

EXECUTIVE SUMMARY

CHAPTER 1

For the EAS (East Asia Summit) countries, steady large-scale power source development in an economically efficient way is an urgent task. It may be possible to optimize or improve the efficiency of power infrastructure investments in terms of not only an economic efficiency but also a stability of electricity supply and reduction of the environmental burden if we consider ways of developing power infrastructures (power plant and grids) on a pan-regional basis.

This study will analyze the possibility and benefits of the pan-regional optimization of power infrastructure investments in the EAS region. By doing so, the study is intended to accelerate or support the existing initiatives such as the Asian Development Bank (ADB) and HAPUA (the Heads of ASEAN power Utilities/Authorities).

CHAPTER 2

This chapter presents an overview of power sector and their power infrastructure development plan toward the time frame of 2030 in 13 countries in East Asia region, namely Bangladesh, Brunei Darussalam, Cambodia, China [Yunnan & Guangxi], India [North-East], Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Vietnam. The information shown in this chapter will be utilized as input data for a simulation analysis in Chapter 4.

CHAPTER 3

This chapter summarizes existing initiatives by ADB and HAPUA for the power

infrastructure development in the East Asia region.

The GMS (Greater Mekong Sub-region) program is an international development plan with the ADB as its secretariat. It was launched in October 1992 through a ministerial meeting of six countries of the Mekong River basin, Thailand, Lao PDR, Cambodia, Myanmar, Vietnam, and China. Some goals of the GMS countries are to establish international power trading in order to increase mutual economic and technical benefits, and to have well-balanced power plants through regional energy sources that enable power transport spanning countries throughout the region.

On the other hand, the ASEAN Power Grid concept in the electric power sector was adopted at the ASEAN summit held in Kuala Lumpur, Malaysia, in December 1997. The secretariat of the ASEAN Power Grid is HAPUA. It was confirmed that regional power interconnection can be promoted through information exchange and technology introduction for the planning, construction, and operation of power grids and through basic research on power interchange.

CHAPTER 4

This chapter presents a result of quantitative analysis of power supply mix in 13 countries in East Asia.

A linear programming (LP) model was developed in order to examine the possibility to optimize power supply mix in the East Asia region. The preconditions (input data) for this LP model are each country's power demand, the cross-border trading capacity of grid, power supply capacity by fuel, generating costs by power source, and CO₂ emission factor by power source. The objective function is cost minimization under a certain limitation of CO₂ emission.

Analysis said that if the HAPUA's grid plan achieved, region can save USD 12,142 million in 2020 at the maximum. In addition, if the cross-border trading capacity will expanded to double, region can save USD 17,410 in 2030 at the maximum. These calculated saving will be differ depends on CO₂ emission allowance. If an allowance is large enough to permit cheap but dirty coal fired power plant in high operating rate, economical benefit will be maximized. However, if an allowance is smaller, much high cost natural gas fired power plant will alternate coal to reduce economical benefit, while environmental benefit will gained.

CHAPTER 5

The following things have become clear through this study.

- Not all power demand can be met through a single form of energy. Therefore, a mix that appropriately combines multiple power sources is essential.
- Power interchange through international interconnected lines will bring changes to the entire power source mixes of the countries and region.
- Total investment in power sources can be reduced for the entire region through power interchange via international interconnected grid networks. The total investment reduction effect will be largest under lax regulations for CO₂ emissions.
- Through power interchange, countries can alleviate discrepancies between power demand and energy resources for power generation. This contributes to greater energy security throughout the region.
- In countries and regions where domestic power grids themselves are insufficient, international interconnected grid networks can be expected to supplement them. On the other hand, it is conceivable that in some cases, upgrading the domestic power grid is necessary in order to maximize utilization of energy resources that

exist in a region.

In light of the above outcomes, the following points should be borne in mind for future power source development.

- Development of potential resources for power generation shall be quick. In a development, it is necessary to consider the roles of each power source for the base, middle, and peak load purpose and to combine them appropriately.
 - Develop hydropower, which is economical and environmentally-friendly (except during construction), and for which there is still much untapped resources in the region.
 - Develop coal-fired power plant, which is outstanding in terms of economy and amount of resources, especially in China, Indonesia and Vietnam.
 - Develop renewable energy that is relatively economical, such as geothermal and biomass, except solar power.
- Energy utilization that ignores environmental impact is impossible. For power generation as well, initiatives that move towards cleaner energy utilization should be strengthened.
 - Promote higher efficiency in coal-fired power generation. Reducing the emission in flue gas through higher efficiency will alleviate the sole disadvantage of coal utilization.
 - Expanded use of natural gas with its outstanding environmental performances is desirable from the perspective of reducing environmental impact, but natural-gas-fired power plant is less economical than coal-fired.

It is, therefore, necessary to mitigate the economic disadvantage of natural-gas-fired power plant by working to lower the procurement cost as well as price of natural gas.