Chapter 1

Overview Report: Review of Initiatives Towards and Estimated Benefits from Integrating Energy Market in the East Asia Summit Region

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OVERVIEW REPORT

REVIEW OF INITIATIVES TOWARDS AND ESTIMATED BENEFITS FROM INTEGRATING ENERGY MARKET IN THE EAST ASIA SUMMIT REGION

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ABSTRACT

This study reviews the current status of, and policy initiatives towards, energy market integration (EMI) in the East Asian Summit (EAS) region with focuses on five policy issues: trade liberalization, investment liberalization, cross border linkage of energy infrastructure, energy pricing reform, and liberalization of domestic energy markets. It also attempts to demonstrate the economic and environmental impacts of these five policy initiatives. Three policy initiatives are successfully estimated and results are modestly encouraging. The study finds that general trade and investment liberalization has been covered in the existing bilateral/multilateral free trade agreements; ongoing and proposed energy infrastructure projects have been limited to the ASEAN plus China region, and much more work towards energy market integration is needed at the national level. Based on this survey and estimation, policy implications are offered.

Key Words: Energy, Market Integration, East Asia Summit

1. INTRODUCTION

Energy cooperation in the EAS has great potential for capturing many opportunities and advantages. Australia, New Zealand, Japan and South Korea are leading countries in energy, and thus could cooperate with China and ASEAN countries in technologies, management and regulatory frameworks. Australia is also important to the EAS region for its endowment of energy resources, including coal, natural gas (distributed as Liquefied Natural Gas (LNG) and uranium, which can help secure the energy supplies of other EAS countries. Brunei, Indonesia, Malaysia and Vietnam have large potentials in oil and gas and thus can provide opportunity for technology transfer and investment from the Plus Six countries (Australia, China, Japan, Korea, India, and New Zealand). The refinery capacities in South Korea and Singapore, and the oil storage capacity in Japan, can provide further benefits with more integration. ASEAN plays an important role in the security of energy supply for major oil importers, such as China, Korea and Japan. More integration with ASEAN can improve the security of energy for the EAS region at large.

Energy Market Integration (EMI) for the entire East Asian region has been proposed in the past decade or so with the emergence of cooperation frameworks between ASEAN and its dialogue partners. Considerable progress in these ASEAN energy cooperation and related areas had been made as a result of cooperation achieved through the ASEAN plus Three (APT) process and, from 2005, through the EAS process. Under the EAS framework, there is an annual meeting of Energy Ministers and periodical meetings of the Energy Cooperation Task Force (ECTF), which was established by EAS in 2007. One of the three work streams under ECTF is EMI.

In the First Energy Ministers' Meeting (EMM), the Ministers launched a study to examine the status of energy markets and explore policies and measures to develop an integrated EAS energy market (ASEAN website, 2007b). The phase 1 of the Energy Market Integration (EMI) project was conducted by Australian consultants, funded by AusAID. It involved a study to identify trade and investment barriers and determine

opportunities for progressing improved energy trade linkages and trade promotion in the EAS region. The EMI Phase 1 report on "Energy Market Integration in the East Asia Summit Region" (Bannister et al., 2008), including the completion of 16 country reports was welcomed by Energy Ministers at their second meeting, but the study was not continued. In the third EMM, Economic Research Institute for ASEAN and East Asia (ERIA) committed to take over the EMI study and started phase two for the 2009/10 financial year.

For the Phase 2 study, Singapore and Australia, as chair and co-chair of the ECTF EMI work stream, asked ERIA to estimate the potential economic benefits for the EAS region from the removal of trade and investment barriers and to review existing initiatives for enhancing energy market integration in the EAS region. In addition to the two requested issues, three other issues have also been studied by the team, namely physical linkage of energy infrastructure, that is, gas pipelines (including LNG terminals) and power grids, liberalization of domestic energy markets, and energy pricing reform, in particular, removal of fossil fuel energy subsidies.

Selection of these issues was based on our understanding of overall EMI in this region. A well-functioning and transparent national market is essential to develop an open, competitive and more integrated EAS regional energy market. To increase the efficiency of energy markets, it is necessary to remove impediments and distortions that prevent the efficient functioning of the market. This will include, but not be limited to, encouraging trade and investment liberalization and the reduction or removal of barriers, such as price restrictions, subsidies and monopolies. Physical linkage of energy infrastructure, which can optimize energy use and improve security of supply, is also a basic issue in the study of EMI as a concept. It is needed to facilitate trade, attract investment and reduce friction costs among markets.

Deepening EMI must take into account national economic, social and political circumstances. Open access of energy infrastructure is a prerequisite for market integration as otherwise there will be monopoly and thus limitation of competition. To make it possible for new investors to enter into energy markets, it is important to liberalize domestic energy markets. The energy industry is often monopolized and vertically integrated. For example, in many EAS countries, there is only one electricity company, which is often state-owned. In such cases, there will be no chance

for new investors, private or foreign, to enter the market and thus the electricity market will be segmented by national boundary. To promote 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. In the case of electricity supply, for example, the sector could be split into generation, transmission and retailing. The transmission sector is a "natural monopoly", and therefore it is not economically viable to bring new transmission systems. But it can promote competition by allowing open access for any investors.

EMI documented in the literature is challenging. Although having over many years worked to encourage EMI between its member countries, the European energy markets are still highly concentrated with low competition, lacking cross-border integration and having insufficient price transparency. In early 2007, the European Commission decided to form a common European energy policy to facilitate the establishment of a single and competitive internal pan-European market (EU Website, 2007). The Nordic electricity market was one of the first international electricity markets in the world and has become a well-functioning multi-national electricity market (Nordic Energy Research Website, 2010). The reform toward a single and competitive national electricity market in Australia may also offer some lessons for other EAS members (Bannister *et al.*, 2008). However, a complete review of EMI in the EAS region is absent from the literature.

Turning to quantitative studies, there have been estimations of the impact of free trade agreements involving ASEAN. Park (2000) finds that ASEAN Free Trade Agreement (AFTA) will enhance intra-ASEAN trade and accelerate the economic growth of ASEAN member nations. The author concludes that economies with higher pre-FTA tariff barriers and larger intra-regional trade volumes, such as the Philippines and Thailand, share larger gains from freer trade. Lee et al. (2009) evaluate the extent of trade adjustments and other economic effects that the enlargement and redefinition of a free-trade agreement to encompass ASEAN+3 or ASEAN+6 could have on the EU and North America. Lee and Plummer (2010) investigate the effects of the ASEAN Economic Community (AEC) on economic welfare, trade flows and sectoral output. They find that streamlining customs procedures and other reductions in administrative and technical barriers, as well as increased competition and improvements in

infrastructure, would be significant in enlarging the benefits of the AEC. The only quantitative study about EMI in the EAS region was the study (Bhattacharya and Kojima, 2010) that was conducted to support this study.

This research studies the benefits and status of initiatives related to the selected issues. The next section will briefly outline the history of energy cooperation in East Asia. Section 3 reviews the current status of existing initiatives regarding the selected issues. Section 4 summarizes the economic and environmental impacts of three different initiatives in the five groups of policy by a Computable General Equilibrium (CGE). Discussions and policy implications are presented in Section 5 and the last section concludes.

2. HISTORY OF ENERGY COOPERATION IN EAST ASIA

In the EAS region, ASEAN has long pursued EMI. The first energy agreement, concluded between Thailand and the Lao PDR, was signed in 1966, one year before the first ASEAN Declaration in August 1967. After the establishment of the ASEAN Council on Petroleum (ASCOPE) in 1975, cooperation widened to include all other fuels. In 1981 the Heads of ASEAN Power Utility Authorities (HAPUA) was established for work on electricity interconnection, and in 1986 the ASEAN Energy Cooperation Agreement outlined a wide range of areas for cooperation.

The series of ASEAN Plans of Actions for Energy Cooperation (APAEC) recognized the importance of establishing an efficient, transparent, reliable and flexible energy market in the ASEAN region and of improvement of access to affordable energy to eradicate energy poverty. In July 1999 ASEAN adopted the APAEC 1999-2004 (APAEC, 1999), which, for the first time, involved the region-wide participation of all ten ASEAN countries and a sharper focus on regional energy cooperation and integration. The APAEC 2004-2009 (APAEC, 2004) specifically mentioned the integration of regional energy infrastructures, promotion of energy security and market reform and liberalization, as well as environmental sustainability. This second series

of APAEC also approved the Initiative on ASEAN Integration (IAI) designed to reduce the development gap between the new and the old ASEAN members. The third and current series of APAEC (APAEC, 2009) approved by the 27th ASEAM Meeting of Economic Ministers (AMEM), essentially maintains and continues those programs identified in AEAEC 2004-2009. The newly added program in the latest action plan is Civilian Nuclear Energy.

Currently, ASEAN member states are working toward an ASEAN single market and production base described and guided by the ASEAN Economic Community (AEC) Blueprint which was adopted at the 13th ASEAN Summit in Singapore in 2007. The AEC blueprint highlights the establishment of interconnecting arrangements towards achieving long-term security, availability and reliability of energy supply through regional cooperation in Trans-ASEAN Energy Networks comprising the Trans-ASEAN Gas Pipeline (TAGP) and the ASEAN Power Grid (APG), and proposes to promote cooperation in energy efficiency and conservation, as well as the development of new and renewable energy sources (APAEC, 1999).

Within ASEAN structures there are regular meetings of ministers in a wide range of areas devoted to pursuing common goals. Of particular relevance to the EMI is the ASEAN Ministers of Energy Meeting (AMEM). Beyond ASEAN, many institutional cooperation frameworks have emerged in East Asia under the principle of ASEAN centrality in the past decades, such as ASEAN Plus One, ASEAN Plus Three (ASEAN plus China, Japan, and Korea (APT)) and EAS. There are also regular energy ministers' meetings under these frameworks. In the APT, there is a regular meeting of energy officials and ministers, which started in 2003. The APT has adopted a 10-year Cooperation Work Plan 2007-2017 and several activities are scheduled for implementation, including in the energy area. The work program of the Senior Officials Meeting on Energy (SOME)+3/AMEM+3 include five fora on energy security, oil stockpiling, oil markets, renewable energy and energy efficiency and conservation, and natural gas and business dialogue. The work program was expanded to include cooperation on Clean Development Mechanism (CDM) and civilian nuclear energy recently, and discussions took place in the 9th SOME Plus Three in July 2010 on the possibility of merging the Energy Security forum with the Oil Stockpiling forum, and the Oil Market forum with the Natural Gas and Business Dialogue forum. However,

electricity, which plays an important role in the liberalization of national energy markets, is not included in the existing fora.

Under the EAS framework, energy cooperation is guided by the Cebu Declaration. The Cebu Declaration, published by the second EAS, outlined the potential energy challenges the region could face in the future, driven by a number of factors including: the limited global reserves of fossil energy, fluctuating world fuel oil prices, worsening energy related environmental and health issues and the urgent need to address climate change (Cebu Declaration, 2007). To deal with these issues, the EAS leaders agreed to create a working group on energy cooperation, that is the ECTF. Three work streams are established under the EAS ECTF: energy efficiency and conservation (Chaired by Japan); energy market integration (co-chaired by Singapore and Australia); and the use of bio-fuels for transport and other purposes (co-chaired by the Philippines and India).

The EAS Energy Ministers at their inaugural meeting recognized that there was significant scope for increasing intra-EAS energy trade and investments. They encouraged the establishment of efficient, transparent, reliable and flexible energy markets, which will help to provide affordable, secure and clean energy supplies for the region. Energy Ministers recognized the importance of addressing impediments to the efficient functioning of markets and supported the EAS Energy Cooperation Task Form (ECTF) work plan to promote better understanding of integrated and liberalized energy markets (ASEAN website, 2007b).

The EAS Energy Ministers at their 3rd meeting (EMM3) in July 2009 noted the importance of promoting EMI in the EAS region again and reaffirmed that the facilitation of energy trade linkages should be advanced as a priority, together with the integration of regional energy markets. The Energy Ministers noted that integration is a long term goal. So the Energy Ministers considered it appropriate that Phase 2 work should highlight the benefits of integrated markets (ASEAN Center for Energy website, 2009).

It is worthwhile to mention the financial resources that support the energy cooperation. ASEAN gets major funds for programs on coal and clean coal technology, energy efficiency and conservation (EE&C), renewable energy and regional energy policy and planning from dialogue partners, namely, the European Union, Japan, Australia, China, Korea, and India. Japan has been providing support to ASEAN

energy cooperation since the establishment in 2000 of the SOME-METI (Ministry of Economy, Trade and Industry, Japan) Consultations. There are two projects under the SOME-METI Work Program, namely: a) energy supply and security planning for the ASEAN region (ESSPA), and b) promotion of energy efficiency and conservation (PROMEEC). The implementation of ESSPA and PROMEEC started in 2000 and will still be continued in the APAEC 2010-2015. In addition, METI of Japan is also supporting the training of ASEAN energy efficiency and conservation specialists in Japan since 2005 (APAEC, 1999). To promote ASEAN-China infrastructure and inter-connectivity, China set up the US$ 10 billion China-ASEAN Investment Cooperation Fund to finance major ASEAN-China investment cooperation projects in infrastructure, energy and resources, information and communication technology and other fields (ASEAN website, 2009a).

3. STATUS AND EXITING INITIATIVES TOWARD EMI IN THE EAS REGION

Under the principle of maintaining "ASEAN Centrality", the existing regional architectures in East Asia all have the characteristics of "ASEAN plus X". Therefore, it is logical to start the review from ASEAN.

3.1. Regional Agreements on Energy Trade and Investment

Within ASEAN, AEC is the flagship program for economic integration. One important component of AEC is the establishment of a single ASEAN market by 2015. The single market should have a free flow of goods, services, and investment, and a free flow of capital, etc. Economic initiatives under the AEC blueprint include: the ASEAN Free Trade Area (AFTA), the ASEAN Framework Agreement on Services (AFAS) and the ASEAN Investment Area (AIA) (Bali Concord II, 2003). Under AIA, all industries shall be open and national treatment will be granted to investors. The ASEAN Comprehensive Investment Agreement (ACIA) is expected to build on and

enhance the existing AIA agreement and the ASEAN Agreement on the Promotion and Protection of Investments (IGA).

Beyond its own area, ASEAN has conducted negotiations for free trade (FTAs) and comprehensive economic partnership agreements (CEPAs) with many dialogue partners, including the "plus six" countries (Table 1). All FTAs/CEPAs between ASEAN and "Plus Three" cover trade in goods, trade in services, investment, and other areas of economic cooperation (ASEAN website, 2009b). The ASEAN-Australia-New Zealand Free Trade Agreement, which covers trade in goods and services (including financial services and telecommunications), investment, electronic commerce, movement of people, intellectual property, competition policy and economic cooperation, is the single most comprehensive economic agreement entered into by ASEAN to date (ASEAN website, 2010). The ASEAN-India Trade in Goods Agreement and other free trade agreements was signed on 13 August 2009 while the negotiations for services and investment are ongoing (ASEAN website, 2009c). For the ASEAN Plus Three (APT) together, Phase II of the East Asian FTA (EAFTA) Study has been finalized by the Experts Group. The Study aims to examine the key elements of market access for goods, services and investment as well as trade facilitation cooperation with a view to identifying some possible options for such a FTA.

Table 1 FTA/CEP Agreements Between ASEAN and Dialogue Partners

Agreement	Date of Sign	Date of Implementation
Framework Agreement on Comprehensive Economic Cooperation between ASEAN and China	November 2002	To establish the ASEAN-China Free Trade Area (ACFTA) in 2010 for ASEAN-6 and China, and 2015 for CLMV.
Agreement on Trade in Goods	2004	Implemented since July 2005
Investment Agreement	August 2009	
ASEAN-Japan Comprehensive Economic Partnership (AJCEP)	April 2008	Goods, trade in services, investment and economic cooperation. Entered into force on 1 December 2008. As of July 2009, Brunei Darussalam, Lao PDR, Malaysia, Myanmar, Singapore, Thailand, Viet Nam and Japan have ratified the Agreement.
Framework Agreement on Comprehensive Economic Cooperation between ASEAN and ROK	13 December 2005	Targeting for an ASEAN-ROK Free Trade Area by the year 2008 (with flexibility to 2010) for ROK, 2010 (with flexibility to 2012) for ASEAN-6, 2016 for Viet Nam and 2018 for CLM
The Agreement on Trade in Goods with ROK	August 2006, except Thailand, which signed in February 2009	Implemented since 1 June 2007
The ASEAN-ROK Investment Agreement	June 2009	
ASEAN-India Framework Agreement on Comprehensive Economic Cooperation	At the 2nd ASEAN-India Summit in 2003.	Targeting for the establishment of an ASEAN-India Regional Trade and Investment Area (RTIA), which includes FTA in goods, services, and investment.
ASEAN-India Trade in Goods (TIG) Agreement	13 August 2009	entered into force on 1 January 2010

	ASEAN-India Investment Agreements	Being processing	
ASEAN-Australia-New Zealand Free Trade Area (AANZFTA)		27 February 2009.	Entered into force on 1 January 2010 and is now being implemented by all Parties, except Cambodia, Indonesia and Lao PDR

Source: Compiled from ASEAN External Relations (ASEC, 2010).

Bilateral FTAs between individual ASEAN member country and ASEAN dialogue countries have been moved forward as well. Singapore has FTAs with all six countries. China-Singapore FTA and Japan-Viet Nam EPA was signed in October and December 2008, respectively. Malaysia-New Zeland FTA was concluded in May 2009 (CEPEA Track II Study Group, 2009).

Bilateral FTAs among the ASEAN dialogue partners are largely under negotiation. While there are nine FTAs under negotiations or implementation, only New Zealand has implemented FTAs with Australia and China. Noticeably, as a major player, Chinas has not started negotiation of FTAs with India, Japan and South Korea; India, has kicked off the FTA negotiation with Japan and South Korea while has no progress with Australia, New Zealand, and China; and South Korea are negotiating FTAs with four other ASEAN dialogue partners with China as an exception. A brief summary status of FTA/EPAs in the EAS region can be found in Table 2.

Table 2 Status of FTA/EPAs in the EAS region

	Australia	China	India	Japan	New Zealand	South Korea	ASEAN
Australia		□		□	●	□	●
China	□				●		●
India				□		□	●
Japan	□		□			□	●
New Zeland	●	●				□	●
South Korea	□		□	□	□		●
ASEAN							

Note: ●: FTA singed/concluded; □: under negotiation

Source: Phase II Report of the Track Two Study Group on Comprehensive Economic Partnership in East Asia (CEPEA2009).

Specific to the energy issue, the policy makers have affirmed their desire for an integrated market. The ASEAN energy ministers' meeting wants to "create suitable conditions that facilitate energy infrastructure investments, in particular in energy production, to secure an adequate and stable supply of energy" (ASEAN website, 2007a). The ASEAN Plus Three (APT) Energy Ministers called for greater cooperation and integration to address the challenges faced by the region. Under the EAS framework, the 'Cebu Declaration' in 2007 specified the major goals of 1) pursuing and encouraging investment in energy resource and infrastructure development by greater private sector involvement; and 2) the promotion of stable energy supplies through investment in regional energy infrastructure. The issue of energy market integration was also discussed by the first EAS EMM and followed up closely.

3.2. Energy Infrastructure Development

Linkage of energy infrastructure has been pursued progressively in ASEAN. Under AEC, 12 priority integration sectors have been identified. Of particular relevance to the EMI is Infrastructure Development, which includes mining cooperation and the two flagship projects of ASEAN energy cooperation, APG and TAGP (APAEC, 1999).

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. The updated ASCOPE-TAGP Masterplan 2000 involves the construction of 4,500 kilometers of pipelines mainly undersea, at a cost of USD 7 billion. Nine bilateral gas pipeline interconnection projects, with total length of approximately 2,300 km, were operating by April 2009 (APAEC, 2009). ASCOPE has set up the ASCOPE Gas Centre to carry forward some of the technical, commercial, regulatory and governance issues that would be needed to realize a working TAGP.

APG, on the other hand, ensures that gas for power is also being optimized with other potential sources of energy. To pursue the program, ASEAN has adopted a

strategy that encourages interconnections of 15 identified projects, first on cross-border bilateral terms, then gradually expanding to a sub-regional basis and, finally to a totally integrated Southeast Asian power grid system. Currently, the APG is in progress with 4 on-going interconnection projects, and an additional 11 projects are planned for interconnection through 2015 (APAEC, 1999). However, interconnection within individual countries has not been fully realized. For example, even in Brunei and Cambodia, there are no national interconnected power networks (Bannister et al., 2008).

For geological reasons, current by proposed energy infrastructure projects concentrate within ASEAN plus China. The "plus 6" countries of EAS are, with a few exceptions, somewhat physically remote from the ASEAN countries. Therefore, electricity interconnection mainly focuses on ASEAN, although southern China and, potentially, India, could become interconnected through ASEAN. India has the potential to link with other EAS countries because of its good location between gas supply centers and East Asian demand regions, but no feasible plan has been set yet. For the gas interconnection, India and China are large current and potential gas consumers with current and planned pipeline access to rich gas reserves in Russia and Central Asia (for China) and Central Asia and parts of the Middles East (for India).

The major energy infrastructure involving China is cooperation under the Greater Mekong Sub-region (GMS) program. The GMS sub-region includes the two southern provinces of China as well as Thailand, Viet Nam, the Lao PDR, Cambodia and Myanmar. The ultimate aim of energy cooperation in the GMS is to develop a staged regional power market between the six GMS countries. With the support of the Asian Development Bank (ADB), GMS countries formed the Electric Power Forum (EPF) in 1995 to promote closer cooperation and integration between the GMS countries. The World Bank joined the GMS/ADB effort in 1996. The Intergovernmental Agreement for Power Trade (IGA) was signed in late 2002 and came into force in November 2003, followed by the formation of the Regional Power Trade Coordination Committee in 2004 and the signing of the Regional Power Trade Operating Agreement in July 2005. According to current plans, it is likely that before 2020 all GMS countries will be interconnected and internal countries grids are sufficiently to support significant transactions by a third party country (Bannister et al., 2008).

However, lack of trust, in particular, political trust is a huge barrier to trade in pipeline gas and electricity, and thus the demand for energy infrastructure. On the one hand a consumer linked to a supplier with pipeline hardware might be regarded as secure because of the supplier's sunk investment, but at the time of contract renegotiation the buyer may have few options also and may be disadvantaged commercially (Bannister *et al.*, 2008). More serious concern is that once a physical network is established and supply is set relying on the trans-boundary trade, the importer will be hurt if the supply is interrupted. This kind of interruption is often caused by political rather than economic disputes. An example is the dispute over gas transmission prices between Ukraine and Russia which left some European countries without heating for a short period in the winter (Fox News, 2009).

Electricity raises particularly sensitive political issues as it supports, like no other fuel, the immediate, day-by-day conduct and welfare of modern societies. Although limited integration can increase energy security by providing additional energy sources to reduce the chances of interruption, history has shown that governments are reluctant to compromise their control of all the resources needed for everyday use and system security. However, when in full integration, 'base-load' supply may rely on imported energy, which then highlights the importance of political trust.

3.3. National Energy Market Liberalization

When discussing market liberalization, it is useful to distinguish energy markets that are essentially global, of which oil is the obvious example, from those which are more regional and sub-regional and which tend to be more subject to government and administrative oversight, such as pipeline gas and electricity. The latter is often the most difficult part of reform and thus subsequently the most challenging step toward EMI.

Building an open and competitive national energy market is challenging but crucial and beneficial toward EMI. Compared with regional agreements and physical energy infrastructure, much more work needs to be done at national level. Prominent challenges at the national level are to construct national competitive markets and to

remove inefficient fossil fuel subsidies. National energy market policy and regulation have an important role in the process of EMI, as an outside agreement cannot be effective if it cannot be implemented in the national markets. Investment in energy mining sectors is often affected heavily by national regulations in areas such as security of mining tenure, access to land, and registration procedures. Trans-boundary energy infrastructure, like investment, is also heavily affected by domestic policy and regulations. In a large country like India, progress in sector restructuring, open access to transmission systems and fair and transparent sector regulation were needed even for stimulating internal trade among the various regions of the country (World Bank, 2008).

In the EAS region, energy market liberalization has been conducted in Australia, Japan, New Zealand, the Philippines, and Singapore, while in others, energy markets are more or less restricted in some of the following ways: markets are dominated by some vertically integrated suppliers, prices are regulated, trade qualification is limited, electricity networks/gas pipelines are not open to access, and so on. Electricity is the most regulated energy product among all major energy products. It is often managed by an integrated state-owned company. Oil, on the contrary, is the least regulated energy product.

The Australian National Electricity Market is one example of how national markets can be liberalized and integrated. The Australian electricity sector originally developed as a set of distinctly owned and operated electricity grids. Under the Australian constitution, States have major power in matters such as infrastructure management, which was a situation rather similar to that now existing in ASEAN. During the Australian market reforms in the late 1980s and early 1990s, the federal Government advanced the process of integration by implementing an interventionist competition policy, not only in electricity but also across many industry sectors. Currently, the development of political, legal and economic governance arrangements, efficient market design and the strengthening of physical transmission infrastructure and its management remain works in progress. But the integration of the markets was actually achieved relatively quickly, over a period of a few years. The domestic energy sectors are also subject to open access, and competition has been encouraged at both the wholesale and retail levels. Even private infrastructure is subject to Australia's "open access" regime, intended to allow even privately owned infrastructure

to be shared by multiple parties on fair terms. Details of this reform can be found at Bannister at al. (2008).

Australian experience in integrating domestic electricity markets may offer lessons relevant to similar developments in the EAS region (Bannister et al., 2008). The core of the reform in the Australian electricity sector was: a single "National Electricity Market" (at least in the eastern, most heavily populated part of the country) with a single, national system and market operator; separation of transmission and distribution from generation and retailing and its regulation under transparent procedures; competitive generation to be dominated by the private sector; competitive retailing to be dominated by the private sector, with customer choice; and an independent regulator and manager of the electricity market rules, who runs an open and transparent process for rule change, within cooperative Federal-States governance agreements. The "competition payments" were also designed to anticipate and compensate for the myriad of complaints about financial and other disadvantages that might flow to specific States or Territories from the development and integration of competitive markets.

Among the EAS developing members, India and the Philippines are pioneers in liberalizing their domestic energy markets. The Philippines has opened its oil, gas, coal and renewable energy industries to foreign investment and has transparent/stable procedures for the exploration for, and production of, these resources. India has opened up of its energy sectors except coal. In many sectors – especially oil and gas exploration and refining, petroleum production and retailing, and electricity generation– energy markets have matured considerably. This liberalization could be driven by internal incentives as pointed by the World Bank (World Bank, 2008).

The current market liberalization is far from enough, which can be demonstrated by the outline status of EMI in the EAS region presented in Table 3. The past study shows that investment to the energy sector may still be restricted in some EAS countries. Countries of the EAS region have widely different approaches to foreign investment in the energy sector. Some countries such as Australia broadly welcome foreign investment in the resource sector and do not have rules banning majority or even complete foreign ownership. Others such as Indonesia require majority ownership locally or apply other restrictions. Such restrictive rules on investment are likely to limit, or even inhibit actual foreign investment (Bannister *et al.*, 2008).

However, it is not unusual as liberalization of national markets is a challenging and long lasting task. Even in the European Union (EU), the single energy market has not been fully created due to lack of unconstrained competition in the national markets. Currently, gas and electricity markets are still largely national and France and Germany have not been convinced by the competitive energy utility model (Bannister et al., 2008).

Table 3 Energy Market Integration Status and Issues

ISSUES	OIL	COAL	GAS	ELECTRICITY
Australia	(+) Stable governance and procedures (+) Fully integrated into international markets	(+) Fully deregulated (+) Stable governance and procedures (-)generally lagging in infrastructure investment	(+) Deregulated except for some pipelines (-) Gas retail market in early stages and disjointed (-) Gas pipeline access issues	(+) Successful National Electricity Market in east (+) Industry deregulated except in NT (+) Highly competitive wholesale spot market (+) Open to foreign investment
Brunei Darussalam	(-) Ownership concentrated (+) Increase in value added exports if proposed refinery proceeds (+) Previous oil conservation policy no longer in force (-) Domestic petroleum product prices are regulated and subsidized	n/a	(-) Ownership concentrated (-) No infrastructure for cross border pipeline trade (-) Regulated prices	(-) Only two players, both vertically integrated. (-) No current plans to change industry structure (-) Use of subsidized gas for electricity generation makes it unavailable for high value export. (-) Pricing is regulated. (-) No immediate plans to introduce more independent generators or retail competition.
Cambodia	(+) Fiscal regime in place for oil exploration, development and production	n/a	(+) Fiscal regime in place for gas exploration, development and production (-) No onshore gas network or facilities in place	(+) Bilateral cross-border power exchange agreements negotiated with neighbouring countries (+) Plans for further transmission system expansion, although timing uncertain (-) Fragmented power system combined with private Rural Enterprises (REEs) in industry results in uncompetitive prices for electricity in many areas (-) Legal and policy framework for investment not mature
China	(-) Tightly regulated domestic markets (-) Dominated by three state-owned firms (-) Foreign trades through only designated firms with quotas	(+) Nominally deregulated (+) Industry is consolidating (-) Governmental interventions	(+) Improving pipeline network and LNG terminals (-) Market highly concentrated from production to distribution (-) Highly regulated industry (-) Government intervention, e.g., priority of gas utilization	(+) Generation separated from grid and consumption (+) Planned progressive liberalization of electricity industry (+) Large system facilitating trades and exchanges (-) Volatile industry structure and policies (-) Lack of experience of market-based operation (-) Inefficient dispatch processes (-) Government interventions
Indian	(+) Relatively open domestic exploration and production system (NELP) (+) Crude oil pricing linked to international markets (-) Domestic market dominated by ONGC and OIL	(-) Industry is nationalized and tightly regulated (-) Government controlled exploration and mining except for captive mining; no competition. (-) Land access issues	(+) Relatively open domestic exploration and production system (NELP) (-) No retail gas market (+) Potential international gas pipeline links (+) Good location between gas supply regions East Asian demand centres (-) Segmented domestic gas	(+) Open access assured (+) Large regional exchanges (-) No direct connections with EAS countries (-) Weak State electricity systems and management, physically and financially (-) No transparent planning and dispatch processes (-) Insufficient metering and law enforcement

ISSUES	OIL	COAL	GAS	ELECTRICITY
			pipelines	
Indonesia	(+) Oil development licenses Issued by independent BPMIGAS, not Pertamina, but not seen externally as transparent (-) Pertamina still dominates downstream sector. (-)Large proportion of population unable to pay world prices.	(+) Foreign investment in coal mining encouraged. (+) Subject to world market trading conditions. (+) Policy to encourage more domestic use of coal for power generation.	(+) No upstream sector monopoly by Pertamina. (+) International companies involved in gas production. (+) State owned PGN separated from supply and responsible for all transmission and distribution. (+) Important link in TAGP, although progress is slow. (-) Limited interconnectivity in domestic gas network.	(-) Sector dominated by a single state owned enterprise, PLN. (-) No retail market competition, customers purchase power from PLN. (-) No open access. (-) Little interest from private and foreign firms in investing in the sector. (+) Plans to introduce more retail competition.
Japan	(+) Oil industry liberalized and not concentrated (+) Open access to pipelines (+) Good investment environment and advanced technologies	(+) Fully dependent on international coal markets (*) Relatively few companies dominate import channels. (+) Overseas investment strong (+) Competitively priced fuel	(+) Gas market liberalized step-by-step. (+) Open access to pipelines	(+) Electricity market being liberalized step-by-step. (+) Open access to electric grids (-) Limited competition in the wholesale market.
ROK	(+) Exposed to world trading conditions (+) Downstream sector subject to some competition (-) Upstream oil sector dominated by a single state owned enterprise (+) The oil and petroleum sector is open to international competition and markets are well established	(+) Subject to world coal market trading conditions (+) Non signatory to Kyoto protocol	(+) Gas sector in Korea is exposed to world trading conditions (+) The structure aims to support open trading (-) All importing and distribution in the hands of government owned enterprise	(-) Industry is vertically integrated and ownership in government hands (-) Very limited competition in the market (-) No opportunities for electricity trading
Laos		(+) Lao PDR enables private sector participation in the development of its coal deposits	n/a	(-) Bilateral deals struck for the development of hydro potential may diminish incentive for a multilateral regime (-) Trading regime for export / import of power into / out of Lao PDR not well developed
Malaysia	(-) Petronas has exclusive rights to own and explore oil resources (-) Petronas is vertically integrated but some competition in downstream	(+) Planned promotion of coal-fired generation	(+) Already a key LNG exporter to EAS countries (-) Petronas has exclusive rights to own and explore gas resources (-) No mechanism for cross border trade. (-) Demand managed by “five fuel” policies rather than pricing.	(-) Highly concentrated and regulated market (-) Vertically integrated (though IPPs exist) (-) No market based pricing mechanism (-) No mechanism for cross border trade.

ISSUES	OIL	COAL	GAS	ELECTRICITY
Myanmar	(+) Foreign investment to explore and produce oilfields is encouraged	(+) Foreign investment in coal mining is encouraged.	(+) Foreign investment to explore and produce gas fields is encouraged;	(+) Foreign investment encouraged in generation, particularly in relation to development of hydro resources. (-) No move toward a competitive market structure
New Zealand	(+) Oil market is liberalized and open to world competition (+) New policy initiatives for oil exploration are in place	(+) Market is liberalized (+) Export of coking coal (-) Solid Energy dominates the small coal market (-) Weak investment	(+) Market is liberalized (+) Open access to gas pipelines	(+) Market is liberalized (+) Open access to grid (+) Customers free to choose suppliers
Philippines	(+) Foreign involvement in upstream oil sector promoted, with transparent / stable fiscal terms for Service Contracts (+) Downstream oil sector has been deregulated	--	(+) Foreign involvement in upstream oil sector promoted, with transparent / stable fiscal terms for Service Contracts (-) Only one major gas field currently produces gas (-) Minimal piped gas network infrastructure	(+) Industry has been reformed and opened up (+) Market arrangements in operation but yet to be expanded to Visayas (+) Selling generation assets (+) Plans to introduce more retail competition through open access regime
Singapore	(+) The oil and petroleum refining sector in Singapore is lightly regulated and exposed to world trading conditions. (+) Upstream sector is competitive but most players necessarily work offshore as no real oil potential. (+) The petroleum sector is open to international competition and markets are well established.	n/a	(+) Singapore is horizontally disaggregating its gas sector but this process is not yet complete. (+) The new structure aims to support open trading. (+) ASCOPE is working on issues that would support cross-border trading. (-) Associated ban on new contracting for imported pipeline gas are a possible restraint on future trade.	(+) Industry is vertically and horizontally disaggregated. (+) Market arrangements are already operating. (-) With current portfolios the level of market competition is limited. (+)Opening up to competition from neighboring countries could improve the level of competition for dispatch. (-) For security, Singapore will insist on being able to generate its own needs. (+) But this does not rule out possible opportunity trading with neighboring countries (including purchase).
Thailand	(+) Oil sector open to foreign investment (-) PTT dominates downstream sector (+) Transparent process for allocating oil and gas exploration blocks (+) Open market downstream	(-) Open market in domestic and imported coal but use dominated by power sector which is concentrated.	(+) Key player in TAGP if it progresses (+) New market structure aims to support open trading. (+) Transparent process for allocating oil and gas exploration blocks	(+) A central participant in GMS market integration strategy (-) Regulated market with EGAT as single buyer and dominant producer (-) No market competition. (-) Incentives to seek low cost bilateral supply deals appear to dominate incentives for further market integration (+) Plans to introduce more retail competition.
Viet Nam	(+) Laws encourage foreign company involvement in oil activities in the country.	(+) Plans to liberalize ownership of the industry within a few years. (-) Reported difficulty organizing import coal contracts	(+) Foreign involvement encouraged. (-) Dominated by PetroVietnam (-) No plans for complete liberalization (-) Upstream development	(+) Laws allow foreign ownership of gen. assets Extended electricity reform process has been stalled (-) Sector dominated by EVN (+) Cross-border trade based on bilateral arrangements (+) IAG and RPTCC membership (+) Policy encourages power purchase or exchange with

ISSUES	OIL	COAL	GAS	ELECTRICITY
			delayed by failure to agree on price	neighboring countries

Sources : Adapted from Bannister et al. (2008); (+)/(-) indicates the point is desirable/ undesirable.

3.4. Energy Pricing Reform and Fossil Fuel Subsidies

Energy subsidies will cause problems in investment, consumption, national economies, and so on. Energy subsidies not only distort national budgets but also cause inefficient and, ultimately, unsustainable usage patterns and discourage investment. They may delay some production developments and reduce the opportunity for mutually beneficial trade as the case of gas subsidies in Malaysia and Indonesia (Bannister et al., 2008). If the world energy prices increase, subsidies to energy imported at world prices can become so expensive that they dominate national budgets, as in Indonesia and Malaysia (Alibaba.com, 2010; The Straits Times, 2010).

However, price regulation of, and subsidy to, the energy sector are being implemented in many countries. Energy prices have been liberalized in Australia, Japan, ROK, New Zealand, and the Philippines. Prices of electricity are more often regulated than coal, oil and natural gas. This may be due to the "natural monopoly" characteristic of power grids and the necessary of electricity in daily life. Oil, despite being exposed to international markets, is often subjected to regulation and subsidy. For example, India and Laos, which have limited domestic oil production, have regulations on oil prices. Prices of coal are regulated only in a few countries such as China and Vietnam. One reason for the less frequent regulation of coal prices is that many EAS countries do not have coal resources and thus are subject to international markets. Details of energy pricing and subsidy for the EAS region are presented in Table 4.

Table 4 Status of Energy Pricing and Subsidy in the EAS countries

ISSUES	OIL	COAL	GAS	ELECTRICITY
Australia	(+) Market based pricing with reference to Malaysia and Singapore benchmark prices	(+) International market and market based pricing	(+) Market based pricing (+/-)prices of sales to small customers are regulated	(+)Competitively priced based on bids (-) prices are subsidized for certain customer classes
Brunei	(-) Petroleum product prices are regulated and subsidized	n/a	(-) Regulated prices	(-) Use of subsidized gas for electricity generation

ISSUES	OIL	COAL	GAS	ELECTRICITY
				(-) Pricing is regulated.
Cambodia	(-)Upstream oil and gas activities are managed	n/a	(-)Upstream oil and gas activities are managed	
China	(-) Regulated prices (-) Subsidies to refinery and some consumption sectors	(-) Early stage of market-based pricing (+) World pricing in regions near trading ports	(-)Subsidies exist at various levels (-) Gas price is regulated (+) Pricing reform is being debated	(-)regulated on-grid and sale prices of electricity (+)Part of the generation capacity was subjected to a pricing test by a competitive bidding process
India	(-) Prices are controlled by government	(-) Prices are regulated (+)Market pricing for nonallocated demand	(-) Part subjected to Administered Pricing mechanism (+) Others are market determined	(-) Subsidy schemes (-) Prices are controlled in all steps of the supply chain
Indonesia	(-) Gasoline and diesel subsidized.	(+) Domestic and international prices similar	(-)Prices subsidized	(-) Prices subsidized (-) Regulated tariffs are insufficient to cover the cost of new entrants
Japan	(+) Market based pricing	(+) Market based pricing	(+) Market based pricing	(-)Residential and small business customer prices are regulated. (+) Other prices are marketed based
ROK	(+)Prices for petrochemicals are liberalized. (+)Existing intervention procedures and rules on raising prices.	(+) Subject to the international price regime	(+)Existing prices reflect world prices.	(+) Pricing is regulated but generally aims to be cost-reflective.
Laos	(-) Imported oil sold at regulated prices.		(-)Prices are regulated	(-)Prices are regulated
Malaysia	(-) Gasoline and diesel subsidized.	A matter for state governments	(-) Regulated and distorted pricing	(-) Regulated and bundled prices
Myanmar	(-)Prices are regulated and petroleum products are subsidized;		(-) Gas is subsidized to end users	(-) Prices regulated to be “affordable”
New Zealand	(+)No price controls	(+) Deregulated	(+) Market is liberalized	(+) Market is liberalized Transmission and distribution prices are partly regulated
Philippines	(+)Downstream is deregulated (+)Upstream is	(+)Transparent	(+)Upstream is transparent	(+) Pricing regulated but generally aims to

ISSUES	OIL	COAL	GAS	ELECTRICITY
	transparent			be cost-reflective
Singapore	(+) Open to competition across refining, trading and retailing	n/a	(+) Prices are set by the individual companies	(+) Only a small portion is regulated; not sufficient to lead to distortion
Thailand	(-) Pricing distortions, especially with low price set for LPG	(+) Prices are not regulated	(-) Regulated domestic prices	(-) Pricing is regulated with cross-subsidies and subsidies
Viet Nam	(-) Prices are regulated (+) Oil product pricing may be liberalized soon	(+) Plans to liberalize pricing within a few years.	(-) Prices are regulated	(-) Electricity use is subsidized

Sources : Major information was extracted from the country report of the first stage EMI study (Bannister et al., 2008); (+)/(-) indicates the point is desirable/ undesirable; n.a: not applicable.

The adoption of market oriented pricing mechanisms in member countries is a prerequisite for a regional EMI. Pricing reforms, in particular, removal of energy subsidies, have been clearly needed, demonstrated and even attempted, but their implementation is far from complete. The Asia-Pacific Economic Cooperation forum (APEC) leaders have committed to rationalise and phase out fossil fuel subsidies over the medium term (APEC, 2009). The plans and actions for liberalizing energy prices and removing subsidies for fossil energy have been demonstrated in many countries, such as China, India, Indonesia, and Vietnam. In China, energy subsidies are gradually going down, and the government is driving the price more towards a market determined price. China has implemented market-based pricing for coal in the past few years (Yu, 2008). Their attempts to break down vertical integration in electricity were initiated a decade ago starting with the separation of generation transmission and distribution (Shi, 2002). However, transmission, distribution and retailing are still highly aggregated. Based on personal contact, the authors are aware that the Chinese government is now also studying means to formulate market oriented pricing regime for electricity transmission and distribution. Discussions have taken place in Indonesia about removing energy subsidies (Alibaba.com, 2010). The immediate first step could be rationing of subsidized fuel while not raising their prices. Malaysia may begin cutting fuel and other subsidies under a proposed five-year plan (The Straits Times, 2010).

Phasing out subsidies, a core handicap for pricing mechanisms, is very difficult socially and sensitive politically. The affordability issue could also be an economic barrier to removal of subsidies. Energy subsidies are not good theoretically but prevail in practice. One major concern is that many people may not be able to afford world prices of oil. So in many developing countries, such as China, India, Indonesia, Myanmar, price regulation is used to provide "affordable" energy. Such affordability issues slowed down the reform of oil pricing in India (Bannister *et al.*, 2008).

4. ESTIMATED BENEFITS FROM EMI

The five groups of selected issues were estimated using the REPA model, which is a multi-regional computable general equilibrium (CGE) model developed for conducting integrated policy impact assessment encompassing environmental, economic and poverty impacts in East Asia (Kojima, 2008). The current version of the REPA model employs a 22-region 32-sector aggregation of the GTAP database Version 7.[1] Impacts estimated by this model are not comprehensive and often are partial and conservative. Many benefits cannot be estimated by the model. For example, productivity is exogenously given in the model, and thus expected productivity improvement due to EMI will not be fully captured. Neither is the full potential of investment liberalization is estimated, due to the crude specification of saving-investment mechanisms in the model. Another uncovered benefit is the improvement of energy security resulting from integrated energy infrastructure.

With these caveats in mind, we not only meet the requirements of ECTF Phase 2 TOR, namely, estimating the impact of trade and investment liberalization, but we also try three additional simulations. However, two of the additional simulations, the linkage of infrastructure and the removal of subsidies are not very successful, due to lack of data in the infrastructure case and the high aggregation in the GTAP database. Although we cannot estimate the impact of all energy infrastructure, a previous study has shown that linkage of electricity grids can create both economic and environmental benefits (Bhattacharya and Kojima, 2008). The results of this study are detailed in the Technical Report by Bhattacharya and Kojima (2010). The following is a summary of relevant results.

In the case of the removal of energy subsidies, although this would be theoretically beneficial, we cannot estimate impacts with the current EAS regional CGE model. Due to lack of a more disaggregated dataset in which energy commodities are composites of subsidized energy commodities, and taxed energy commodities are subject to net tax,

[1] GTAP Ver.7 comprises all East Asian countries. However, the dataset aggregates Brunei Darussalam and Timor-Leste as one region (other South-east Asia), but we assume that this region represents the economy of Brunei Darussalam as its GDP share (based on 2008 World Bank GDP ranking) is 95.8%.

energy subsidy removal can only be modeled through equivalent tax increases, which introduces further market distortions. In the real world, however, removal of subsidies should reduce market distortions. Therefore, their simulation results are not presented at the overview report, but details are reported in the technical report prepared by our simulation team. Furthermore, the simulations of domestic market liberalization and trade liberalization are only indicative, because the impacts are only partially estimated and the method of choosing parameters is arbitrary.

The estimation results of trade liberalization, investment liberalization and domestic market liberalization are presented in Tables 5, 6, 7 and 8.

In the simulation of trade liberalization, tariff and export subsidy/tax are removed. The results show that the EAS region as a whole will gain in real and in nominal GDP due to energy trade barrier liberalization. The distribution of economic benefits is not balanced, but the magnitude of impact in most countries is close to zero. Some countries like Australia, Indonesia, Malaysia and Singapore will lose in that context. However, such loss is very small and in some cases negligible (viz. Australia). The reasons for the negative impacts are complicated in the CGE model, which models the impact through complex inter-sectoral and international linkages. For example, in Australia the largest negative impacts are observed in the non-ferrous metal and the other manufacturing sectors; the real GDP loss of Singapore is mainly due to a reduction in trade balance, as trade liberalization will undermine the comparative advantage of the current free trade policy of Singapore. With the increase of GDP, CO2 emission will also increase (Table 5).

Table 5 Impacts on GDP and CO_2 emissions due to trade liberalization, % change from 2020 Baseline scenario

Region	Real GDP	CO_2 emissions
China	0.000	0.05
Japan	0.003	-0.19
Korea	0.052	0.02
Cambodia	0.128	1.25
Indonesia	-0.065	-0.37
Lao PDR	-0.130	0.96
Myanmar	-0.044	-0.37
Malaysia	-0.078	-0.47
Philippines	0.011	0.38
Singapore	-0.070	0.12
Thailand	0.011	-0.13
Vietnam	0.263	3.21
Brunei Darussalam	-0.147	-0.02
India	0.368	6.83
Australia	-0.002	-0.95
New Zealand	-0.003	-0.23
Brazil	-0.012	-0.07
EU	-0.004	-0.09
USA	-0.001	-0.05
Russia	-0.035	-0.06
MENA and Venezuela	-0.052	-0.13
Rest of the World	-0.010	-0.11
World Total	0.000	0.14
EAS Total	0.024	**0.58**

Source: Bhattacharya and Kojima (2010)

Due to border tax reduction to zero, more or less all the countries experience reduced levels of domestic energy prices except Indonesia and Malaysia (Table 6). Due to increases in imports of cheaper energy, domestic production of energy might fall because of lack of demand and thus create downward pressure on market prices. For example, the Indian domestic consumer price for coal will reduce by 28%, which could attribute to an increase in imports of energy commodities.

Table 6 Impact of energy trade liberalization on consumer prices of energy commodities

Region	coal	crude oil	gas	petroleum products	electricity	gas distribution
China	0.01	0.13	-0.24	-0.04	-0.06	-0.23
Japan	2.35	0.11	-0.27	0.08	0.04	-0.01
Korea	1.15	-0.13	-0.78	-0.16	0.02	-0.06
Cambodia	1.79	1.7	-0.23	-4.28	-0.26	0.02
Indonesia	3.37	1.15	0.17	0.18	0.28	0.02
Lao PDR	-2.96	-0.03	-0.07	-1.89	-0.25	0.02
Myanmar	2.62	-0.03	1.42	-0.84	0.43	0.24
Malaysia	2.54	-0.21	0.49	0.57	0.34	-0.01
Philippines	-2.36	0.56	-0.04	-0.34	-0.22	0.02
Singapore	1.85	1.19	-0.14	0.11	0.02	-0.05
Thailand	0.95	0.28	-0.09	0.22	0.01	-0.02
Vietnam	5.16	-0.59	-6.14	-8.44	0	0.34
Brunei Darussalam	1.19	1.79	-0.22	0.41	0.07	0.16
India	-28.73	0.03	0.33	-0.57	-2.02	-0.01
Australia	3.83	0.83	-0.2	1.12	0.52	0.05
New Zealand	2.84	0.72	-0.1	0.53	0.04	-0.01

Source: Bhattacharya and Kojima (2010).

In the estimation of investment liberalization, capital was reallocated from investing countries to recipient countries, the national capital endowment of which is increased to that amount. The allocation of such endowment among all sectors including energy sectors within a country is endogenously decided by the model. Simulation shows that real GDPs for the investing country reduce but the real GDPs increase for all the recipient countries. The negative impact on GDP in the investor countries do not mean their welfares will be damaged. Actually, their national income can be increased because profits will be repatriated and thus compensate for the loss of production of transferred capitals.

The overall negative impact of investment liberalization to the EAS region could be due to the fact that potential positive impacts are not fully captured by the model. For example, with capital shortage, the marginal productivities of capital in the recipient country usually are much higher than those in the investing countries. With capital transfer, some low marginal productivity capital will be transformed to high differences between GDP and GNP natural welfare marginal productivity capital. This productivity gain, although is predicted in economic theory, cannot be modeled by the

current model. Furthermore, in this estimation the investor countries are simply transferring a portion of their capital to the recipient countries without any revenue gain, and reduced capital endowments as a result of transfer simply reduce the production capacity of investing countries. It highlights the importance of proper specification of full dynamics and investment mechanisms, which remains as an important future task.

As a consequence of real GDP growth, corresponding CO_2 emissions also increased for the recipient countries compared to the investing countries (Table 6).

Table 7 Impact on GDP and CO_2 emissions due to capital reallocation (Investment Liberalization), % change from 2020 baseline

Region	real GDP	CO2 emissions
China	-0.086	-0.05
Japan	-0.305	-0.45
Korea	-0.225	-0.26
Cambodia	0.973	0.82
Indonesia	0.819	1.42
Lao PDR	0.476	1.71
Myanmar	0.848	2.95
Malaysia	0.825	1.26
Philippines	1.218	1.21
Singapore	-0.170	-0.10
Thailand	1.276	1.16
Vietnam	0.907	1.37
Brunei Darussalam	1.037	2.03
India	1.041	0.88
Australia	-0.248	-0.33
New Zealand	0.346	0.41
Brazil	-0.011	-0.01
EU	-0.003	-0.01
USA	-0.001	-0.01
Russia	-0.027	-0.01
MENA and Venezuela	-0.052	-0.01
Rest of the World	-0.008	-0.01
World Total	-0.011	0.04
EAS Total	-0.026	0.15

Source: Bhattacharya and Kojima (2010)

Liberalization of domestic energy markets is assumed that it will reduce the monopoly of energy distribution and retailing in domestic energy market through open access to transmission system by other retailers, domestically and internationally. Consequently, it is expected to improve the efficiency of these energy services. In our simulations this improved efficiency of energy services is modeled as improvements of total factor productivity (TFP) of the electricity sector (ely) and the gas manufacturing and distribution sector (gdt).

To estimate the impact of domestic market liberalization, the simulation assumes that due to such liberalization there is an overall improvement in the total factor productivity of the energy distribution services (assumed 20% in the estimation), that is electricity transmission and gas distribution, due to increased competitiveness through open access to transmission systems. The simulation shows double benefits of market liberalization: i.e. overall economic development and reduction of CO2 emissions[2] (Table 8).

The simulation results demonstrate significant benefits overall to the EAS region from integrating energy markets. These significant benefits, however, have an unbalanced distribution. The estimation results show that no single policy can create the miracle of an integrated market where all the member countries are winners. Some members may lose from certain initiatives. Such loss often is caused in sectors other than the energy sector, which indicates that trade-offs may occur between the energy sector and other sectors.

Table 8 Impact on GDP and CO_2 emissions due to market liberalization, % change to baseline 2020

	Real GDP	CO2 emissions
China	1.551	-0.84
Japan	0.737	-2.23
Korea	0.834	-1.53
Cambodia	0.725	1.78
Indonesia	0.852	1.87

[2] The study although test 10% and 15% TFP growth and the observation is the same to this one.

Lao PDR	0.943	8.47
Myanmar	1.926	10.54
Malaysia	1.278	2.48
Philippines	0.934	-2.11
Singapore	0.760	-2.85
Thailand	1.464	1.05
Vietnam	2.479	4.52
Brunei Darussalam	1.139	1.70
India	1.825	-2.49
Australia	0.620	-1.29
New Zealand	0.829	2.59
Brazil	-0.010	0.27
EU	0.003	0.55
USA	0.003	0.43
Russia	-0.079	0.38
MENA and Venezuela	-0.029	0.11
Rest of the World	-0.004	0.49
World Total	0.259	0.01
EAS Total	1.090	-0.80

Source: Bhattacharya and Kojima (2010)

To better understand the impact of EMI on a broader context, the study also estimates a combined scenario where all three policy initiatives estimated above are assumed to be implemented together. That is, the scenario estimates a combination of the following three policy scenarios: trade liberalization; investment liberalization and market liberalization (20% increase in TFP for distribution service sectors). The results show the potential of win-win outcomes of energy market integration for the EAS region as a whole: in the combined policy scenarios, regional total CO_2 emissions will be reduced while there positive economic impacts (Table 9). Another important finding is that all EAS countries gain in terms of GDP growth. In terms of CO2 emissions, even though some member countries will increase their emissions, the overall impact is negative and thus desirable. The result that less developed countries will gain more economic benefits than developed ones is also desirable for the region because narrowing development gaps are beneficial for the process of regional integration.

Table 9 Impact on GDP and CO_2 of combined policy scenarios, % change to baseline 2020

Region	Real GDP	CO_2 emissions
China	1.472	-1.03
Japan	0.425	-2.73
Korea	0.684	-1.64
Cambodia	1.840	3.89
Indonesia	1.729	2.20
Lao PDR	1.620	11.61
Myanmar	2.893	13.80
Malaysia	2.119	1.51
Philippines	2.188	-0.44
Singapore	0.503	-2.73
Thailand	2.815	1.92
Vietnam	3.781	8.65
Brunei Darussalam	2.278	3.82
India	2.733	4.81
Australia	0.370	-3.18
New Zealand	1.174	2.90
Brazil	-0.013	0.23
EU	-0.001	0.51
USA	0.002	0.41
Russia	-0.083	0.35
MENA and Venezuela	-0.034	0.04
Rest of the World	-0.007	0.42
World Total	0.252	0.14
EAS Total	1.069	-0.31

Source: Bhattacharya and Kojima (2010)

The overall benefits for each member country are positive from the combined scenario, which shows a trade-off among various initiatives toward EMI.

In summary, the simulation results suggest that policy determination and intervention are required to balance the tradeoff between economic growth and CO_2 emissions. In the case of trade and investment liberalization, CO2 emissions will grow. However, in the case of liberalizing domestic markets, economic growth will be accompanied by a decline in CO2 emissions. These results indicate that liberalization of domestic markets can bring double benefits, and thus imply that such liberalization

should be promoted. The fundamental point is that an integration of energy markets should be accompanied by necessary policy to safeguard the environment.

5. POLICY IMPLICATIONS

Since trade and investment in broad terms has been covered in the existing bi/multilateral free trade and investment agreements, the remaining task is to make sure that energy goods and services, and investment in the energy sector, are not restricted or excluded by these agreements. More broadly, current agreements could be harmonized, through unification of such thing as Rules of Origin, and simplified to fewer agreements with broad coverage, like CEPEA. A further detailed review of energy trade and investment in the current regional agreements and frameworks will add value to further policy decision.

With development of more infrastructures, such as introduction of marine transportation, the networks of energy infrastructure may be expanded to other countries, in particular in the case of LNG, such as the Philippines and Australia. The planning of such projects should take into account current studies, such as the ASEAN Connectivity Master Plan and the Comprehensive Asia Development Plan which are under formulation.

Although regional and bilateral agreements have proceeded well, an even more challenging task is to construct open and competitive markets and to remove inefficient fossil fuel subsidies at national levels.

Phasing out subsidies has to be a long-term process and needs to be carefully planned in consideration of each individual country's circumstances. Each country needs to have a comprehensive road map which integrates economic, political and social issues, to achieve market oriented energy pricing mechanisms. Despite the process requiring an extended time-frame, immediate actions in terms of planning could facilitate the process and reduce difficulty. In countries where subsidies cannot be removed, immediate actions could include: increasing public awareness of and

promoting debates on subsidy issues; making plans to avoid further deterioration of subsidies; and removing subsidies in the least controversial sectors.

In order to build an open and competitive domestic market, it is important to establish clear and transparent market rules and principles. This will provide strong legal protection, reduce transaction costs to business, enhance investor confidence, and enable the free flow of goods, services, and capital[3]. In the case of electricity industries in two countries, operating by state-owned and private companies respectively, such as in Indonesia and Malaysia, it would be difficult to do trans-boundary trade between these two kinds of companies, and thus change of domestic legislation is necessary. Technical standards should also be harmonized to allow smooth utilization of energy across the board. Diversification in standards for electricity appliances, for example, is a major barrier for the development of APG. Even the successful Nordica electricity market still needs further development to change and harmonize regulations, standards, and others matters, (Nordic Energy Research Website, 2010).

Some mechanisms to share the benefits and offset losses from EMI, such as a broader set of binding initiatives, are necessary. Different impacts among various initiatives and possible benefits from the combined scenarios imply that more initiatives and a broader coverage of market integration are better than less, because each country may be able to achieve an overall benefit despite losses from some other aspects. It is also implied that member countries need to face possible losses and to prepare for trade within sectors in their own country and with other member countries.

In the worse scenario where some countries cannot get a positive benefit, the negative impacts could be either offset by gains from other sectors, or through regional compensation mechanisms. EAS may learn from the Australian experience in establishing compensation and financial incentive schemes. The Australian Federal Government, like ASEAN and other regional organizations, did not have the constitutional power to force the reform but relied instead on its financial strength to

[3] This need for "software" has been well recognized. For example, the AGP action described by the AEAEC 2010-2015 is "Harmonization of legal and regulatory framework for bilateral and cross border power interconnection and trade and formulation of institutional and contractual arrangements for cross border trade to include taxation, tariff and Third Party Access".

offer “competition payments” to states when they achieved certain milestones in the reform process, the goal of which was to advance competition.

For less developed countries, even though they seem to be able to gain more than developed countries from EMI, it is important to improve their investment policy and governance and thus improve their national and regional competitiveness. Such improved competitiveness is necessary for less developed countries to be able to gain from EMI, because more competition will not only generate overall benefits but also generate winners and losers. Apart from compensation mechanisms, capacity building is also necessary since there are huge divergences among EAS member countries.

To deepen the integration of energy markets, it is also necessary to improve political trust. Theoretically, an integrated energy market reduces dependence on a particular country, fuel or trade partner and such a connected supply structure would facilitate crisis support between countries. However, if countries are not trust each other in respect of cross-boundary transmission, the impact of EMI on energy security will be discounted. Unfortunately, lack of political trust is a prevalent situation in the trade of energy by networks, such as gas and electricity, in this region. Within ASEAN, there are many mutual suspicions among potential trading partners (ACE2006). In East Asia, one prominent hurdle to integration is the unresolved different perspectives on history among China, Japan and Korea.

Regional architectures, such as specialized regular forums and institution like an East Asia Energy Agency, may be able to facilitate the EMI. Member countries can learn from each other, and thus policy forums with specific focuses may be needed from time to time. With more and more energy cooperation activities emerging and the institutionalization of regional architectures, such as EAS, and, in particular, the move towards an East Asia Community, the existing regular meetings of energy ministers and senior officials are not sufficient. More work is needed to turn discussions into actions and to set up monitoring mechanisms. It is also important to share information and to understand the energy status and potentials, which needs solid support from data. An East Asian Energy Agency could undertake these regular activities and provide information.

A step further could be to establish a regional energy regulator, coordinating energy policy and monitoring the process of market integration. In addition, a common energy

policy is desirable for an integrated energy market (EU Website, 2007), although the road towards such a common policy will be very long.

6. CONCLUSION

EMI has been pursued for many decades, and the movement has accelerated in the past decade. A range of visions about regional communities of various kinds has boosted the need for EMI. This report reviews the current status and policy initiatives of EMI and the results of a technical study of the economic and environmental impacts of EMI in the EAS region. Two issues that have been highlighted by EMM and ECTF, namely removal of trade and investment barriers, are studied. The study also attempts to address three other key issues in EMI, these are: linkage of energy infrastructure, energy pricing reform, and liberalization of domestic energy markets.

A review of the current status of these five issues demonstrates that trade and investment liberalization have been well attempted at the regional level; the linkage of energy infrastructure also has been planned in ASEAN and China, though its potential with India and with pipelines and marine transportation has not been explored yet. The review shows that major challenges exist at national levels, such as the need for relaxation of domestic restrictions on investment and competition and the establishment of market-oriented energy pricing mechanisms. It concludes that for sensitive and challenging issues such as deregulation and subsidy removal, policy discussions should be undertaken for long-term implementation of these goals with immediate actions.

The estimation results show that the economic benefits of EMI often come with increasing CO2 emissions, which thus needs technical innovation and policy intervention. Different impacts among individual policies demand more initiatives and broader policy coverage. Capacity building is necessary to help countries deal with the challenge from increased competition and reap benefits from EMI. Political trust and regional architectures are also demanded to facilitate EMI in the EAS region.

Steps towards EMI may be a study on the removal of energy subsidies and creation of a roadmap toward a market oriented energy pricing mechanisms. This further step

can be tested in the electricity sector, where improvements can be made in deregulation, disaggregation, and pricing reform. It is also necessary to work toward transparent and regionally harmonized regulatory systems, such as harmonization of policies, legislation, and regulatory practices as well as energy investment frameworks in the member countries.

Although the models have various limitations, the estimated results can be explained more optimistically. The estimated economic impacts are indicative in nature and could be less than real benefits, mainly because many economic benefits, and most environmental and social benefits, cannot be modeled. However, this study shows the direction of economic and environmental impacts of EMI in the region, which can be the building block for future policies in this context.