

Utilization of Carbon Resource toward Future Electricity System Reform

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Abstract

Electric Power system reform, which has cabinet approval and is to commence from 2015, will effect drastic revisions of the hard and soft systems involved in the supply and demand of electrical power. As a result, power generation from fossil resources (carbon resources) should become increasingly important.

For this power system reform, we evaluated, both qualitatively and quantitatively, the important role played by carbon resources, and their possibilities. Coal, with its small PC unit price (fuel cost per unit of heat), plays an important role as a large-scale source for electrical power. On the other hand, gas, which has a large PC unit price and high mobility, plays an ancillary role in stabilizing the network, whereas oil, which can be stored for long periods, plays an important role as an emergency fuel source; i.e., it is completely feasible that solid, liquid, and gas fossil resources can be utilized by focussing on roles, which take advantage of their respective properties. Despite the fact that renewable energy has been attracting a lot of attention in recent years, having a thorough understanding of the properties of fossil resources to economically achieve a real reduction in greenhouse gases through their use is also important.

1. Introduction

Since the inception in 1951 of the present electrical power supply structure in Japan, a stable electrical power supply service has been realised. Furthermore, this high-quality power supply service has contributed greatly to the post-war economic growth of Japan. However, using the earthquake of 2011 as an opportunity to address the whole concept of nuclear power generation, which was a main driving issue related to the earthquake, discussions have divided the public opinion. At the same time, it was also decided to discuss, in the wake of this disaster, the issue of the weak security associated with advanced aggregated power supply systems that are attempting to provide low-cost, high-quality electrical power. That is, it is essential for this system reform to adopt an approach such that various power sources, including renewable energy,

can match the demand with the same high quality as in the past.

Even with the introduction of various power sources to the supply network, thermal power plants that use fossil resources as fuel, with their characteristic mobility, are vital in achieving a stable quality. The feature of electrical power is the balancing of the supply with the demand. This is achieved by the prompt feedback of the supply and demand balance to the supply facilities, and attempting to balance the market. With this functionality, the quality of Japan's electrical power is thus maintained, and both thermal and hydroelectric power generation play a key role in this.

2. Power system reform

The power system reform was approved by the Cabinet in April, 2013. This is a reform which



focuses on (1) ensuring a stable supply, (2) imposes a maximum limitation on electricity charges, and (3) expanding the choice of customers and business opportunities for business operators. Additionally, this will be accomplished in three stages, such that, (1) expansion of wide-area system operation in 2015, (2) total liberalization of retail and power generation in 2016, and (3) further guarantee of the neutrality of the power distribution sector using a method for legal separation in 2018. This bill was submitted at the 185th extraordinary session of the Diet in October of 2013.



Fig.1 Schedule of Electric System Reform (1)

3. Power generation using fossil resources as fuel

For a stable supply of electrical power, sufficient capacity needs to be guaranteed for occasional demands. In particular, when renewable energy sources such as sunlight are introduced into a power generation network, in principle, just that

amount's worth of power needs to be on standby (banking, etc.). Gas combustion power, with its high mobility, is the most likely candidate for this standby power. In considering the risks of each individual power supply, such as accident prevention, the use of oil is also expected as standby power because of its long-term storability.

4. The effect of resource prices on the cost of power generation

OPEX makes up most of the proportion of the cost structure for thermal power, which is equal to OPEX (Operation) / CAPEX (Capital) = 1.5–4.0. Furthermore, the majority of OPEX is made up of the cost of the fuel, and inevitably, the PC unit price (unit price/1000 kcal) of coal, oil, and gas is directly connected with the price competitiveness of individual power plants. Therefore, coal combustion thermal power presents an overwhelming advantage as a base power supply.

5. The role of carbon resources in Japan's power supply

By taking advantage of the respective properties of these different carbon resources, much activity is expected in all areas, in contributing to system stabilization through the support of renewable energy power supplies, and also as a power supply to backup Japan's stable supply of electrical power, or alternatively, as its base power supply.

Reference

- (1) "Power System Reform Technical Committee Report" METI 2013.2.15