



What do customers want from improved residential electricity services? Evidence from a choice experiment



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HIGHLIGHTS

- Customers' preferences for improved residential electricity services are analyzed.
- Empirical setting is a sample of residents in South Korea.
- The electricity bills and electricity mix are important to customers.
- Increase in electricity bill of different electricity mix is considered.

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ABSTRACT

Improvements in customer satisfaction as well as product/service quality represent a common objective of all businesses, and electricity services are no exception. Using choice experiments and a mixed logit model, this study quantitatively analyzes customers' preferences and their marginal willingness to pay for improved residential electricity services. The study provides an ex ante evaluation of customers' acceptance of hypothetical electricity services. According to the results, customers consider the electricity bill and the electricity mix as the two most important attributes when choosing their electricity services. Customers are willing to pay 2.2% more in the average electricity bill (an additional monthly electricity bill of KRW 1,064; USD 0.96) for a significant increase in the share of renewable energy, which is far less than the actual cost of achieving this renewable target. Therefore, it is better to maintain the current electricity mix in principle, and the renewable share should be gradually expanded instead of making a sudden change in the electricity mix. In addition, customers are willing to pay KRW 6,793 (USD 6.15) more to reduce blackouts once in a year and KRW 64/year (USD 0.06/year) to reduce a minute of each blackout.

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1. Introduction

Customer satisfaction by improving service and product quality is a common objective of all firms, and the electric power industry and electricity services are no exceptions. Although the detailed structure of each country's electric power sector may be different, every electric power company should improve its customer satisfaction as well as the quality of electricity services to gain a competitive advantage. Therefore, to offer better electricity services that satisfy customers, their preferences and willingness to

pay (WTP) for improved electricity services should be clearly understood.

After Japan's Fukushima nuclear disaster in 2011, many countries have been concerned about achieving an optimal energy mix (electricity mix) in the long term. However, a change in the electricity mix requires a change in the composition of power generation facilities, which is likely to bring about a change in the cost of electricity generation. Therefore, it is necessary to plan an optimal future electricity generation mix based on a social consensus through comprehensive research. After all, a desirable electricity mix is an outcome of end users' choice, and the government's role is to build a system that can realize such an electricity mix. Therefore, it is important to make the general public share the same vision concerning the future electricity mix. For this, it is necessary to conduct an accurate analysis of consumers'

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Table 1
Previous studies of customers' preferences for energy sources of electricity generation.

Author and year	Country/target sources	Methodology	Key findings
Goett et al. (2000)	– The U.S. – Renewables	– Choice experiment – Mixed logit model	– Customers are vitally concerned about renewables. – A majority of customers prefer hydro or a mix of sources to wind.
Borchers et al. (2007)	– The U.S. – Wind, solar, biomass, farm methane	– Choice experiment – Nested logit model	– Individuals prefer solar to generic green and wind. – Biomass and farm methane are the least preferred sources.
Navrud and Bråten (2007)	– Norway – Wind, hydro, gas	– Choice experiment – Multinomial logit model	– Norwegians prefer to build more domestic wind farms instead of importing electricity from coal-fired power plants. – Wind farms have a NIMBY effect.
Gracia et al. (2012)	– Spain – Wind, solar, biomass	– Choice experiment – Mixed logit model	– Preferences for various types of renewables are heterogeneous.
Kosenius and Ollikainen (2013)	– Finland – Wind, hydro,; energy from crops, energy from wood	– Choice experiment – Nested logit model	– Wind power is generally the most popular source. – Regional differences exist, and energy from wood is favored in rural areas.
Kaenzig et al. (2013)	– Germany – Coal, nuclear, renewables	– Choice experiment – Mixed logit model	– The price and the electricity mix are the two most important product attributes. – A majority of consumers prefer nuclear-free electricity.
Welsch and Biermann (2014)	– 25 European countries – Nuclear, coal and peat, oil, gas, hydro power, geothermal, solar and wind, bio-fuels and waste	– Subjective well-being regression – Ordered probit model	– Individuals' subjective well-being varies systematically and significantly with differences in the electricity mix across countries and over time. – A larger share of solar and wind power relative to nuclear power and electricity from coal and oil is preferred.

preferences for electricity services, particularly for the electricity mix.

From this perspective, several studies have analyzed consumers' preferences for electricity services by focusing on energy sources of electricity generation. Table 1 provides a summary. Previous studies have focused mainly on renewable sources and indicated that people generally prefer electricity from renewable sources. However, given that electricity-generating systems based on different sources vary in terms of their technological levels and costs, it is clear that a different electricity mix results in differences in the cost of power generation. Therefore, most studies are limited in that they have not quantitatively forecasted consumers' acceptance of changed electricity services if the cost of the changing electricity mix is passed on to them.

This study analyzes consumers' preferences for residential electricity services and estimates their marginal willingness to pay (MWTP) for an electricity generation mix, smart meter installation, the number of blackouts, the duration of each blackout, and the electric power provider's social contribution level of residential electricity services. In addition, the study simulates how much consumers are willing to pay for future electricity service scenarios. The simulation focuses specifically on changes in the electricity mix accompanied by an increase in the electricity bill to compensate for limitations of previous studies not considering a potential increase in the electricity bill. The results have important managerial and policy implications for a future electricity mix that can better meet consumers' needs and provide electric power providers and governments with useful information for designing improved electricity services.

The choice experiment, one of the stated preference techniques, is used for data generation. In addition, the mixed logit model, a discrete choice model, is used to analyze the heterogeneity of preferences across respondents. Because energy-mix issues such as the promotion of renewable energy and the reduction of nuclear dependence have recently been highlighted in most countries, this study provides meaningful policy implications

for a future electricity mix not only for the Korean government but also for many other countries.

The rest of this paper is organized as follows: Section 1.1 gives a brief overview of the Korean electricity market and examines several issues. Section 2 describes the methodology by explaining the mixed logit model and then identifies factors potentially influencing customers' preferences for electricity services, followed by an explanation of the design of the choice experiment. Section 3 presents the quantitative analysis results for customers' preferences for residential electricity services and their acceptance of hypothetical electricity services. Finally, Section 4 concludes by providing policy implications, discussing limitations, and suggesting some directions for future research.

1.1. An overview: current issues in Korean electricity services

The share of electricity in final energy consumption accounted for 24.5% in 2010 in Korea¹, which ranked the eighth among 34 OECD countries. At the end of 2011, total electric power consumption in Korea was about 455,070 GWh, ranking the eighth in the world (CIA, 2012). This increased by 63% from 2002. From 2002 to 2011, the average annual increase in electric power consumption in Korea was 5.6%, exceeding both its average annual economic growth (3.8%) and the average annual growth rate of electricity generation capacity (3.7%). It is natural that electric power consumption increases with a country's economic growth and improved standard of living. Korea has the second highest rate of increase in electric power consumption among OECD members (Hyundai Research Institute, 2013). Although debatable, several factors are considered to cause rapid increases in electric power consumption in Korea, including continuous economic growth, the expansion of industries that depend on electricity, increases in housing and home appliances, a shift in demand from other forms

¹ In this paper, all references to "Korea" or "Korean" refer to South Korea (Republic of Korea).

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