OUTAGE ACCEPTANCE AND FEASIBLITY OF REDUCING RESERVE POWER CAPACITY IN JAPAN

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Overview

In designing renewable power systems, the provision of reserve power is essential to securing a stable electricity supply during peak demand periods. A number of studies have shown the effectiveness of demand response (DR) programs in reducing peak demand, thereby minimizing the reserve power capacity.

The purpose of this study is to investigate the feasibility of DR implementation for electricity supply system design in Japan by estimating the outage cost based on the annual electricity bill reduction and estimating the saving cost of reducing reserve power capacity.

Methods

A nationwide questionnaire survey in Japan was conducted concerning acceptable standards for electricity quality and monetary compensation for reduced quality, assuming that the introduction of renewable energy would be accelerated. The survey asked the attributes of the survey subjects, their energy-saving behavior and consciousness, acceptable periods for power outages, combinations of acceptable duration and frequency of power outages, and reduction in electricity rates. The demand-side requirements and acceptable standards were then analyzed.

By surveying more than 1,600 consumers, this study investigated combinations of the frequency and the duration of outages that are acceptable to consumers and the relationship between the acceptance rate of the outage scenarios and reductions in their annual electricity bill. This study also estimated the saving cost of reducing reserve power capacity.

Results

For no reduction in the electricity bill, five combinations of outage duration and frequency gained acceptance rates higher than 50%, namely one to four 30-minute outage(s) per year (76%, 69%, 60%, and 57%, respectively) and one 1-hour outage per year (51%). It was found that the total acceptance rate correlated strongly with the amount of bill reduction. It is estimated that to reach an acceptance rate of 51%, a minimum reduction of JPY12,100 for two 1-hour outages per year and JPY25,200 for three 1-hour outages per year would be required.

Conclusions

Demand-side control is one of the options for reducing reserve power capacity in renewable electricity systems, in addition to supply-side improvements. This study has identified the costs and benefits of outages and showed possibilities for reserve power reduction. DR is considered as a feasible approach to implementing renewable power system design in Japan.

References

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