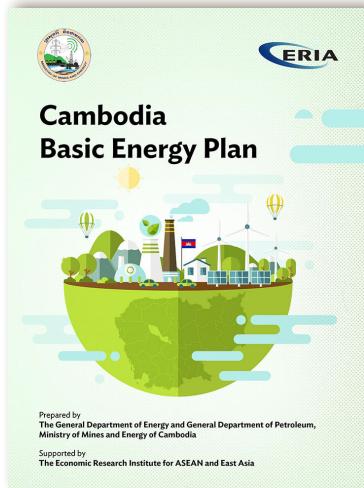




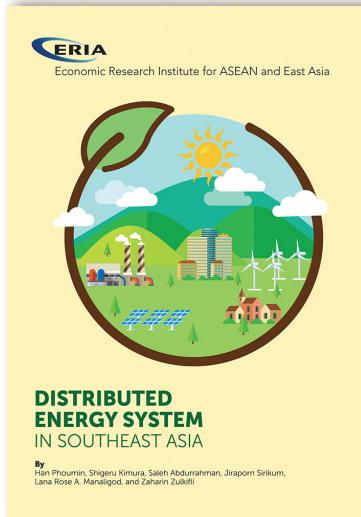
Energy



Cambodia Basic Energy Plan

*Prepared by Ministry of Mines and Energy of Cambodia
Supported The Economic Research Institute for ASEAN and East Asia*

The Cambodia Basic Energy Plan is the first ever publication of energy policy targets with numerical values, as much as possible, for each energy field such as oil, electricity supply, renewable energy, energy efficiency, energy security, and the energy outlook. This basic energy plan applies a common approach to analysing each energy field including current issues and establishing the appropriate targets for solving the issues, and provides action plans, policies, and roadmaps for achieving those targets. The plan aims for energy supply to Cambodia with affordability and accessibility, and it provides suggestions for creating a transparent energy market. The plan sets out many medium-term targets. These targets will need to be reviewed every 5 years after the government's implementation of programmes and actions aimed at achieving the targets set.

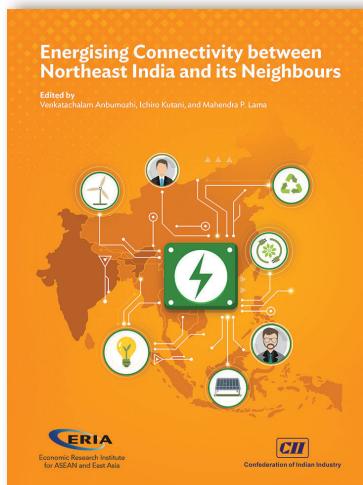


Distributed Energy System in Southeast Asia

By Han Phoumin, Shigeru Kimura, Saleh Abdurrahman, Jiraporn Sirikum, Lana Rose A. Manaligod, and Zaharin Zulkifli

The study of distributed energy systems (DES) in the Association of Southeast Asian Nations (ASEAN) highlights the potential role DES could play in enhancing electricity access and provide energy solutions as a modern energy system in response to increasing energy demand. This study assesses the overall status and policies of DES in selected ASEAN countries through a literature survey and information exchanges from meetings and conferences within the region. The study also attempted to estimate the DES-related renewable energy capacity and investment needed for the period 2013–2040. It found that DES is modern small power generation with the flexibility to provide electricity to end-users more effectively due to its advantages of lower investment cost and ease of handling compared with large national power plants.

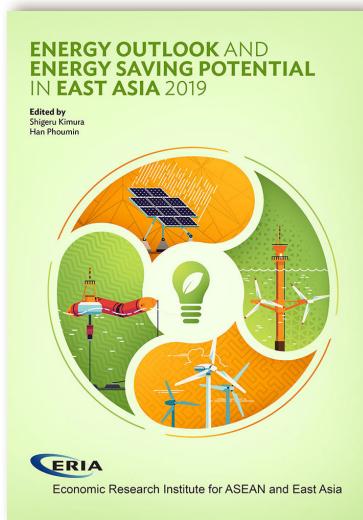
The study recommends ASEAN should carefully design friendly policies to support DES both using a top-down policy approach through use of renewable energy targets know as Renewable Portfolio Standard (RPS) and other policies such as fiscal incentives. DES could also be deployed more effectively if financial institutions were to provide support through risk-reduction mechanisms and by improving the profitability aspects of DES-related renewable investment. Finally, the study suggests that DES-related investment opportunities are large, and that DES will provide jobs and many business opportunities. DES is a modern generation system and its deployment will help to address the electricity supply shortage in ASEAN countries.



Energising Connectivity between Northeast India and its Neighbours

By Venkatachalam Anbumozhi, Ichiro Kutani, and Mahendra P. Lama

Energy is a common thread that connects multiple areas of sustainable development of countries and sub-regions in Asia. In the drive to trigger and consolidate inclusive development, the North Eastern Region (NER) of India offers great potential as an electricity trading hub. This book analyses the multiple benefits of connecting the NER with neighbouring economies through cross-border energy trade. Supply and demand analysis under different connectivity scenarios shows that not only would NER–India be able to fully utilise the economic benefits of energy connectivity, but neighbouring countries like Bangladesh, Bhutan, and Myanmar could also keep carbon emissions in check by importing reliable and cost-effective renewable energy sources. In addition, those countries can reduce the energy security risks of serious supply gaps arising in the dry seasons. To harness the untapped energy potentials and make NER a robust economic growth pole, this report recommends initiating multi-layered interdisciplinary dialogues on tariffs and consultations on investment cooperation amongst the various stakeholders and development partners, both within NER states and outside India.

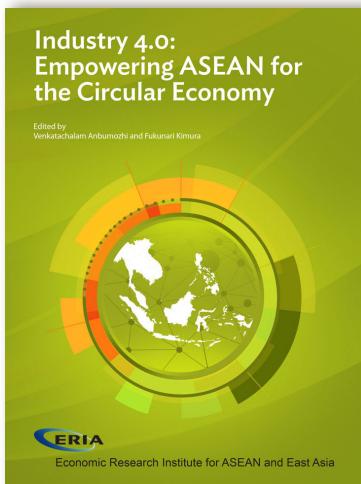


Energy Outlook and Energy Saving Potential in East Asia 2019

By Shigeru Kimura and Han Phoumin

The Economic Research Institute for ASEAN and East Asia–East Asia Summit (ERIA–EAS) Energy Outlook was updated in 2017–2018 through a revision of macro assumptions, such as economic and population growth as well as crude oil prices in the current lower price situation. This outlook also incorporates more recent information on the EAS17 member countries' energy-saving goals and action plans, and power development plans such as renewable electricity. The EAS17 Outlook 2018 includes an estimation of the investment cost required for power generation and the whole energy infrastructure, including liquefied natural gas (LNG) receiving terminals and oil refineries.

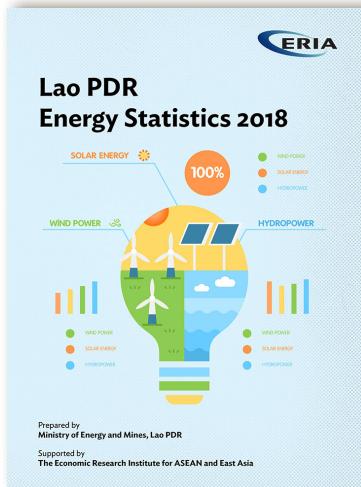
The outlook still focuses on analysing the additional energy savings that might be achieved by the individual countries above and beyond the Business-as-Usual scenario (BAU) projection. It continues to examine two scenarios – BAU and the Alternative Policy Scenario (APS) – and predicts energy supply, consumption, and CO₂ emissions from 2015 until 2040. The APS includes not only more ambitious energy-saving targets but also rapid advances in low-carbon energy technologies, especially renewable energy. The outlook also assesses the Intended Nationally Determined Contributions (INDC)/NDC reported by EAS17 countries. Energy supply security has become a top priority energy issue for the EAS17 region. Implementing Energy Efficiency and Conservation measures and increasing renewable energy shares will certainly contribute to maintaining regional energy security through the reduction of imported fossil fuel consumption and increasing the use of domestic energy. Regional energy networks, such as the Trans-ASEAN Gas Pipeline and the ASEAN Power Grid, and oil stockpiling are recommended to be set up and accelerated to maintain energy supply security. Nuclear power generation always remains an option for securing the energy supply in this region.



Industry 4.0: Empowering ASEAN for the Circular Economy

Edited by Venkatachalam Anbumozhi and Fukunari Kimura

The transition to a circular economy is a unique opportunity for fast-growing Asian economies to be resource efficient, competitive, and innovative. The circular economy aims to eradicate wasteful use of raw materials and energy from the manufacturing process as well as systematically throughout the various life cycles, and to reuse the by-products. By creating an enabling policy framework for circular economy, government can also motivate corporate leaders to achieve greater benefits for sustainable development. This book investigates the challenges and opportunities of how countries and corporations are able to strike a better balance between economic growth and resource efficiency stewardship in the context of the emerging paradigm on circular economy policy. Through analysis of a number of case studies, this book also highlights immediate and relatively easy-to-implement circular thinking based on current policy approaches and market trends.

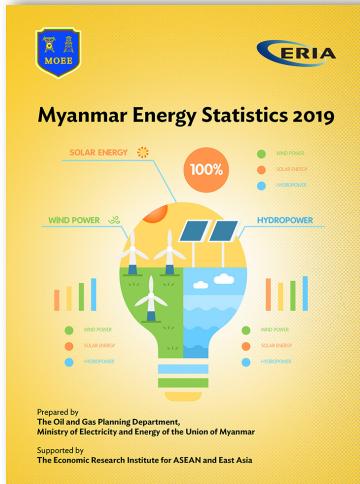


Lao PDR Energy Statistics 2018

*Prepared by Ministry of Energy Mines Lao PDR
Supported by ERIA*

Insufficient information and inadequate capacity to carry out comprehensive energy planning are identified as the main contributing factors to the current circumstances of the energy sector in Lao People's Democratic Republic (Lao PDR). To overcome such constraints, the Ministry of Energy and Mines (MEM) requested technical support from the Economic Research Institute for ASEAN and East Asia (ERIA). ERIA's president responded very positively to Lao PDR's request for support, and ERIA subsequently deployed technical staff and its expertise to support staff of MEM from Department of Energy, Policy and Planning (DEPP) to collect data and conduct analysis for the formulation of this 'Lao PDR Energy Statistics'.

This project and publication have greatly enhanced energy policy planning in Lao PDR. For the sustainability of the Project, the DEPP of the MEM will establish a systematic collection of energy data from various energy supply companies and other government agencies/corporations, so that energy data and statistics can be published continuously into the future. Having a good energy statistics will allow Lao PDR to contribute to and share data with ASEAN, International Energy Agency, Joint Organization Data Initiative (JODI), and other international forums and arenas.



Myanmar Energy Statistics 2019

*Prepared by the Oil and Gas Planning Department,
Ministry of Electricity and Energy of the Union of Myanmar*

Supported by ERIA

Insufficient information and inadequate capacity to carry out comprehensive energy planning are identified as the main contributing factors to the current circumstances of the energy sector in The Republic of the Union of Myanmar. To help overcome these constraints, the Ministry of Electricity and Energy (MEE) requested technical support from the Economic Research Institute for ASEAN and East Asia (ERIA). ERIA's president responded very positively to Myanmar's request, and ERIA has deployed technical staff and expertise to support staff of the Oil and Gas Planning Department (OGPD) of the MEE with data collection and analysis for the formulation of this 'Myanmar Energy Statistics 2019'.

This project and publication have greatly enhanced energy policy planning in Myanmar. To ensure the sustainability of the Project, the OGPD will establish a systematic collection of energy data from the electricity sector, Myanmar Oil and Gas Enterprise (MOGE), Myanmar Petrochemical Enterprise, Myanmar Petroleum Products Enterprise, and other related sectors, so energy data and statistics can continue to be published. Having good energy statistics will allow Myanmar to contribute to and share data with ASEAN, International Energy Agency, Joint Organization Data Initiative (JODI), and other international forums and organisations.

An Analysis of Alternative Vehicles' Potential and Implications for Energy Supply Industries in Indonesia

ERIA Research Project Reports 2017 No. 15

Edited by Shigeru Kimura, Shigeru Suehiro, and Naoko Doi

An increasing demand for oil is one of Indonesia's top policy priorities as it is linked to many of the country's concerns, such as the deteriorating security of its oil supply, growing fiscal imbalances, and worsening air quality. Indonesia has announced that it aims to ban sales of internal combustion engine vehicles by 2040. The country also intends for alternative vehicles to account for 20% of all vehicles produced by 2025. The impacts of these targets are expected to transform the energy industry, with significant repercussions for electricity generation, transmission, and distribution; as well as for refineries, oil product retailers, and gas stations. This study aims to support policymakers in East Asia Summit countries by analysing the shift towards electric vehicles as a way to improve the efficiency of the transport sector and mitigate oil demand concerns. A quantitative analysis was carried out to present the magnitude of the impact of this shift on energy demand, carbon dioxide emissions, and investment requirements. Moreover, a qualitative analysis comparing international vehicle incentives was carried out to support policymakers in formulating similar incentives in Indonesia.

An International Analysis of Public Acceptance of Nuclear Power

ERIA Research Project Reports 2017 No. 3

Edited by Tomoko Murakami and Venkatachalam Anbumozhi

Across countries and continents, public acceptance of nuclear power is a crucial factor for governmental establishment of a nuclear energy programme. Therefore, it is important to understand the determinants of public acceptance of nuclear power. This report examines the effects of knowledge, trust, risk, and benefit related factors on public acceptance of nuclear power in Europe, the United States, and Japan. Through field visits and interactive workshops different levels of public acceptance and related communication strategies to effect changes are identified. The report also identifies the effective communication role sub-regional and non-governmental organisations could play. The cost of generating electricity and energy security concerns appear to have the strongest positive effect on public acceptance of nuclear power.

Assessment of Electricity Storage Technology for Solar PV

ERIA Research Project Reports 2017 No. 13

Edited by Sichao Kan, Yoshiaki Shibata, Ichiro Kutani

Solar photovoltaic (PV) is one of the promising technologies to address not only climate issues but pollution and energy security concerns as well. The rapidly declining cost of solar PV systems makes it an even economically feasible choice for a country. However, it is also a fact that on-grid solar PV is beset with unresolved issues such as fluctuating power output. In terms of the choice of technologies, we already have existing alternatives such as lithium-ion batteries. In choosing the most appropriate technology, however, cost is one of the biggest considerations. This issue is well known but has not been well quantified. Hence, this study tries to quantify the necessary capacity of batteries against the output from solar PV, as well as their estimated total system costs. The cost estimates based on varied assumptions will help policymakers create better energy policies in their respective ASEAN countries.

Assessment of Readiness for Fossil Fuel Import Disruption

ERIA Research Project Reports 2017 No. 6

Edited by Tsunaeki Nakamura, Shim Jun Young, and Ichiro Kutani

Many emerging countries in the East Asia Summit (EAS) region are likely to increase dependence on imported fossil fuel supply in the future. This trend means that the energy security of these countries will become more vulnerable. Amongst various fossil fuels, liquefied natural gas (LNG) is expected to become an increasingly important energy supply source in the coming decades.

This study looks at disruption of LNG imports to investigate possible countermeasures and contingency plans in emerging EAS countries introducing LNG, such as Myanmar, the Philippines, Thailand, and Viet Nam. The report concludes with some policy recommendations. The risk assessment process of LNG import disruptions and countermeasures are generalised and summarised for countries to potentially incorporate them into national energy supply plans. In addition, recommendations for energy policy, LNG import and natural gas policy, and regional cooperation are discussed. It is stressed that countries need to set up long-term energy supply plans, which should be considered along with building resilience against LNG import disruptions.

Assessment of Necessary Innovations for Sustainable Use of Conventional and New-Type Geothermal Resources and their Benefits in East Asia

ERIA Research Project Reports 2017 No. 7

Edited by Kasumi Yasukawa and Venkatachalam Anbumozhi

Against a backdrop of rising demand for sustainable energy solutions, there is a growing convergence in the role new types of geothermal technologies such a Ground Source Heat Pump (GSHP) can play in addressing energy security, generating local employment, and mitigating climate change. This report critically examines technical, social, policy, legal, and fiscal barriers to geo-thermal power production, direct use, and GSHP, and the estimated benefits in China, Indonesia, Japan, the Republic of Korea, Malaysia, the Philippines, Thailand, and Viet Nam. Amongst the five types of barriers, it was found that technical and policy barriers dominate the Indonesian geothermal sector, while fiscal barriers are prevalent in the Philippines. Social barriers remain a challenge in Japan regarding direct use and GSHP. Three main areas are recommended for immediate policy action. One, clarify precisely the role of each state entity in providing critical incentives and concessions at three different stages of geothermal power development. Second, the tariff setting and tax holidays for geothermal, direct use, and GSHP should be seen not as a one-time event, but as a process – based on a published methodology and stakeholder consultation. Third, the inability to develop new resources is often due to lack of information on the reserve capacity. More spending on research and development is recommended.

Comparative Analysis of Power Prices in the Philippines and Selected ASEAN Countries

ERIA Research Project Reports 2017 No. 12

Edited by Emiri Yokota and Ichiro Kutani

This study compares the electricity supply costs in the Philippines with that in three ASEAN member countries – Indonesia, Malaysia, and Thailand. The study presents seven recommendations pertaining to the Philippines' electricity supply chain, ranging from fuel supply to electricity distribution.

Recommendations to 'shift back to market-based load dispatch', 'adopt thermal efficiency standards for power generation', and 'create good business environment to reduce WACC' are identified with larger effects on cost reduction than the other recommendations. Thus, it is suggested that promotions should focus on the most impactful policy recommendations.

Electricity Futures in the Greater Mekong Subregion: Towards Sustainability, Inclusive Development, and Conflict Resolution

ERIA Research Project Reports 2017 No. 8

Edited by Hisashi Yoshikawa and Venkatachalam Anbumozhi

International energy markets are seeing a wave of innovations and the rise of new ideas and values, and the emerging economies of the Mekong sub-region should not be left behind. This report focuses on the electricity future of Myanmar and the Greater Mekong Subregion, emphasising rural electrification through renewable power generation by means of mini-grids as well as central-grid capacity expansion through sustainable power options. It analyses the current energy situation, including constraints in the region during this transitional stage, and proposes tangible policy recommendations that work towards energy security, environmental protection, and climate change mitigation. It recommends Myanmar takes advantage of the falling cost of solar electricity by making it a strategic priority in its power development plan; devises appropriate financial support schemes and power purchase agreements to be provided to mini-grid developers as well as operators; actively participates in the regional power grid to expand its access to electricity and meet rising urban power demand; and minimises environmental and societal risks.

Formulation of Temburong Eco Town Master Plan in Brunei Darussalam

ERIA Research Project Reports 2017 No. 11

By Nikken Sekkei Civil Engineering Ltd

Brunei Darussalam's 'Wawasan Brunei 2035' vision assumes a sustainable society for the future and advocates a departure from oil dependence, development of human resources, creation of new industry, and development of small and medium-sized enterprises. In Temburong district, tourism will increase with the opening of the new bridge from Bandar Seri Begawan district in 2020. To ensure compatibility between development and nature conservation, this project sets vision of a carbon-neutral society for wildlife preservation in Borneo. It proposes strategic development throughout the following approaches or key concepts: a) Living lab: diverse community, creative work and life style; b) Carbon-neutral: renewable energy, sustainable mobility system, sustainable architecture/agroforestry, small economy; c) Learning tourism, featuring Temburong and Borneo, and a Showcase of Smart Tech. This study proposes to improve the internal road and new bridge connecting the two areas divided by the Temburong River, and to make the road in front of the current commercial area along the river a pedestrian priority area to turn it into a bustling riverfront. Labu Estate will have university, R&D, hotel, convention, tourism centre, and residential functions as the centre of education, R&D, and tourism. By clustering universities, R&D, and houses, the formation of a diverse community that fosters interaction and innovation is proposed.

Liquefied Natural Gas Demand in Asia

ERIA Research Project Reports 2017 No. 5

Edited by Yoshikazu Kobayashi and Yanfei Li

The global liquefied natural gas (LNG) market has been undergoing sustained and fundamental transformation since 2010. A combination of forces led by the revolution in shale gas production in the United States, rising global LNG use, diverging natural gas and crude oil prices, and demand shifts from traditional Northeast Asian countries (Japan, Republic of Korea, and Taiwan) to China, Southeast Asia, and South Asia present new challenges and opportunities for producing and consuming regions. The LNG market is already experiencing rising competition from the United States and Australia in a market traditionally reliant on suppliers from Asia and the Middle East. While new competitive forces present challenges to producers, the development of a broad-based liquid and flexible LNG market can deliver substantial economic, environmental, and energy security benefits throughout the region. The challenge for policymakers in securing the widespread benefits of rising supplies of LNG is to transform potential LNG demand in Asia into real demand. This study delves deeply into these challenges and draws policy implications for supporting a growing market for LNG in this region.

Natural Gas Master Plan for Myanmar

ERIA Research Project Reports 2017 No. 17

Edited by Yoshikazu Kobayashi and Han Phoumin

Natural gas will play very important role in Myanmar in the future. Natural gas demand in Myanmar is forecasted to grow from 457 million cubic feet per day (mmcf) in 2017 to 1,097 mmcf in 2040. Although demand from the power sector will continue to lead demand growth in the country, demand from the industrial sector and (after 2030) the residential sector is also expected to grow significantly. As the country's dependence on natural gas grows, its domestic infrastructure will need to be upgraded. The pipeline connecting Shwedaung and Magway in particular needs to be renovated urgently. Gaps between demand and supply are expected to appear in Myanmar's natural gas balance around 2023. Importing LNG will likely be the most realistic option to fill in the gaps and deploying floating storage and regasification units will make it relatively easy to import LNG into Myanmar. The Government of Myanmar should continue to play a pivotal role in developing the natural gas market. Policy recommendations to the Myanmar government are: 1) provide policy support to create demand, 2) encourage domestic upstream development, 3) enhance the resilience of the pipeline network, 4) reform the energy pricing system, 5) manage quality issues with natural gas, and 6) grow human capital.

Potential of Oil Stockpiling at Oil Terminals in Southeast Asia

ERIA Research Project Reports 2017 No. 4

By Shigeru Kimura and Tetsuo Morikawa

Oil demand in Southeast Asia has increased by 3% per year since 2000, which is faster than the world average, and regional oil production is struggling to keep up. This has resulted in dependency on oil imports from outside the region, which reached 44% in 2015. Import dependency is expected to be higher in the long term, raising concerns about oil supply security in Southeast Asia. Many Southeast Asian countries have been working on expanding oil stockpiling and introducing government stockpiling. While some countries have significant oil stockpiles, the stockpile in Southeast Asian countries is generally lower than the International Energy Agency (IEA) standard. A joint stockpiling scheme in the region is an even more distant target. This study analyses the current status and future prospects of oil stockpiling in selected Association of Southeast Asian Nations (ASEAN) countries with considerable demand size and geographical proximity – Indonesia, Malaysia, Singapore, and Thailand. This study firstly describes the oil demand, supply, governance, and industry in these four countries. It then examines the current status of oil stockpiling in these countries and analyses various oil stockpiling options for the future.

Seeking Optimal Solutions for Delivering Liquefied Natural Gas to Mid-sized and Large Islands in the Philippines

ERIA Research Project Reports 2017 No. 14

Edited by Shigeru Kimura

The Philippines consists of many small, medium-sized, and large islands and there is large potential to increase electricity demand in future. The country's main power source is coal, followed by domestic natural gas produced by the Malampaya gas field. Imports of liquefied natural gas (LNG) will increase due to depletion of this gas field and a shift in power generation from coal to gas. It is essential, therefore, to devise an economic system for delivery of small and medium-scale LNG from primary to subordinate (secondary and tertiary) terminals located near the islands' gas-fired power plants (GPPs). The following approaches are applied to determine the optimal small and medium-scale LNG delivery solutions: 1) Estimation of electricity demand at the provincial level in 2040 based on the Philippines' Power Development Plan; 2) Estimation of LNG consumption and location of GPPs; 3) Optimal (minimum-cost) LNG delivery from a primary terminal to a subordinate terminal near GPPs using the linear programming model; 4) Based on the delivery results from the linear programming model, computerised simulation of LNG delivery using a dynamic simulation model under assumptions including LNG barge operation, tank size of the subordinate terminals, and in the case of typhoon strike.

Simulation Study on Energy Mix for Power Generation in Temburong Eco Town

ERIA Research Project Reports 2017 No. 2

Edited by Shigeru Kimura

The eco town development plan in Temburong district, Brunei Darussalam, is about applying energy efficient technologies to achieve lower energy demand, especially electricity, to be used by buildings, and renewable energy such as solar photovoltaic (PV). Using a computer simulation model, this study seeks to determine appropriate capacities for both solar PV and electricity storage based on solar radiation data in Brunei and estimated electricity demand of commercial buildings for the eco town in Temburong district. There is already a diesel power plant in Temburong that installs 4 units x 3 megawatts (MW) power generation system, which provides electricity to subscribers in the area. In addition, about 6MW solar PV system will be installed soon. After installation of the system, electricity generation by the diesel station will be reduced. However, once new buildings are constructed according to the Temburong district development plan, more solar PV will be needed. In 2015 and 2016, ERIA collected climate data – solar radiation and rainfall data – in Brunei Darussalam to check intermittency caused by PV system installation. ERIA applied a dynamic simulation approach to check the intermittency under the combination of diesel power generation, solar PV system, and electricity storage. After the simulation, ERIA extracted the best capacity mix of diesel power, solar PV, and storage at minimum cost.

Sustainable Development of the Transport Sector: Malaysia

ERIA Research Project Reports 2017 No. 10

Edited by Hiroshi Kondo and Ichiro Kutani

Malaysia intends to reduce its greenhouse gas emissions intensity of gross national product by 35%, and by an additional 10% under certain conditions by 2030 from 2005 figures. Since the transport sector is the second-largest CO₂ emitter in the country (28% of the total), and since car ownership and thereby CO₂ emission due to gasoline and diesel combustion is expected to rise, it is crucial to implement an appropriate policy to reduce CO₂ emission in this sector. This report conducts a scenario analysis to show that the deployment of energy-efficient vehicles (EEV scenario) has the larger potential to reduce CO₂ emissions, followed by electric vehicles (EV scenario), public transport (PT scenario), and biofuels (bio scenario). Specifically, the study discusses two approaches to reducing CO₂ emission in the transport sector – (1) maximise use of public transport and (2) deploy low-emission vehicles.

Study of Renewable Energy Potential and Its Effective Usage in East Asia Summit Countries

ERIA Research Project Reports 2017 No. 9

By Makoto Toba, Shinichi Goto, Shoichi Ichikawa, Nuwong Chollacoop, and Venkatachalam Anbumozhi

East Asian countries are actively promoting the introduction of first-generation biofuels such as bioethanol and biodiesel, but are constrained by several feedstock and production factors. To reduce the import of crude oil and energy consumption in the transportation sector, overarching action such as production of next-generation biofuels from nonconventional resources, improvement of fuel efficiency of vehicles, and maintenance of road infrastructure needs to be taken. Against this background, the report estimates the potential of a diversified transportation energy mix, analyses the techno-economic feasibility of next-generation biofuels, and scrutinises the advances that need to be made in the use of bio-methanol as a mainstream energy carrier. Country-specific recommendations on the introduction of alternate biofuels, fuel efficiency standards, and regional trade are provided for Indonesia, Thailand, Malaysia, and the Philippines.

Vehicle Recycling in the ASEAN and other Asian Countries

ERIA Research Project Reports 2017 No. 16

Edited by Michikazu Kojima

It is predicted that about 2.4 million motor vehicles will have been discarded in the Association of Southeast Asian Nations (ASEAN) from 2015 to 2020. End-of-Life Vehicle (ELV) recycling and disposal are expected to soon become more serious challenges for Asian countries. Hence, the development of the vehicle recycling system, including the development of industrial infrastructures such as the recycling facility of ELVs, is becoming a pressing issue. Simultaneously, a proper institutional system for vehicle recycling should be established. This study aimed to identify the current status and challenges of ELV recycling in Asian countries and to propose policy recommendations to address these problems. Research target countries under this study include ASEAN countries such as Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Thailand, and Viet Nam, and major Asian countries such as India and Japan. The study included a literature review, interviews with stakeholders, and field surveys.

Two working group meetings with specialists from research target countries were held to review the results of the study, discuss desirable policy recommendations, and share feedback on the status, challenges, and policy direction of ELV recycling and disposal systems.