Chapter 1

Introduction

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Chapter 1

Introduction

1. Background and objectives of the study

Reserved underground in many ASEAN member countries, including Indonesia, coal allows power generation at a lower cost than other fuels. In the Association of Southeast Asian Nations (ASEAN) member countries, power consumption has increased along with their economic growth, and further increases in coal-fired power generation are expected. Coal is one of the cheapest power generation fuels in terms of cost, but its demerit is that it emits more air pollutants harmful to human health than other fuels. For this reason, the countries using coal-fired power generation have enacted standards to regulate air pollutants from coal-fired power plants. The bottom line is whether a management system has been established and whether it is functioning properly for monitoring the emission standards.

This study analyses essential elements to increase the effectiveness of emission control regulations for coal-fired power plants in developing countries in ASEAN. In the power sector, air pollution concerns can become a barrier for developing necessary power stations. As such, the appropriate implementation of air pollution control regulations is crucial for the sustainable development of the economy, and hence the study will highlight it.

The study also made a comparative analysis with selected Organisation of Economic Co-operation and Development (OECD) countries. The analysis is expected to derive policy recommendations for ASEAN countries to improve their implementation mechanisms.

The study is consistent with the strategic themes in the 'ASEAN Economic Community (AEC) Blue Print 2025' and its subordinate paper, 'ASEAN Plan of Action for Energy Cooperation (APAEC) 2016–2025 Phase 1', and contributes to the 'Coal and Clean Coal Technology,' study as it dealt with emissions from power plants. In addition, the study is consistent with the goal to create a sustainable society in the 'ASEAN Socio-Cultural Community (ASCC) Blueprint 2025', corresponding to the principles of C.1. Conservation and Sustainable Management of Biodiversity and Natural Resources, C.2. Environmental Sustainable Cities, C.3. Sustainable Climate, and C.4. Sustainable Consumption and Production.

2. Study method

(A) Survey of the Status of Emission Regulations

The study surveyed the status of regulation and execution systems relevant to air pollution (SOx, NOx, and PM) from coal-fired power plants (CPP). The survey included:

- Existence or non-existence of regulations (central and/or municipal government)

The following items will be only applied to central government regulations

- Emission standards
- Process of regulation development
- Management system of power company (measurement, record, verification, report)
- Management system of regulator (organization, human resources, checking)
- How to enforce (authorization, order, penalty)
- Support for power company (technical guidelines, finance, education)

(B) Comparative Analysis with Developed Country

The study conducted a comparative analysis of regulations and systems in developed countries such as Australia, Europe, Japan, and the United States. The subjected country and/or region will be selected through a preliminary survey. The study will identify the advantages and disadvantages of existing regulations and systems in ASEAN countries.

Based on each country's situation and/or standards, the study team will propose 'common environmental standards for the coal-fired power generation in the region'.

(C) Derive Policy Recommendations

The study derived policy recommendations for improving the capability of a country to implement and execute air pollution control regulations for CPP.

(D) Set Up Expert Working Group

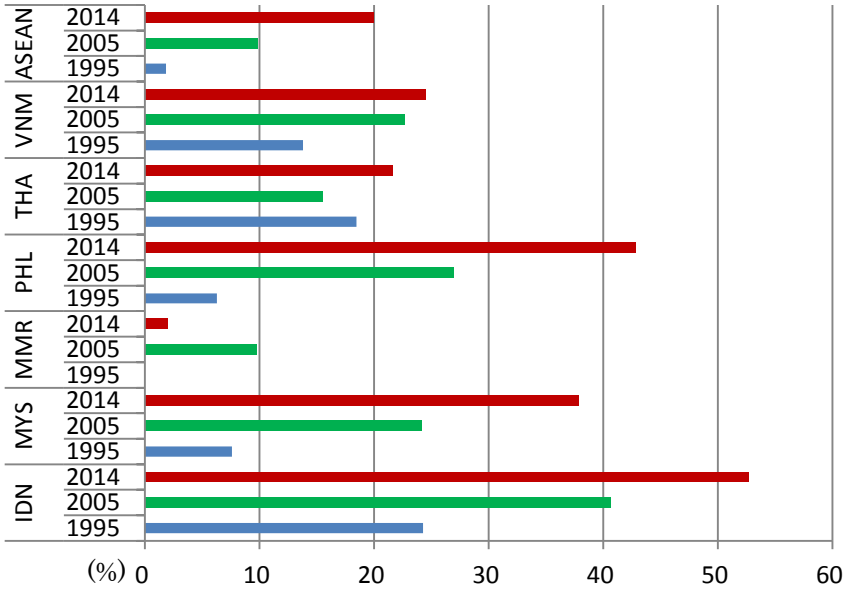
The study was set up an expert working group to discuss the issue and to share the results, hence expects to contribute to improve the effectiveness of policy implementation and execution in the region.

3. Focus area of fiscal year (FY) 2016 study: survey

(A) Why focus on air pollution from CPP?

Figure 1 shows the share of coal-fired power generation in total power generation in selected ASEAN countries. Except for Myanmar, the share of coal-fired power generation increased from 1995 to 2005 and 2014.

Figure 1: Share of coal-fired power generation in selected ASEAN countries



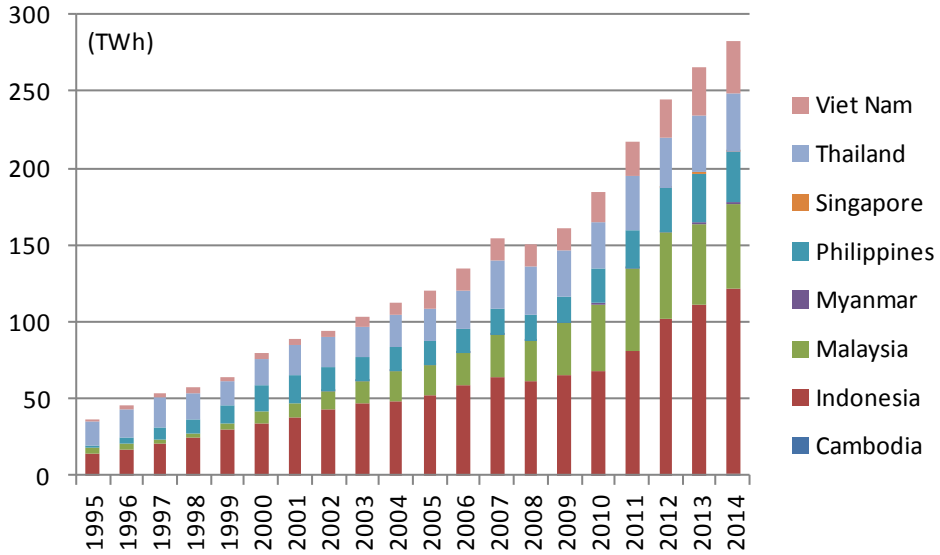
ASEAN = Association of Southeast Asian Nations, IDN = Indonesia, MMR = Myanmar, MYS = Malaysia, PHL = Philippines, THA = Thailand, VNM = Viet Nam.

Source: International Energy Agency (2016), World Energy Balances.

As a result of the increased share of coal-fired power generation, output increased greatly as shown in Figure 2. In the entire ASEAN, from 1995 to 2014 the annual average increase rate of total power generation output was 14%, but that of coal-fired power generation was 29%.

In ASEAN, coal is an important fuel for power generation and its consumption is expected to increase along with higher electricity demand. From a viewpoint of energy security, the use of coal enhances energy self-efficiency in ASEAN because there are coal export countries such as Indonesia.

Figure 2: Coal-fired power generation in ASEAN



Notes: Lao PDR is excluded due to no data availability. Brunei Darussalam has no coal-fired power generation.

TWh = terawatt hours.

Source: International Energy Agency (2016). World Energy Balances.

(B) Necessity to regulate harmful air pollutants

The major harmful air pollutants from coal-fired power plants are sulphur oxides (SOx), nitrogen oxides (NOx), and particulate matter (PM). SOx, NOx, and PM are harmful as follows.[1]

a) Sulphur dioxide (SOx)

Short-term exposure to sulphur dioxide (SO_2) can harm the human respiratory system and make breathing difficult. Children, the elderly, and those who suffer from asthma are particularly sensitive to the effects of SO_2.

Emissions that lead to high concentrations of SO_2 in the air also lead to the formation of other sulphur oxides. SOx can react with other compounds in the atmosphere to form small particles. These particles contribute to PM pollution: particles can penetrate deeply into sensitive parts of the lungs and cause additional health problems.

At high concentrations, gaseous SOx can harm trees and plants by damaging foliage and decreasing growth.

SO_2 and other sulphur oxides can contribute to acid rain that can harm sensitive ecosystems.

SO_2 and other sulphur oxides can react with other compounds in the atmosphere to form fine particles that reduce visibility (haze).

The deposition of particles can also stain and damage stone and other materials, including culturally important objects such as statues and monuments.

b) Nitrogen dioxide (NOx)

Breathing air with a high concentration of nitrogen dioxide (NO_2) can irritate airways in the human respiratory system. Such exposure over short periods can aggravate respiratory diseases, particularly asthma, leading to respiratory symptoms (such as coughing, wheezing, or difficulty breathing), hospital admissions, and visits to emergency rooms. Longer exposure to elevated concentrations of NO_2 may contribute to the development of asthma and potentially increase susceptibility to respiratory infections. People with asthma, as well as children and the elderly are generally at greater health risks from the effects of NO_2.

NO_2 along with other NOx react with other chemicals in the air to form both particulate matter and ozone. These are also harmful when inhaled due to the effects on the respiratory system.

[1] Source: US Environmental Protection Agency (EPA).

NO_2 and other NOx interact with water, oxygen, and other chemicals in the atmosphere to form acid rain. Acid rain harms sensitive ecosystems such as lakes and forests.

The nitrate particles that result from NOx make the air hazy and reduce visibility. This affects the many national parks that are visited for the view. NOx also contributes to the formation of smog and acid rain which are harmful for health.

NOx in the atmosphere contributes to nutrient pollution in coastal waters.

c) Particulate matter (PM)

Particulate matter includes:

– PM_{10}: inhalable particles, with diameters that are 10 micrometres and smaller; and

– $PM_{2.5}$: fine inhalable particles, with diameters that are 2.5 micrometres and smaller.

Particulate matter contains microscopic solids or liquid droplets that are so small that they can be inhaled and cause serious health problems. Particles less than 10 micrometres in diameter pose the greatest problems, because they can get deep into people's lungs, and some may even get into the bloodstream.

Fine particles ($PM_{2.5}$) are the main cause of reduced visibility (haze).

4. Working Group activities in fiscal year 2016

To conduct the study, a Working Group (WG) was organized. The WG members consist of experts from the region and a research team as a secretariat from The Institute for Energy Economics, Japan (IEEJ).

In fiscal year (FY)2016, a WG meeting was held in February 2017 in Bangkok, Thailand.

First, the meeting explained this study. and proposed two study items. One is financing because existing and new coal-fired power plants require huge investment for environmental measures. The other is technical aspects because highly-efficient facilities are required for the environmental measures. Since analysis results become complicated if multiple elements are contained, it was acknowledged that FY2016 should focus only on the management system, with the other elements as topics for the next fiscal year onwards. There were also concerns that the tightening of emission

standards might add to the cost of coal-fired power plants, which would cause the loss of cost competitiveness in comparison with other fuels. It was also proposed that the minimum emission standards should be compiled by ASEAN and India.

The management system in the selected OECD countries was then explained. The major opinions are as follows. The technology selection assistance provided by the United States Environmental Protection Agency is a good reference. Japan's method of phased tightening of control in accordance with the operators' capability to cope and technological advancement is valuable information for the ASEAN countries. Also, there were questions on the environmental control cost recovery methods, specific procedures for suspension of operation, and the situation of monitoring posts as with the Japanese cases.

Finally, there were presentations from the member countries, followed by discussions. Major discussion points included the levels of emission standards, emission monitoring systems, relations between the central government and local governments, and the price level of coal and natural gas for power generation to provide competition, among others.