2. Issues on energy, environment, food and water resource

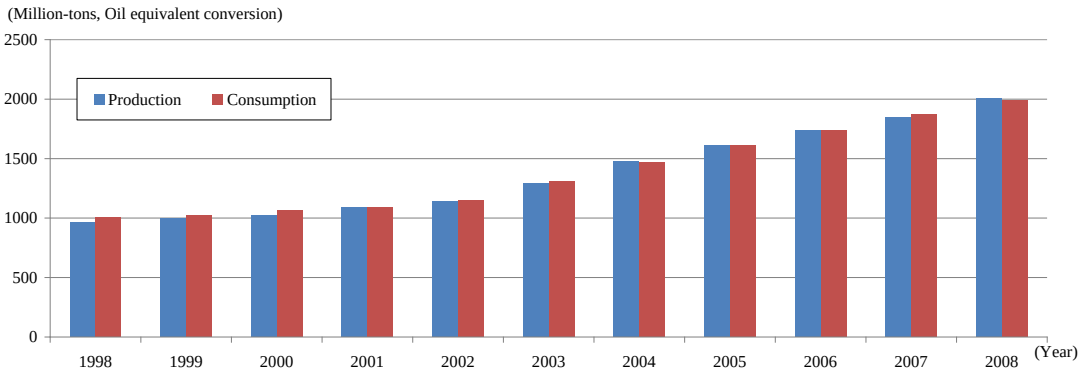
(1) Energy resource issue

The demand and supply status of primary energy that includes coal, oil and natural gas in Asia shows that demand and supply for coal matches in the region (see Figure 2-5-2-1) while about 70% of oil consumption (see Figure 2-5-2-2) and about 20% of natural gas consumption (as of 2008) is satisfied with imports (see Figure 2-5-2-3).

In emerging countries such as China and India, the demand for fossil fuel including oil, coal and natural gas is expected to grow further along with the future economic growth. IEA[2] estimates that the demand for primary energy would double from 1,970Mtoe[3] to 3,827Mtoe in China and 595Mtoe to 1,287Mtoe in India from 2007 to 2030 (see Figure 2-5-2-4).

As for energy-derived carbon dioxide emission, the increase of the emission along with the consumption of fossil energy spurred by the rapid economic growth is remarkable in Asian emerging countries (see Figure 2-5-2-5). Particularly China has become the world largest energy-derived carbon dioxide emitting country superseding the U.S in 2007. Its emission is forecasted to reach 11,615Mt which is larger than the combined volume of North America, EU and Japan and equivalent to about 30% of world total[4] in 2030[5].

Figure 2-5-2-1: Trends in Production/Consumption of Coal in Asia



Note: Values for consumption are total of consumption in Australia, New Zealand, China, India, Japan, Malaysia, Philippines, Singapore, South Korea and Thailand. Values for production are total of consumption in Australia, New Zealand, China, India, Indonesia, Japan, Thailand, South Korea and Vietnam.
Reference: It was created according to "BP Statistical Review of World Energy June 2009" BP statistics.

Figure 2-5-2-2: Trends in Production/Consumption of Oil in Asia

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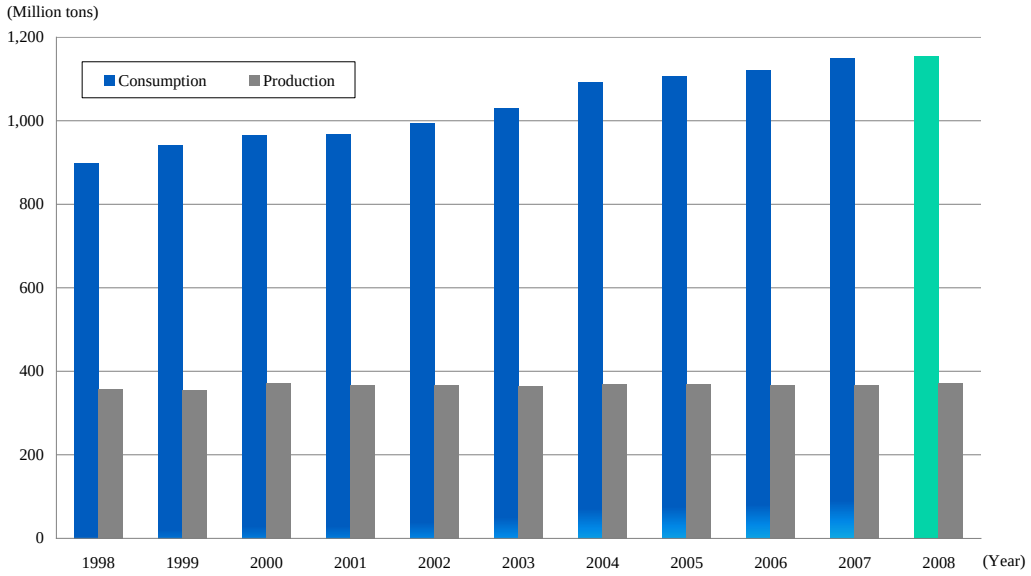
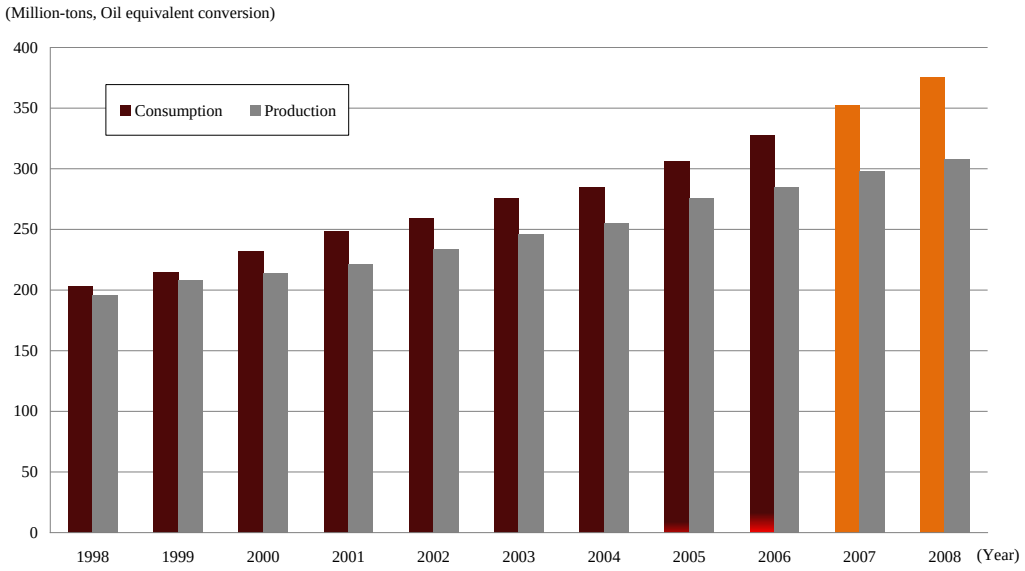
2 IEA "World Energy Outlook 2009"
3 Energy equivalent to 1 million ton of oil per unit
4 World CO2 emissions in 2030 are estimated to be 40,266Mt. (IEA "World Economy Outlook 2009")
5 The forecast is based on reference scenario by IEA "World Economy Outlook 2009" which doesn't assume any additional measures.



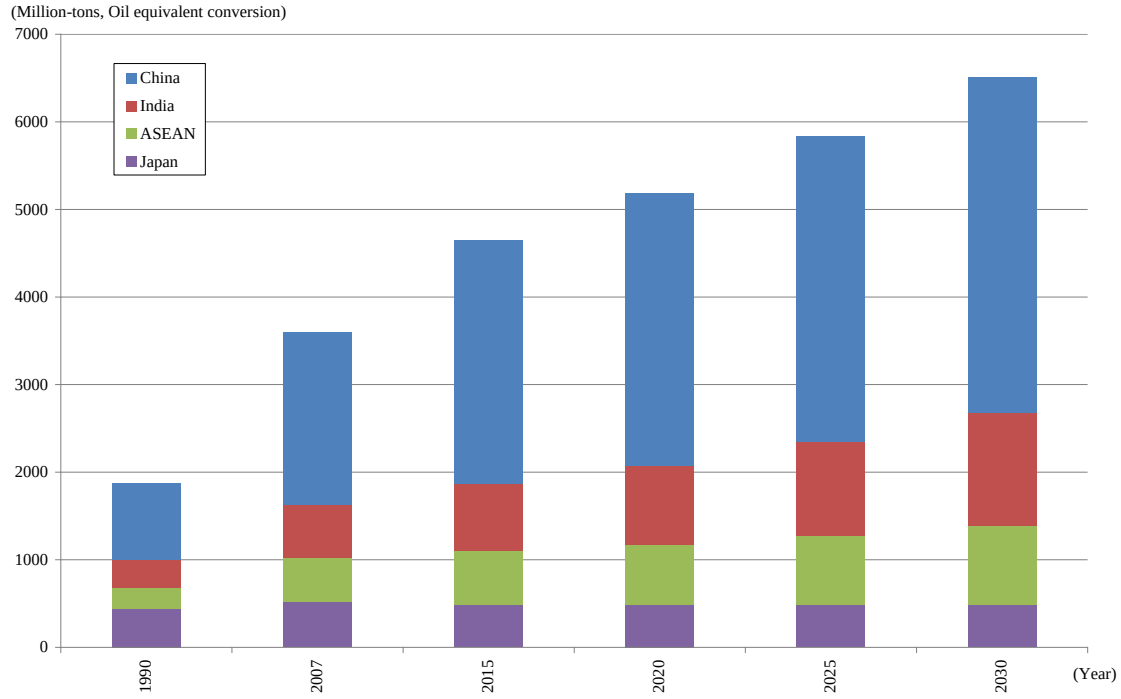
Note: Values for consumption are total of consumption in Australia, New Zealand, China, India, Indonesia, Japan, Malaysia, Philippines, Singapore, South Korea and Thailand. Values for production are total of consumption in Australia, Brunei, China, India, Indonesia, Malaysia, Thailand and Vietnam.
Reference: It was created according to "BP Statistical Review of World Energy June 2009" BP statistics.

Figure 2-5-2-3: Trends in Production/Consumption of Natural Gas in Asia



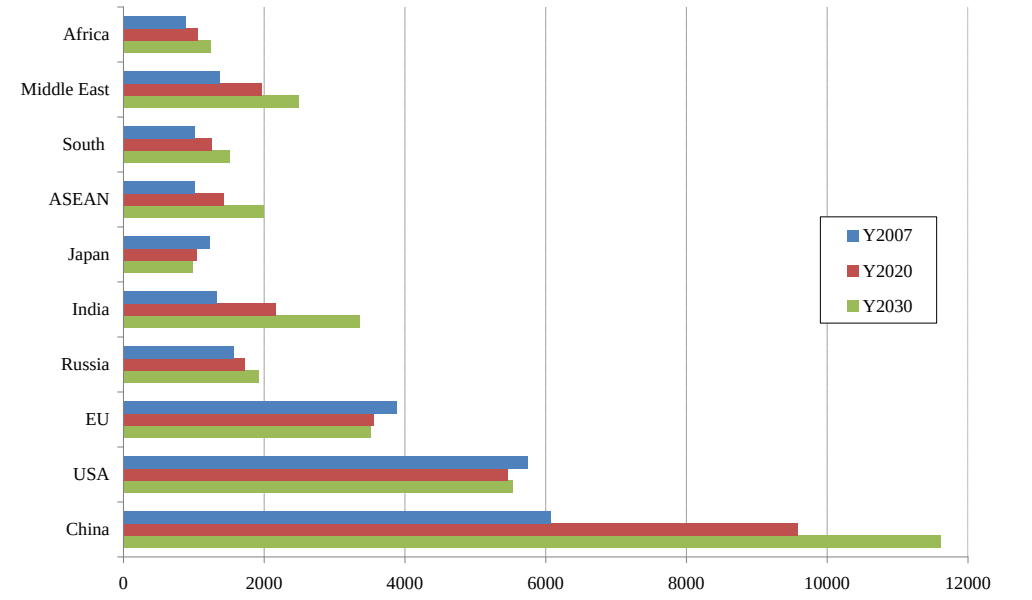
Note: Values for consumption are total of consumption in Australia, New Zealand, China, India, Indonesia, Japan, Malaysia, Philippines, Singapore, South Korea and Thailand. Values for production are total of consumption in Australia, New Zealand, Brunei, China, India, Indonesia, Myanmar, Thailand and Vietnam.
Reference: It was created according to "BP Statistical Review of World Energy June 2009" BP statistics.

Figure 2-5-2-4: Trends in Production/Consumption of Primary Energy in Japan, China, ASEAN and India



Reference: It is created according to "World Energy Outlook 2009" IEA.

Figure 2-5-2-5: Estimated CO2 Emissions by County/Region



Reference: It is created according to "World Energy Outlook 2009" IEA.

In addition, overall energy consumption efficiency is low in emerging countries including China which has large shares of primary energy consumption. As for primary energy supply per GDP, China of which consumption is high is 7.6-fold of the supply per GDP of Japan and India's figure is 7.8 times larger than that of Japan marking a huge gap (see Figure 2-5-2-6). Japan is one of the most energy-efficient countries in the world and expected to contribute for the improvement of energy efficiency of Asian emerging countries utilizing its excellent energy conservation technology through

the frameworks such as Asia-Pacific partnership on Clean Development and Climate (APP) and Japan-China Energy Conservation Forum.

(2) Environment problem

Rapid industrialization and urbanization have been simultaneously causing complex environment problems such as industrial pollution, pollution by automobile and waste problem.

(A) Air contamination

In Asia, a large volume of air-contaminating substitutes including sulfur dioxide (SO_2), nitrogen oxide (NO_X) and volatile organic compounds (VOCs) are released into the air from various sources including the combustion of fossil fuel through the operation of thermal power plants, factories and automobiles, the combustion of coal at home, agricultural residual burning in the air, slash-and-burn agriculture and forest fires (see Figure 2-5-2-7 and Figure 2-5-2-8). The emission of air-contaminating substances started rapidly increasing along with the expansion of fuel consumption from the second half of the 1980s (see Figure 2-5-2-6 and Figure 2-5-2-7) and is causing air pollution problems such as acid rain and photochemical smog. Especially in Asian emerging countries including China and India, it is anticipated that the problems would further worsen along with fast economic growth and affect health, food production and ecosystem.

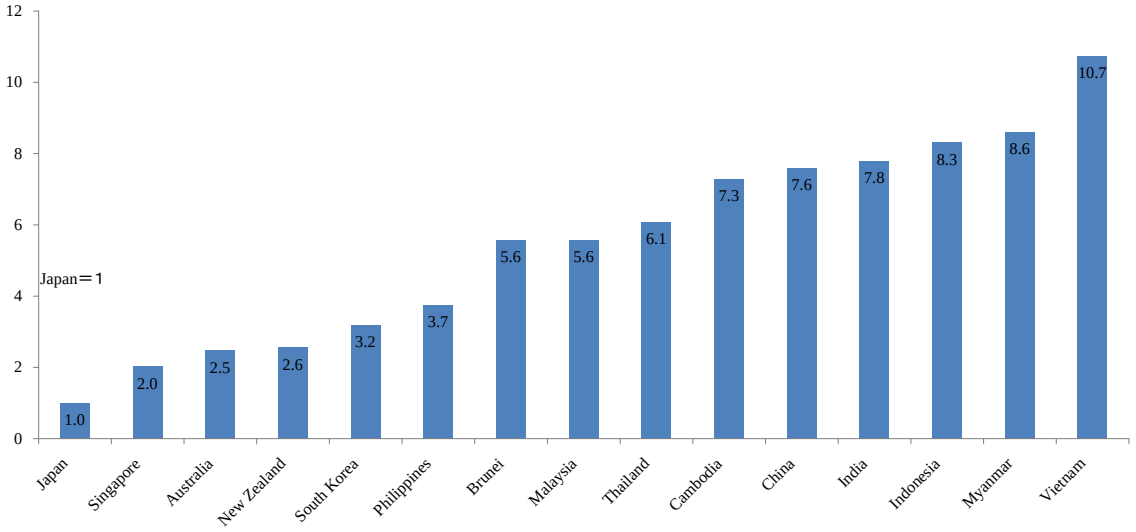
(B) Waste disposal and recycle

Along with the economic growth and population increase, the volume of disposed waste is also rapidly increasing. The waste problem is becoming more serious due to the disposal processes which are environmentally inadequate. Particularity in China, the disposed waste volume surged about 1.8-fold in 9 years from 1995 to 2004[6]. The worldwide disposed waste volume is estimated to double from the size of 2000 in 2050[7]. The cooperation that involves whole region of Asia is needed to promote measures such as the use of appropriate waste disposal and recycle systems to build the recycling-based economy in Asian countries. Japan has implemented (i) policy dialogues, (ii) joint-projects to human resource training in the area of 3 R(reduce, reuse and recycle) and waste disposal, and (iii) cooperation for Asia Eco-town projects.

Figure 2-5-2-6: Comparison of Primary Energy Supply per GDP unit in Asian Countries (2007)

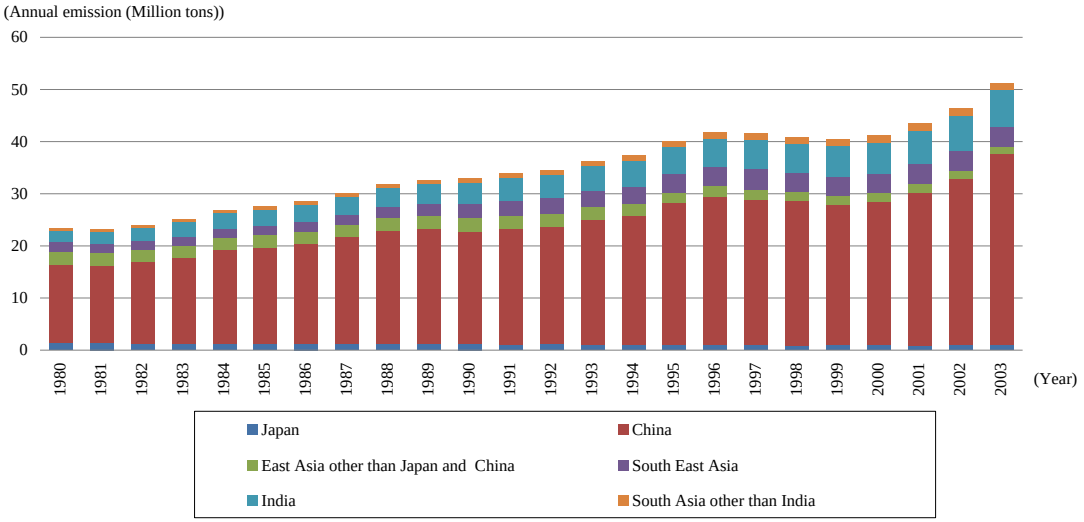
[6] General Environmental Policy Department, Ministry of the Environment (2007) "Annual Report on the Environment and the Sound Material-Cycle Society in Japan Fiscal year 2007" GYOSEI

[7] Saeko Yoshizawa, Masaru Tanaka, Ashok V. Shekdar (2004) "SEKAINO HAIKIBUTSU HASSEIRYOO SUITEITO SHOURAIYOSOKUNIKANSURU KENKYUU" (15KAI HAIKIBUTSUGAKKAI KENKYUUHAPPYOUKAI KOUENRONBUNSHUU I p38-41)



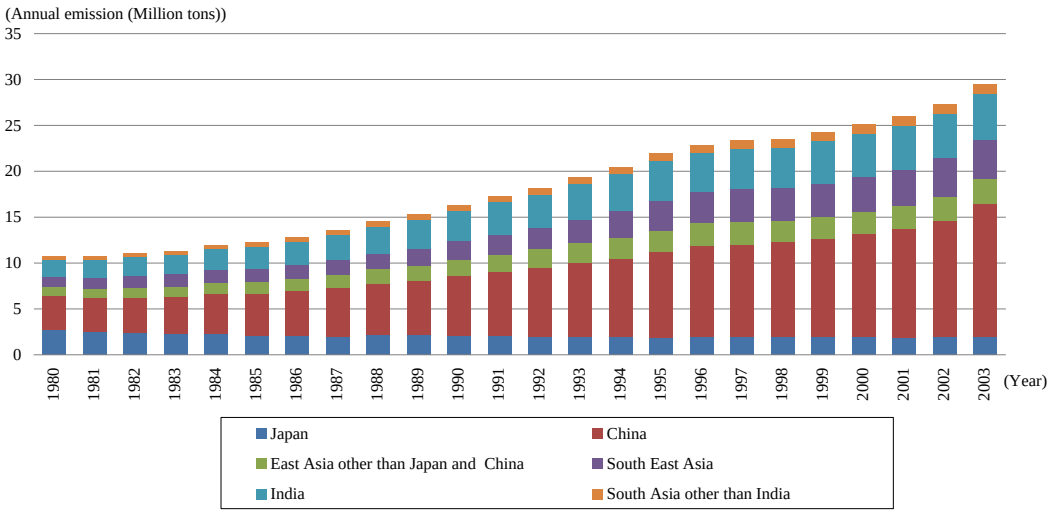
Note: This graph shows index numbers to Japan's value as 1, based on the value from dividing the primary energy supply by GDP.
2.GDP is converted to dollar with Y2000's average exchange rate.
Reference: It was created according to IEA "ENERGY BALANCE of OECD Countries (2009EDITION)" and "ENERGY BALANCE of Non-OECD Countries (2009EDITION)"
（Definite value of Y2007）

Figure 2-5-2-7: Changes in SO2 Emissions in Asia



Reference: It was created according to a webpage of Environmental GIS "A Map of Extensive Air Pollution in East Asia / Annual Emissions of Air Pollutants (secular changes)" Incorporated Administrative Agency National Institute for Environmental Studies.

Figure 2-5-2-8: Changes in NOx Emissions in Asia

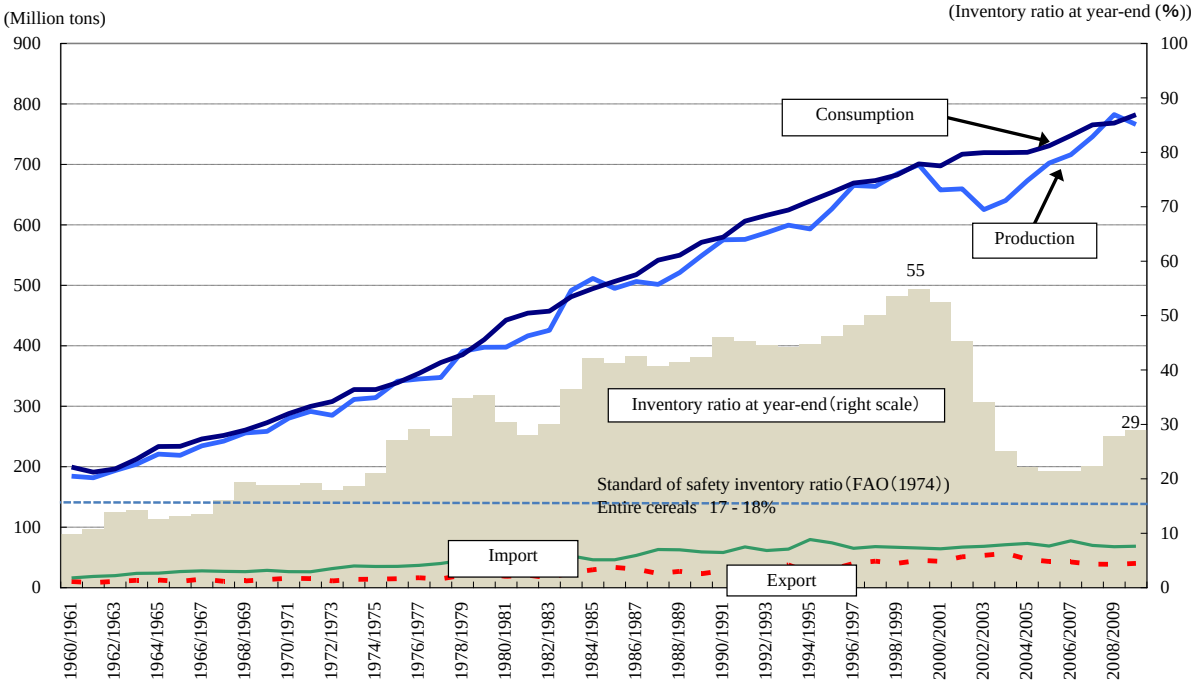


Reference]: It was created according to a webpage of Environmental GIS "A Map of Extensive Air Pollution in East Asia / Annual Emissions of Air Pollutants (secular changes)" Incorporated Administrative Agency National Institute for Environmental Studies.

(C) Food and water supply problem

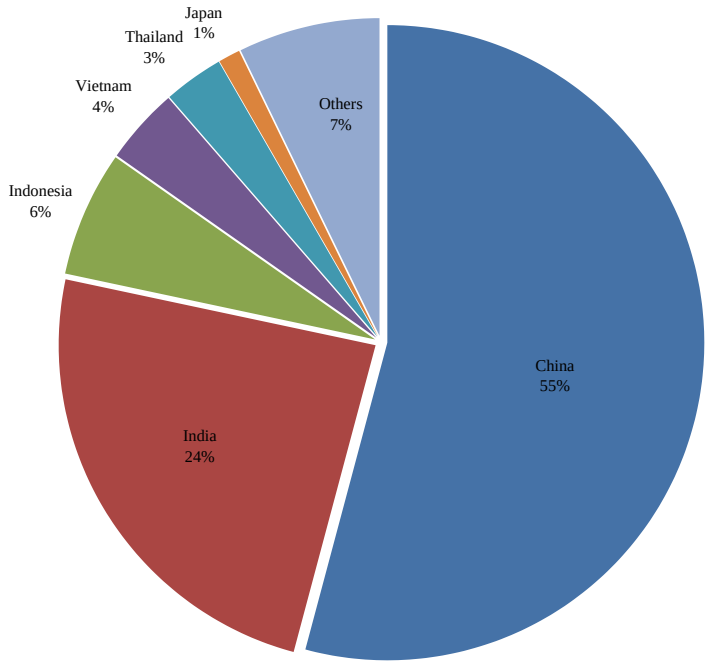
In Asia, food consumption is increasing due to the population increase in each Asian country and the diversification and sophistication of diet supported by increased income along with the economic growth. Moreover, despite continuous increase in production volume of grains including rice, corn, soybean and wheat, the supply is not sufficient against the growth of grain consumption (see Figure 2-5-2-9). Year-end inventory ratio, which is the ratio of inventory in consumption, was 55% in 1998 however, reduced to a half, 29%, in 2009. When food supply is insufficient against demand and causes food price hike, countries with high dependency of food import may receive a large negative social and economic impact because the price changes directly pressure people's life. This could be the constraint for economic growth.

Figure 2-5-2-9: Supplies/Demands of Major Cereals (Wheat, Rice, Soy-bean and Corn) in Asia



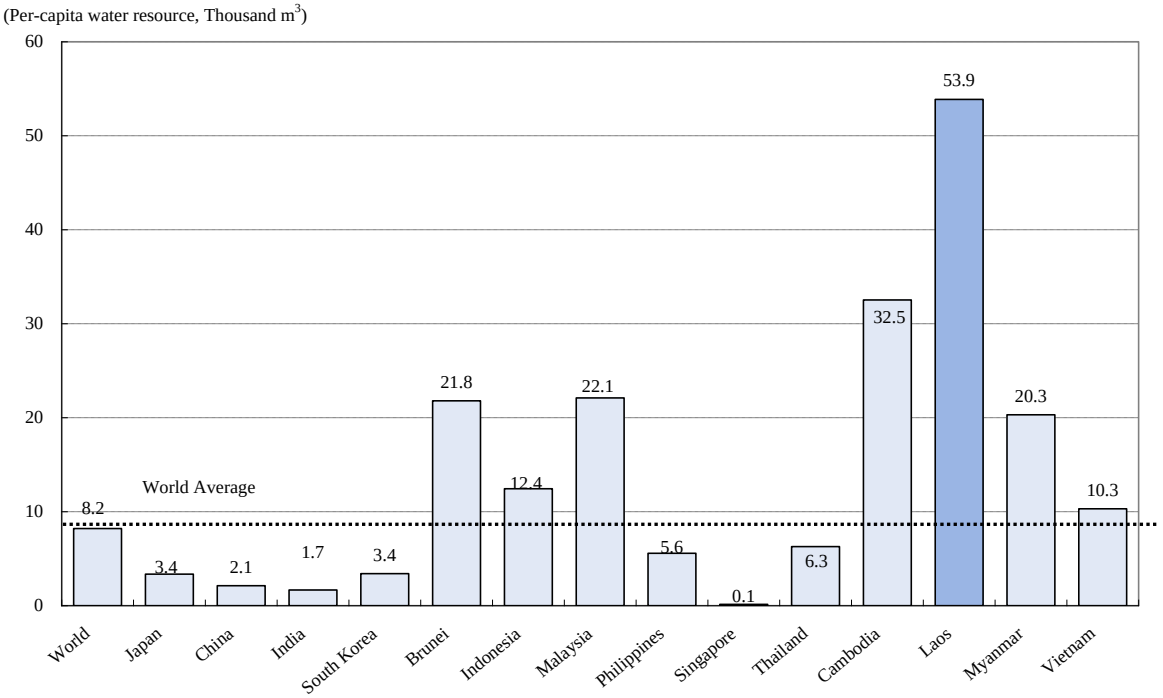
Note: Main cereals are wheat, corn, soybean and rice.
Reference: It was created according to "PS&D" USDA.

Figure 2-5-2-10: Shares of Major Cereal Production in Asia (2009)



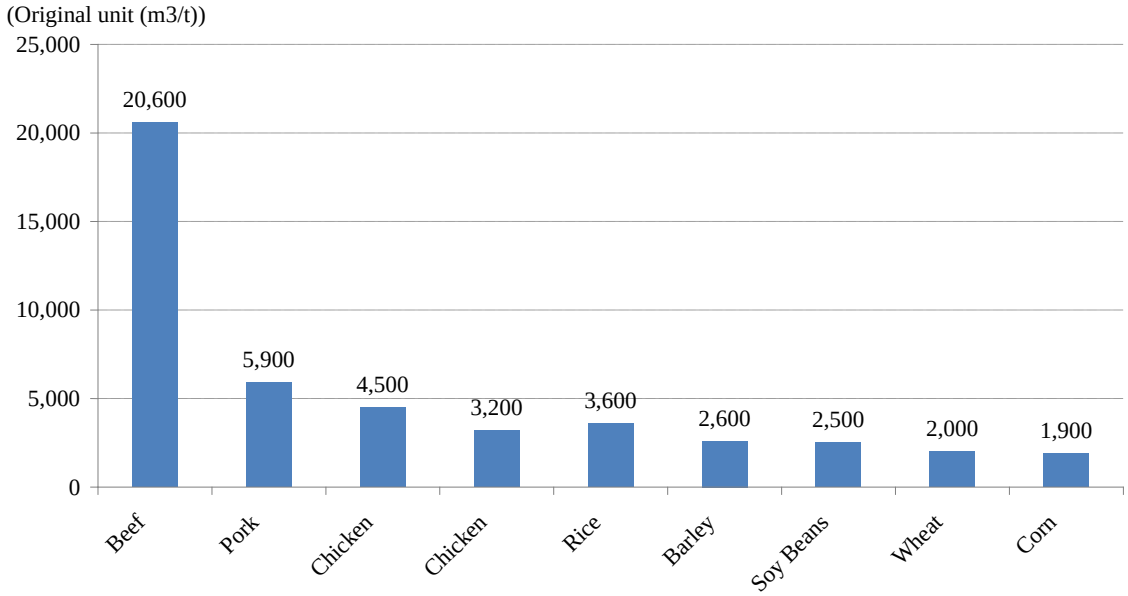
Note: Main cereals are wheat, corn, soybean and rice.
Reference: It was created according to "PS&D" USDA.

Figure 2-5-2-11: Volume of Water Resource per Capita in Each Country/Region



Reference: It was created according to the website of World Resource Institute.

Figure 2-5-2-12: Basic Units of Water Resource for Cereals and Animal Products



Note: [Original unit of water consumption (m3/t)] = [Amount of converted water resource (m3)]÷([Weight(kg)]×[yield rate]÷1000)
Reference: It was created according to "Import and Export of Virtual Water Mainly of Japan" Motofumi Miyake/Taikan Oki/Katshumi Mushiake (2002)

Food production requires many water resources. Although Asia produces a large volume of major grains (see Figure 2-5-2-10), water resource volume per capita in China and India (see Figure 2-5-2-11) is lower than the world average and that of Japan. Moreover, livestock requires 2 to 10 times more of water compared to grain (see Figure 2-5-2-12). The water demand in countries including China and India is increasing due to the increased demand for livestock supported by the diversification and sophistication of diet along with the income level rise. In 2025, the water demand

in Asia is estimated to account for 60% of world demand[8]. It is important to support consortium formation[9] and the promotion of partnership between public and private sector for the international expansion of Japan's water business and water-related technologies.

(4) Problem solution involving whole region

Problems regarding environment, energy, food and water resources are not the issues that one country or one area can solve. These are the common agendas that the whole region shares. By utilizing its superb environment and energy conservation technologies, Japan is expected to promote international cooperation in Asia and its extended area, Asia-Pacific, and make a contribution toward solving these common issues.

[8] Report by Ministry of Agriculture, Forestry and Fisheries "SEKAINO KANGAINO TAYOUSEI" Its original source is I, A. Shiklomanov,Assessment of Water Resources and Water Availability in the World, 1996" (World Meteorological Organization)

[9] It provides comprehensive solutions consolidating water processing technology and knowhow as packages for large-scale water cycle system issues of countries and regions.