Energy Supply and Demand Analysis for Asia and the World up to 2035 and 2050

Abstract

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Overview

This study provides an energy demand and supply outlook for Asia and the world through 2035, based on the analysis of both historical and recent international energy trends, and new world economy trends, including the economic development of emerging countries in Asia, as well as recent global policy shift towards deployment of low-carbon technologies. In addition to the "Reference Scenario" that considers past trends and reflects current energy and environment policies, we analyzed the "Technologically Advanced Scenario" where advanced low-carbon technology becomes widely deployed around the world at the back of the progress in research and development and promotion of international technology cooperation.

Additionally, taking into account the recent move toward setting greenhouse gas emissions target in a longer time horizon beyond 2035, we attempted to estimate the impact of the deployment of advanced technologies up to 2050 on the energy demand and supply balances and the CO2 emissions reductions.

Methodology

The projections are calculated using IEEJ's energy forecast model. This model consists of mainly three modules, i.e. the macroeconomic model, the energy demand and supply model and the technology model. The macroeconomic model calculates GDP components, price, labor, industry and transport activities, etc. from the assumptions of GDP and population growth, exchange rate, world trade, etc. Using the output from the macroeconomic model as the input assumptions, the energy demand and supply model calculates energy demand, CO2 emissions etc. for each region. Finally, the technology model estimates the maximum introduction of various technologies that can reduce energy consumption and/or CO2 emissions.

We developed two scenarios: the Reference Scenario and the Technologically Advanced Scenario. The Reference Scenario assumes highly probable deployment of energy policy and energy technology based on current economic and political situations, which yields normative future evolution of energy demand and supply, whereas in the Technologically Advanced Scenario, (Tech. Adv. Scenario) advanced low-carbon technologies become even more widespread around the world at the back of the promotion of international

technology transfers mainly from developed countries to developing countries.

The whole world is geographically divided into 43 regions, each representing major countries and economic regions. Asia is divided into 14 countries and regions, so that detailed analysis can be done with regards to this important area.

Expected Results

In the Reference Scenario, world's primary energy demand will expand from 11.3 billion tons oil equivalent (Btoe) in 2008 to 17.3 Btoe in 2035. Fossil fuels will account for 79% of the primary energy demand growth during this period, continuing to serve as the major energy sources. Energy demand of Asia will increase substantially from 3,740 million tons of oil equivalent (Mtoe) in 2008 to 7,375 Mtoe in 2035, led by the increase of China and India. Global CO2 emissions will increase from 29.4 Gt in 2008 to 42.9 Gt in 2035 (up 102% from the 1990 level). This suggests an urgent need for developing countries to strengthen measures to reduce emissions.

In the Technologically Advanced Scenario, demand for fossil fuels(oil, natural gas, and coal) will be lower than in the reference scenario by 3,560 Mtoe in 2035. Oil demand will reach its peak in 2030, while natural gas demand will continue to increase. Global CO2 emissions will reach its peak in 2024, while that of Asia will reach its peak in 2029.

Due to the expansion of low-carbon technology, the world's CO2 emissions in 2035 will be 14.5 Gt (or 34%) less than in the reference scenario. Of the total CO2 emissions reduction, developed countries will be responsible for 4.4 Gt and developing countries 10.1 Gt. Asia's CO2 emissions reduction will reach 7.7 Gt, accounting for approximately 50% of the world's total reduction, indicating Asia's extremely high CO2 reduction potential. To realize this potential, it will be important for Asia to cooperate with developed countries toward introducing advanced technologies.

In 2050, the world CO2 emissions from technologically advanced scenario will be lower by 41% compared with the 2008 level. These findings suggest that aside from the assumed technology deployment, further efforts are necessary to invest in research and development for nuclear power, renewable energy, CCS, fuel cell, and energy conservation technologies, toward achieving earlier commercialization of innovative technologies.

References

1) IEA; Energy Balances of OECD Countries, Energy Balances of Non-OECD Countries, (2011)

2) Y. Matsuo et al.; Asia / World Energy Outlook 2011, IEEJ Forum on Research Works, to be published.