Estimate of the Electricity-Saving Effects Taking Account of Temperature Change Effects in the Service Areas of Tokyo Electric Power and Tohoku Electric Power

Abstract

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Overview

The analysis results show that the government's electricity-saving target of a 15% reduction compared with the previous year has mostly been attained in the service areas of both Tokyo Electric Power and Tohoku Electric Power. The results also show that the effects of temperature changes were greater in July and August than in June and that the effects were greater in the service area of Tokyo Electric Power than in the service area of Tohoku Electric Power. The electricity-saving rate excluding the effects of temperature changes is estimated at approximately 13% to 15% in the peak hours in June, July and August in the service areas of both Tokyo Electric Power and Tohoku Electric Power, indicating that electricity-saving efforts have been effective in reducing demand. In the service area of Tohoku Electric Power in particular, the effects of the temporary shutdown of factories as well as the effects of electricity-saving efforts can be observed. However, given the possibility of unpredictable emergencies such as an unexpected temperature upsurge and a power plant accident, electricity-saving efforts should be maintained for the moment.

Methodology

Generally speaking, there is a significant correlation between electricity demand and temperature. The correlation between electricity demand and temperature is expressed as temperature sensitivity, which indicates how much electricity demand changes in response to a one degree change in temperature. According to an estimate by Nishio (2011), the daytime temperature sensitivity in the service area of Tokyo Electric Power in 2010 was approximately 3%. Following that analysis, we will estimate the temperature sensitivity in the service areas of Tokyo Electric Power and Tohoku Electric Power this summer based on the analysis of the correlation between temperature and electricity demand. We will also estimate the reduction rate of electricity demand and the net electricity saving rate excluding the effects of temperature changes by using the temperature sensitivity as a basis of the estimate. By expressing the correlation between the two as a first approximation, we formularize the correlation. In this case, the gradient of the first approximation formula corresponds to the temperature sensitivity and the intercept of the formula corresponds to

the net electricity-saving rate..

Expected Results

The peak-hour electricity-saving rate excluding the effects of temperature changes in the service area of Tokyo Electric Power is close to the target rate of 15%, indicating that efforts by various relevant parties have yielded results. On the other hand, when the temperature rose sharply, the overall electricity-saving rate declined significantly despite electricity-saving efforts. In particular, when the temperature was high on a holiday, the electricity-saving rate tended to decline. From this, we may presume that considerable electricity-saving effects were achieved on weekdays, with the electricity-saving rate in the commercial sector at a particularly high level. The peak-hour electricity-saving rate excluding the effects of temperature changes in the service area of Tohoku Electric Power, too, is close to the target rate of 15%. As in the service area of Tokyo Electric Power, the reduction rate tended to decline when the temperature was high. In the service area of Tohoku Electric Power, the estimated rate of electricity demand reduction due to electricity-saving efforts was approximately 10% in early June regardless of the time of the day. This apparently reflects the impact of the temporary shutdown of factories that would have operated around the clock in usual years as well as the effects of electricity-saving efforts. In August, the rate of reduction due to electricity-saving efforts exceeded 20% sometimes, particularly during the bon holiday season. That is presumably due to a decrease in the number of people who returned to their hometowns in the Tohoku region, which apparently reflects the huge impact of the earthquake disaster.

References

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