or degree of energy self-reliance. The second approach analyses the historical long term energy mix by employing the Autoregressive Moving Average (ARMA) model. The third approach analyses structure of electricity output by sources by using Markov Model (MM) for policy scenario analysis. The results of this study found that the shares of electricity production in EAS countries from renewable sources are still relatively low, except in the Philippine and New Zealand cases (see Table 3).

Table 3: Electricity Production by Sources (% of total)

No	**Country**	**Oil**		**Coal**		**Natural gas**		**Renewable sources, excluding hydroelectric***	
		1971	2009	1971	2009	1971	2009	1990	2009
1	Brunei Darussalam	1.6	1.0	NA	0.0	98.4	99.0	0.0	0.0
2	Cambodia	NA	95.6	NA	0.0	NA	0.0	NA	0.5
3	Indonesia	56.0	22.8	NA	41.8	0.0	22.1	3.4	6.0
4	Lao PDR	NA	NA	NA	NA	NA	NA	NA	NA
5	Malaysia	72.4	2.0	NA	30.9	0.0	60.7	0.0	0.0
6	Myanmar	23.2	8.9	3.9	0.0	3.9	19.6	0.0	0.0
7	Philippines	99.9	8.7	0.1	26.6	0.0	32.1	22.4	16.8
8	Singapore	100.0	18.8	NA	0.0	0.0	81.0	0.0	0.1
9	Thailand	53.6	0.5	6.1	19.9	0.0	70.7	0.0	4.0
10	Vietnam	0.0	2.5	73.3	18.0	0.0	43.4	0.0	0.0
11	Australia	3.4	1.0	71.0	77.9	3.3	13.7	0.5	2.6
12	China	7.9	0.4	70.5	78.8	0.0	1.4	0.0	0.8
13	India	6.3	2.9	49.1	68.6	0.6	12.4	0.0	2.2
14	Japan	62.6	7.2	11.9	26.8	1.4	27.4	1.4	2.5
15	Korea, Rep.	80.6	4.4	6.9	46.2	0.0	15.6	0.0	0.4
16	New Zealand	2.0	0.0	4.8	7.6	0.3	20.6	8.2	15.9

Note: *includes geothermal, solar, tides, wind, biomass, and biofuels. NA is not available.
Source: World Development Indicators, the World Bank.

Although RE has been promoted among the EAS countries, the diversity index indicates that electricity production from fossil fuel has grown much faster than RE electricity production. The primary energy mix in electricity generation has become less diverse because some EAS countries continue to intensify their use of coal-firing. The ARMA model and Markov model also confirmed that the share of RE (excluding hydropower) will increase marginally and most EAS countries will continue to rely on the fossil fuels for electricity generation. Facilitating the penetration of RE needs to be urgently discussed among EAS members.

To understand the potential for RE in a developing economy in the EAS, a case study of Cambodia was undertaken. Cambodia's RE resource has a substantial potential to contribute to national economic development and environmental sustainability. However, RE is not widely known to Cambodia's policy makers, implementers, and population. In addition, high expectations for developing Cambodia's large-scale hydropower projects and for imports from neighbouring countries may prompt the Cambodia Government to overlook the development of other RE resources. Few of Cambodia's potential RE resources have been developed to meet the immense electricity needs of the country, particularly for off-grid electricity, and to assist with Cambodia's electrification rate. Non-hydro RE resources in Cambodia, essentially biomass and solar, has the potential to expand electricity access for rural and remote areas and to bring down the cost of supplying electricity to these populations. The study also found that a developing economy will need institutional capacity building and a policy framework to disseminate RE technologies and promote such investment.

Throughout the EMI studies, evidence found that energy subsidies are widespread in EAS countries, and they vary greatly in their form and level of support. India's case study on energy subsidies through its Direct Cash Transfer Scheme (DCT) has aided our understanding of the approaches taken by the Government of India (GoI) to ensure that affordable energy commodities and services are available to lower income households. This approach is moving away from general subsidies to an approach more targeted to the economic poor. India provides major subsidies to the household, agriculture, industry, health, education and transportation sectors, and, for the last couple of years, the total subsidy provided

by the GoI has been between 2-3 percent of GDP. The target is to contain this below 1.75 percent of the GDP in the next three years. This study suggests that continuation of these subsidies may not be possible due to the limits on domestic production of oil and gas, the rising cost of energy commodities, and the GoI's burgeoning fiscal deficit. Theoretically, any form of fossil-fuel subsidy will undermine RE development. However, the GOI has chosen the DCT Scheme as a step-wise approach to reduce the financial burden on the Government compared to the general subsidies of the past. The actual implementation of the DCT Scheme remains to be seen.

Pricing mechanisms remain a central discussion to EMI. Price regulation in the energy market, such as price caps and subsidies, has been practiced for a long time and is still prevailing in many EAS countries. Many policy makers prefer to have such price regulation on the grounds that these measures can insulate a domestic economy from the negative impacts of high global oil prices. However, many studies have found that the induced distortion may exert negative impacts. Contributing to this debate is the EMI study of oil price shocks, market distortion and output growth in China. This study found that oil price distortion hurts industrial growth in the short run and that this negative impact persists in the long run. Thus, price control is one important barrier to energy market integration and the finding of this study lends support to the energy market integration that many regions, such as East Asia, are advocating.

East Asia is actively promoting energy market integration (EMI), but such integration takes a long time and there is no clear picture as to its future shape. Contributing to this debate, the study on economic growth, regional disparities and energy demand in China attempts to explore a possible shape of an integrated energy market for East Asia by analyzing China's cross-province energy demand under a perfectly integrated energy market. Using the panel data of 30 provinces between 1978 and 2008, the study found that economic development tends to increase demand for energy, while EMI will, in general, reduce the response of price to the increased energy demand through cross-province trade in energy products. In addition, the effects of commodity price increases can be alleviated through reducing transportation costs and improving marketisation levels by privatization and

deregulation. The findings of this study have important policy implications that suggest that EMI is beneficial to the EAS region through facilitating diversified energy demand/supply patterns across countries.

3. Policy Recommendations

The findings of the studies of the EMI study 2012-13 provide policy and recommendations for EAS countries and, to some extent, reflects implications for future ASEAN market integration.

Recommendation 1. ***Fostering EAS's RE aspirations and deployment targets***.

EAS countries are strengthening the sharing of common goals on poverty alleviation, energy security, energy access, investment, and trade, which are substantially covered in bilateral/multilateral ASEAN agreements. These are important elements to fostering energy market integration among neighbouring EAS countries. As an early step towards EMI and RE deployment, EAS members could also develop RE deployment goals for each country within a target period that reflects the reality in each member's economy. EAS could tap the experience of the Nordic/Europe which suggests that RETs do not fit into current electricity market structures without their deliberate and positive support. Therefore, it is suggested that EAS countries should consider and evaluate regionally supported and harmonised policy options such as

- the development of clear but simple institutional framework of RE policy instruments (e.g. Feed-in-Tariff, tradable green certificate scheme) because it has a direct impact on the administrative burden faced by authorities and eligible actors;
- feed-in-tariffs combined with renewable portfolio standards (complemented with GHG pricing);
- tradable green certificates (complemented with GHG pricing);
- tax credits for R&D and production-based (per-kWh tax credits), and soft loans;

- the development of a long-term EAS multilateral finance model/fund(s), which aligns private and public sector investment (including regional development banks) to support low carbon infrastructure investment;
- a legal and enforceable framework that provides investors the assurance to invest in RE power infrastructure, new production, and storage options.

Recommendation 2. ***Establishment of the framework for a regional regulatory and power trading body for integrating a regional power system***. It will be necessary to set up a regional electricity regulatory and trading institution which is exclusively responsible for the promotion, harmonisation, implementation and enforcement of policies and regulations for an integrated power market and for RETs within that market. Key functions of a regulatory and trading institution include administering and enforcing power market regulation, accurate and high-quality information, equal access for all market participants, and guarantee of all trades and their delivery. Importantly, it could also provide a forum for regional coordination and cooperation across EAS governments in RE policies, investment, and technologies. The regional integration of EAS electricity markets, with RE as a key part of the electricity generation mix, may benefit from Nordic experience in their establishment of a regional regulatory and power trading institution.

Given the geographical spread of EAS countries, this recommendation is more immediately pertinent for ASEAN member countries. ASEAN countries should assess whether the current ASEAN Power Grid (APG) initiative and other ASEAN platforms such as the ASEAN Energy Regulators Network, which have the commitment of ASEAN Heads of States/Governments, could be the starting point for a functioning market institution as seen in the Nordic/Europe. Taking into account the relatively early stages of energy market integration in the ASEAN region, continuous and decisive political decisions will be crucial to developing an effective framework for the institution.

Recommendation 3. ***Removal of trade barriers on RE Technologies and Commodities (RETCs) is key to promoting utilisation of RE products and to supporting investment in RE technologies.*** Fostering the implementation of a "free trade" in goods and services of RE Technologies and Commodities (RETC) across EAS countries will reduce costs on RETC by the removal or reduction of import tariffs. This will also help address the problem of asymmetric technological development particularly in the smaller EAS economies. To support investment consideration into RETC in EAS countries, a proper analysis on the cash-flow is required. If the EMM so decides, ERIA is available to undertake a detailed cash-flow analysis on RETC investment.

Recommendation 4. ***Harmonisation and standardisation of RE technologies and products is necessary in an integrated regional market***. The Governments of EAS countries have a window of opportunity under the ASEAN "free trade agreement" and other trade facilities to review RE products and come up with "minimum operating standards". RETs are relatively new products in most EAS members, and EAS members will need to adopt common standards and practices. This is a prerequisite for EMI, and EAS countries may explore the best practices regionally and globally before developing a regional approach. If EMM so decides, ERIA is available to lend support into this further study.

Recommendation 5. ***Cross-border power infrastructure connectivity is necessary for an integrated power market that brings RE into the regional electricity mix***. The Nordic/Europe experience points to the implementation of the ASEAN Power Grid initiatives and interconnection with southern China as the starting point for a regional integrated power market. The Nordic integrated power market has been developed from separate national markets to a cross-border pan-regional trading market that heavily utilises RE power generation. An EAS regional market will develop at a different but gradual

pace, initially forming sub-markets (e.g. country-to-country market coupling, followed by sub-regional market coupling), on the road towards wider regional integration. Here, the coordination of the involved EAS Governments and industry is crucial. The Nordic countries' and the European Union's legal developments have provided the guiding regulatory framework that has harmonized the practices across the European electricity markets to enable their interconnection. Similar attention will be required by EAS countries and further analysis and information gathering on the Nordic/European experience would be useful for EAS consideration. ERIA is available to further support this analysis.

Recommendation 6. ***Institutional capacity building and development of financing mechanisms in RE are key to reducing the lead time for RE deployment***. Recognising each EAS country's level of development, study findings point to EAS countries requiring institutional capacity building and development of financial mechanisms to make RE deployment a possibility. Consequently, financial cooperation and capacity development amongst EAS countries are policy priorities to support developing member countries to embark on RE development. The New Zealand case study on policy support incentives for RE deployment highlighted similar experiences to the Nordic/Europe region, and these provide lessons and successes that could be replicated or tailored-to the EAS context.

Recommendation 7. ***Removal of fossil fuel subsidies is key to initiating green development***. The Governments of EAS countries will need to review their national fossil fuel subsidies. The India case study pointed to a win-win policy reform by removing subsidies that are both economically costly and leading to greater fossil-fuel use. India has moved away from a general subsidy toward one that is more targeted to the economically poor population to ensure their welfare and access to energy.

Recommendation 8. ***EAS countries shall speed up the implementation of the Energy Market Integration as it provides benefits to economies at large***. EMI studies highlighted the issue that, while economic development tends to increase energy demand, EMI, in general, reduces the response of prices to the increased energy demand. This important finding suggests that EMI would benefit the EAS region through facilitating a diversified energy trade pattern across member countries.