

Executive Summary

Japan has experienced a severe electricity shortfall since the Great East Japan Earthquake in March 2011 and the subsequent shutdown of nuclear power plants. Disruption to the supply–demand balance was especially severe in Tokyo and Tohoku in summer 2011, forcing the government to introduce mandatory rationing for large customers. Following intensive efforts, a reduction in demand of more than 15% compared with the 2010 level was achieved in these two regions. Surprisingly, most of the savings achieved in 2011 have persisted for almost four years. Compared with other electricity shortfalls and associated demand-side responses that have been reported in the literature, two distinctive characteristics can be found in the Japanese experience of saving electricity after 2011. First, Japan has experienced a large-scale shortfall that has persisted over a long term. Demand–supply balance has been tight for almost the entire four-year period, mainly due to the on-going shutdown of nuclear power plants after the accident at the Fukushima Daiichi Nuclear Power Plant. The magnitude and duration of this electricity shortage and energy conservation efforts are uncommon and worth researching. Another notable characteristic of the post-2011 electricity savings in Japan is that a large demand reduction was achieved without price increases. It was not until 2013 that many power companies began to raise their tariffs due to the increased use of fossil-fired power plants. The delay in price increase implies that energy conservation in the first two years after the earthquake was motivated by factors other than price signals, while price signals are gradually gaining importance for maintaining conservation activity in later years. The fact that a large demand reduction was achieved by non-price factors has implications for effective energy conservation policy, which requires both price and non-price measures.

This paper examines Japan's experience with electricity saving activities over the past four years to draw lessons both for electricity-saving strategy to cope with temporary shortfalls and for long-term energy conservation policies. In addition to reviewing the policy response and demand trends after the electricity crisis, this paper provides a detailed review of a series of surveys we conducted each fall from 2011 to 2014, which cover the commercial and industrial (C&I) sectors in addition to the residential sector, and analyze major electricity-saving measures, energy users' perceptions and motivations in each sector, and trends of those measures and perceptions from 2011 to 2014. We found that, in households, electricity

conservation related to the use of air conditioning have accounted for the largest share, roughly 40% of the overall savings in Tokyo in the summer of 2011. The most effective measure was reducing air conditioner operation, followed by adjusting air conditioner temperature settings. After 2012, the decreasing sense of crisis has lowered the implementation rates of these measures in both the Tokyo and Kansai areas. In large industrial firms in the summer of 2011 in Tokyo, around 25% of the demand reduction was achieved by increasing in-house power generation, and 30% by shifting hours of operation. For many of these large industrial customers, such a large demand reduction was costly and inconvenient. Cutting electricity demand by 15% for the entire summer period required many large factories to install in-house power generation and to shift operations to off-peak periods. These measures turned out to be costly and burdensome and their implementation rates have declined substantially since 2012. In contrast, electricity savings in the commercial sector mainly came from limiting use of lighting and air conditioning, which turned out to be much less burdensome than the measures in the industrial sector. This implies that there was excessive electricity consumption in this sector that could be reduced without compromising comfort.

One important implication from the Japanese experience is that a large demand reduction in a short period is attainable without price increases if awareness of the crisis is high enough and customers have strong normative motivations. This implies that both price signals and non-price policies such as voluntary reduction targets, information on electricity-saving measures, and stimulation of normative motivation are important strategies to drive electricity conservation. Another implication is that a large demand reduction caused by a temporary electricity shortfall can be persistent for some years. In the Japanese case, the cumulative impact of replacing old equipment with high-efficiency models seems to be playing a key role in the persistence of electricity savings, which has supplemented the decreasing impact of behavioral measures. This implies that, assuming a steady replacement of old technology with new efficient ones continues, most of the current demand reduction in Japan may even persist for years to come.