



**Energy**

## **Advancing the Energy Management System in the East Asia Summit Region**

**By Yanfei Li**

*ERIA Research Project Report 2014-39*

This study aims to analyse the potential for deploying the Energy Management System (EMS) in the East Asia Summit region and to propose, upon identifying the policy challenges common in the region, policy recommendations for its promotion. This study targeted five member countries of ASEAN—Indonesia, Malaysia, Singapore, Thailand, and Viet Nam. For the first-year study, the head office (Yayasan Building) of PT PLN in Indonesia and the Nonthaburi Office of the Metropolitan Electricity Authority (MEA) in Thailand were chosen as case studies on the potential of deploying the building management system. The potential for energy saving through implementation of affordable EMS measures and technologies in the two cases has been identified. This study will identify specific challenges in advancing EMS in the EAS region, and will propose policy options.

## **Building Guidelines and a Cooperative Framework in East Asian Countries for Radioactive Emergencies**

**By Tomoko Murakami**

*ERIA Research Project Report 2014-37*

Several ASEAN member countries plan to introduce commercial nuclear reactors in the 2020s in order to meet their rapidly growing demand for energy; hence, the need for guidelines and a relevant framework in East Asia for emergency preparedness and response in case of radioactive emergencies. Such framework of close coordination among East Asian countries would significantly improve nuclear safety in the region.

A reliable information and communication network, a shared database, and a joint working group for establishing recommendations on practical methods for emergency preparedness would bring about benefits, such as systematic support to member countries. Specific support measures may include technical assistance for establishing guidelines on emergency preparedness and response, human resources development, and financing in related research and development projects. Sharing the database on nuclear facilities and alert systems across East Asian countries is recommended for accurate information to protect the health of their population and their environment .

## **Energy Efficiency Improvement in the Transport Sector through Transport Improvement and Smart Community Development in Urban Areas**

**By Ichiro Kutani, Yasumoto Sudo, and Yanfei Li**

*ERIA Research Project Report 2014-38*

Da Nang City in Viet Nam plans to develop a bus rapid transit (BRT) system in the near future but does not have any blueprint for the necessary feeder line bus system that enables the BRT to perform better and, accordingly, avoid traffic problems and excessive demand for oil. This study, which focuses on the feeder line bus system issue, analyses how urban transport can be improved (and consequently improve the sector's energy-use efficiency) by promoting a shift in transport mode when a mass rapid transit system is introduced. The study investigates precedent actions and relevant policies worldwide and finds that many localities experienced significant economic loss and difficulties in addressing the problem because policies were not able to catch up with the rapid development of cities. Thus, to prevent such deterioration in the traffic system, this study reviews the framework of problem awareness in urban transportation and proposes.

## **Energy Outlook and Energy Saving Potential in East Asia**

**By Shigeru Kimura and Han Phoumin**

*ERIA Research Project Report 2014-33*

Sustained population and economic growth in the East Asia Summit (EAS) region have significantly increased energy demand. Total final energy consumption is projected to increase by 1.7 times. Demand in the transport sector is projected to grow most rapidly, increasing by 3.4 percent per year, followed by industry average growth, and commercial and residential sectors' demand per year. Primary energy demand is projected to increase in 2035, with coal still having the largest share of primary demand. Projections on power generation in the region for 2012–2035 reveal that (i) it will grow at 3.3 percent per year on average; (ii) the share of coal-fired generation will remain at about 60 percent of the total; (iii) that of natural gas will be stable at around 12 percent; (iv) nuclear share will increase to 10.5 percent in 2035, depending on nuclear energy developments in Japan, China, and Viet Nam.

The increasing energy demand threatens energy security in the EAS region. Thus, potential energy saving is key to reducing energy demand and CO<sub>2</sub> emissions. This study shows energy saving potential using both the business-as-usual and alternative policy scenarios.

## Macroeconomic Impact of Coal-Fired Power Plants

By Ichiro Kutani and Venkatachalam Anbumozhi

*ERIA Research Project Report 2014-43*

Energy is critical for almost all modern economic activities and for broader human development. Yet, access to energy in middle-income countries such as India, Indonesia, and South Africa lags far behind industrialised, and even many industrialising, countries. However, economic growth in these countries has long been fed by coal, which accounts for 71 percent, 49 percent, and 94 percent of energy mix in India, Indonesia, and South Africa, respectively. To help inform these countries on formulating better policies for the sustainable development of the coal sector, a quantitative analysis is undertaken to estimate the macroeconomic impact of phasing out international public financing for coal-fired power plants (CPPs). Cumulatively, said financing accounts for about 10–30 percent of upfront investment cost of highly efficient low-polluting CPPs in these countries.

Results show that phasing out international public financial support to retrofitting existing CPPs or planned power plants will retard economic growth in the short and medium term by 0.11–0.5 percent in the countries of study. Restricted financing will further aggravate their current account balance, with India being most affected among the three, as it may go up to 33 percent in 2035. Decreased investments in CPPs will increase the average electricity price for households and industry from US\$2.5/kWh to US\$13/kWh. Given the enormous development benefits of highly efficient clean coal use, international public institutions should consider financing these initiatives as part of an overall policy to clean up the fossil fuel-based power sector.

## **Oil Stockpiling and Emergency Response Cooperation of East Asia**

**By Yoshikazu Kobayashi and Venkatachalam Anbumozhi**

*ERIA Research Project Report 2014-32*

Asia's energy security is usually defined in terms of security of oil supply, given the region's growing demand for oil, its flattening oil production, and its overdependence on regions such as the Middle East. Oil supply security can be attained through long- and short-term policy measures. Long-term measures include diversification of oil import sources, investment in alternative energy sources and technologies, and cooperation between oil producers and consumers. Short-term measures include information sharing, standby oil production, and drawdowns of emergency oil stockpiles. This study analyses the merits and demerits of oil stockpiling, which is regarded as an insurance against damage caused by any disruptions in oil supply. It also proposes a regional cooperation mechanism for oil stockpiling among ASEAN member states, Japan, and the Republic of Korea by ticketing and bilateral oil stockpiling mechanism based on market principles.

## **Scenario Analysis of Energy Security in the East Asia Summit Region**

**By Ichiro Kutani, Mitsuru Motokura, and Han Phoumin**

*ERIA Research Project Report 2014-35*

This study uses the following scenarios as key factors affecting regional energy security: supply uncertainty in the Middle East and Russia, low oil price, and use of cheap coal. In each scenario, the plausible outcomes are generated based on expert analyses. This study further proposes the following policy recommendations:

- (i) Create a resilient-energy system which means that importing countries need to have diversified fuel mix, shifting from fossil fuel consumption to more renewable energy. For exporting countries, this means becoming less dependent on oil revenue for domestic economic growth.
- (ii) The exporting country needs to have an earning margin, which is also fair enough to reflect affordability of importing countries.
- (iii) Encouraging, implementing, and accelerating the deployment of highly efficient coal-fired power generation and other environmental technologies are key to using resources effectively and abating carbon dioxide emissions, thus, contributing to energy security.

## Selecting the Best Mix of Renewable and Conventional Energy Sources for Asian Communities

By Yuki Kudoh and Venkatachalam Anbumozhi

*ERIA Research Project Report 2014-26*

The ERIA Working Group on 'Feasibility Study on the Best Mix of Renewable and Conventional Energy Sources Sustainable for Various Asian Communities' conducted a two-year project (2013-2015) to establish guidelines on energy systems using renewable energy (RE) that is sustainable for communities in various Asian countries. Best mix represents the combination of energy resources available to a target community that achieves the maximum positive impacts for the three pillars of sustainability—environmental, economic, and social indicators. The guidelines comprise the following: (i) a screening method intended to provide users of the guidelines with a method to narrow down the possible options of energy systems before embarking on the more demanding exercise of selecting the best mix; (ii) the sustainability criteria for selecting the best mix consisting of energy demand, resource availability, technology availability, environmental indicators, economic indicators, and social indicators; and (iii) operational requirements to make the RE initiatives sustainable.

Target users are local governments and other stakeholders to RE initiatives. The guidelines are expected to contribute to strategies that will enable stakeholders to establish workable RE initiatives and regional energy policies to promote sustainable RE use in Asian communities.

## **Study on Effective Power Infrastructure Investment through Power Grid Interconnections in East Asia**

**By Kazutaka Fukasawa, Ichiro Kutani, and Yanfei Li**

*ERIA Research Project Report 2014-30*

Dense cross-border power grid connections can benefit the ASEAN region through maximum use of untapped resources to generate power and stabilise power supply with low investment for power stations. This study aims to support existing initiatives—ASEAN Power Grid and Greater Mekong Subregion Power Master Plan—by quantitatively showing possible economic and environmental benefits of such power grid connections. This study selected specific routes from candidate international connection lines extracted from a FY2013 study on the same subject, and carried out preliminary planning and cost estimation for said selected routes and cross-border line per kilowatt-hour. The results indicate that although cross-border connection lines are capital intensive, the attainable benefits seem large enough to rationalise the investment. This study drew policy implications on how to resolve the remaining institutional barriers.

## **Study on the Strategic Usage of Coal in the EAS Region: A Technical Potential Map and Update of the First-Year Study**

**By Yasuo Otaka and Han Phoumin**

*ERIA Research Project Report 2014-35*

The demand for coal in East Asia Summit economies is largely due to increasing electricity demand, half of which will be met by coal-fired power generation. Coal use in generating power has vastly increased in India, and future increases are also forecasted in the ASEAN region. As coal is priced lower than petroleum and natural gas, demand for it is therefore expected to continue increasing. Considering their level of development, emerging economies will likely use low-efficient coal-fired power plants such as sub-critical technology. Thus, disseminating clean coal technology for the clean and efficient use of coal in emerging Asia is of pressing importance. To facilitate informed decision-making in choosing appropriate coal-fired power generation technologies, this study examined various technologies—ultra supercritical (USC), supercritical, and subcritical—and compared their generation cost by boiler type and coal price. The study found that USC is both economically sound and environment-friendly; yet, it needs to have an attractive financial scheme to reduce its capital cost. Results also reveal that there is potential to (i) attract a US\$1,803 billion investment from the introduction of clean coal technologies and coal mines, (ii) create jobs, and (iii) reduce carbon dioxide emissions.

## **Sustainability Assessment of Utilising Conventional and New Type Geothermal Resources in East Asia**

**By Keichi Sakaguchi and Venkatachalam Anbumozhi**

*ERIA Research Project Report 2014-41*

New methods of low-carbon energy production and use are crucial building blocks for sustainable development. Despite having a number of advantages over other forms of renewable energy production, geothermal still comprises a relatively small part of energy mix in Asian countries. To catalyse a significant shift towards the sustainable production and use of geothermal energy, new techniques, such as engineered geothermal systems, reservoir engineering, and monitoring and scale controlling, have to be introduced effectively.

This study analyses the application of such technologies in China, Indonesia, Japan, the Republic of Korea, the Philippines, Thailand, and Viet Nam. Practical guidelines and standards that have been implemented by the geothermal industry as best practice benchmarks of these techniques and that significantly improved the geothermal energy's uptake are also developed.

## **Sustainable Development of Natural Gas Market in East Asia Summit Region**

**By Ichiro Kutani and Yanfei Li**

*ERIA Research Project Report 2014-31*

The role of natural gas in energy supply is increasing in the East Asia Summit region where energy demands are steadily growing. The driving factors of this trend include the effective use of domestic resource, diversification of energy source, and reduced environmental load. At the same time, rising import dependency of natural gas supply is seen in many member countries, which is casting energy security concern.

As such, implementing necessary and appropriate policy measures that can respond to this changing natural gas supply-demand structure is needed. This study will hopefully succeed in finding the answer to this important and difficult question: What will be required to achieve the sustainable development of the natural gas market and, thus, contribute to the economic growth of the region and of countries?



## **Engendering Liveable Low-Carbon Smart Cities in ASEAN as an Inclusive Green Growth Model and Opportunities for Regional Cooperation**

**By S. Kumar**

*ERIA Discussion Paper 2015-57*

This paper discusses the status, opportunities, and modalities for engendering liveable low-carbon smart cities in ASEAN as an inclusive green growth model and the opportunities for regional cooperation. Transforming cities to make them liveable through low-carbon green growth will not only increase the comfort for city dwellers by improving liveability but also minimise greenhouse gas emissions. Initiatives have been taking place in ASEAN to encourage cities to promote green growth though these are often implemented on a project basis, which are short term and lack a sustaining impact. A well-constructed, city-level, and market-driven framework that allows for participation of all stakeholders and that has a built-in monitoring and evaluation system with well-thought-out measurable indicators to track performance would be useful to systematically transform ASEAN cities. Regional cooperation has a role in strengthening the development of low-carbon green growth in the region. The ASEAN Socio-Cultural Community will provide an excellent opportunity to model the benefits of low-carbon city development.

## **Low Carbon Green Growth in Asia: What is the Scope for Regional Cooperation?**

**By Venkatachalam Anbumozhi**

*ERIA Discussion Paper 2015-29*

This paper develops a framework to assess possible collaboration among countries pursuing low-carbon green growth since little attention has been given to how countries can work together to achieve this objective. Regional cooperation can help overcome resource constraints by providing additional resources for incremental costs, technical assistance, and policy support. The paper likewise examines several critical areas from technology to capacity building, where regional cooperation brings a more significant impact compared to a single country alone. The paper concludes with concrete policy actions to realise the potential of regional cooperation in developing Asia.

## **Market-Based Mechanisms to Promote Renewable Energy in Asia**

**By Venkatachalam Anbumozhi, Alex Bowen, and Puthusserikunnel Devasia Jose**

*ERIA Discussion Paper 2015-30*

Market-based instruments are increasingly favoured as an alternative to increase the uptake of renewable energy. Focusing on renewable energy industry and policy in Asia, this paper analyses the strengths and weaknesses of market-based approaches in the long-term interest of developing Asia. It is found that approaches such as renewable energy certificate are disadvantaged by a lack of market acceptance and strong institutional and programme support. A comparative analysis with the United Kingdom model revealed some fundamental issues around market-based approaches in Asia, underscoring the need for a policy design to address the concerns of buyers and sellers in the market.

## **Policy Effects on Total System Energy Efficiency:**

### **Comparisons of Advanced and Developing Economies in the EAS Region**

**By Phoumin Han and Venkatachalam Anbumozhi**

*ERIA Discussion Paper 2015-67*

The study attempts to assess the policy effects and investigate the patterns of Total System Energy Efficiency (TSEE) in the economies of selected ASEAN and East Asian countries. Using time series data for 1971-2011, a dynamic lag model of TSEE was formulated. TSEE in these economies is likely to be explained by both foreign direct investment (FDI) and domestic investment. Above all, the policy effect will be the prime investigation for all changes in TSEE. Results reveal that policy effects on TSEE are likely to have occurred in Japan, China, Philippines, Thailand, and India. Another key determinant of TSEE is FDI inflow as a result of which China and India have shown positive impacts. The findings led to the following key policy recommendations: China and India provided good examples of using FDI inflows to impact TSEE, and the developed economies of Japan, Republic of Korea, and Australia provided mixed outcomes in terms of how the Cebu Declaration is likely to have had an effect.

## **Renewable Energy Policies and the Solar Home System in Cambodia**

**By Han Phoumin**

*ERIA Discussion Paper 2015-64*

Only about one-third of households in Cambodia have access to commercial energy. Full rural electrification remains far from being achieved. Energy services are mainly delivered through fuel-based engines or generators to produce electricity that can then be stored in batteries, whereas biomass rather than electricity is used to power many small industrial processes. This study aims to review the current renewable energy policies in Cambodia and analyse the cost structure through the levelised cost of electricity of solar home systems compared with current electricity costs in rural areas. The results imply that promoting solar home systems would enable rural households to cut spending on electricity, thus increasing disposable incomes and the social well-being of rural communities.

## **Tracking Clean Energy Progress in ASEAN Member States and Analysis of Implementation Deficits**

**By Venkatachalam Anbumozhi and Han Phoumin**

*ERIA Discussion Paper 2015-87*

The prevalence of extreme energy poverty in several ASEAN member states calls for urgent action. This paper shows how clean energy development can be made inclusive by involving low-income households as producers, employees, and business owners. From this perspective, it also analyses how ASEAN economies are stepping up clean energy ambitions and the implementation deficits. One imperative is clean energy with positive externalities that are not factored in either the production or purchasing decisions of consumers. If non-clean energy companies or products generate negative externalities but no tax or disincentive is levied, then governments may either tax these firms or give incentives to clean energy producers. It concludes that ASEAN member states need to link the clean energy paradigm and inclusive development policies as part of the environmental fiscal reform to strengthen the foundations for the ASEAN Socio-Cultural Community.

## Power Grid Interconnections in East Asia: Investment in Several Key Projects Are Well Justified

**By Yanfei Li**

*ERIA Policy Brief 2016-01*

The recent ERIA report on 'Effective Power Infrastructure Investment through Power Grid Interconnections in East Asia' aims to support existing initiatives—the ASEAN Power Grid and Greater Mekong Subregion Power Master Plan—by quantitatively showing the possible economic and environmental benefits of such power grid interconnections. The study team selected specific candidate routes of cross-border transmission lines for further examination. They carried out the preliminary project planning and per kilowatt-hour cost estimation for the selected cross-border lines. The estimated results indicate that although these are capital-intensive projects, attainable benefits seem to be large enough to justify the investment well.