

Performance Evaluation of New and Renewable Energy Program for Home Use : the Case of Korea

Gahyeong Hur(Ph.D), National Assembly Budget Office of Korea, 82-2-788-4679, hurgh@nabo.go.kr

Sunyoung Jung(Ph.D), The Bank of Korea, 82-2-759-5431, sjung@bok.or.kr

Overview

This study evaluates the performance of NRE(New and renewable energy) supply program for home use in Korea. Especially it focuses efficiency and equity of photovoltaic panel in households. NRE program has dispatched more than 40,000 kW in homes under the title of '1million Green Home program' since 2004. However, it has not been reviewed its performance such as how much NRE was generated and when the investment can be recovered in the view of households. So, we tried to evaluate the performance of photovoltaic panel for home use in the respect of effective-ness, efficiency and sustainability. The NRE program made some achievements in the aspect of facility supply in households. Approximately 800 million\$ was invested on the public side until 2009, which seemed to create 76,390 jobs, generate 133,490 toe and reduced 402,780t CO₂. However the electricity purchase of photovoltaic panel installed household was not decreased as much as expected from the designed photovoltaic generation. It may result from two reason. This study tried to analyze the reason with on-site performance data and econometric model. The collected data is monthly electric bill and usage of households with and without photovoltaic system, which we call Greenhome and No Greenhome and collect 2,461 and 15,993 households for each for 5 years. As a result, we found that green home with photovoltaic system significantly increase electric consumption than ordinary households with the consideration of the regional meteorological variables such as hours of sunshine and average daily temperature as well. Therefore the Korean greenhome case can be an evidence of rebound effect of small-scale renewable energy instalment for home use. To expand photovoltaic market and eliminate climate change pressure, it seems to necessary to enhance both pre and post-review process and to incorporate incentives to care for the performance of renewable energy facilities and manage the electricity consumption increase in households.

Methods

To analyze the performance of photovoltaic panel for home use, we collect 6 years monthly electric bills of 2,461 households which joined in NRE supply program in 2007 and was subsidized 50% of the panel price, and 8,000 ordinary households of no renewable system. We set the records of electricity consumption and electric charge from 2005 to 2010 to trace electricity consumption pattern and economics of photovoltaic panel for home use. First we analysed the performance of photovoltaic panels with econometric model after adjusting seasonal effects and then, add more variables such as ordinary households and amount of sunshine by region to check the socio-economic effect of electric consumption. Second, we compare the results of photovoltaic installed household and uninstalled households to confirm the rebound effect. The econometric estimation methods used are as follows:

- Econometric estimation considering the treatment effects.
- Panel data estimation: Fixed effects, Random effects, 2SLS, GMM.
- Econometric estimation:Structural break considered.

Results

The installation of a photovoltaic power generation system has significantly effected in reduction in electric charges and electric consumption. The results of examining the changes in electric charges sections in each year of the

experimental group and the control group showed that 50-60% of the households that did not install the photovoltaic system had no changes in the progressive tax sections compared with the previous year and about 20% had regular changes of increase or decrease in the progressive tax sections, but about 80% of the households that installed the photovoltaic system experienced the decrease in electric charges in 2008 right after the system was installed. However in 2009 about 44% of those households had no changes in the progressive tax and in 2010, about 40% showed increase in the progressive tax, so it can be seen that electric charges decreased temporarily after installing the photovoltaic system but as time passed, the electricity consumption increased. This can be viewed as reflection of usual increase in electricity consumption according to time trends, but it can be interpreted as the rebound effect that electricity consumption even increases after the photovoltaic system is installed.

As a result of examining whether the installation of the photovoltaic system had effective influence on reducing electricity consumption, assuming various assumptions, it could be confirmed that expected reduction in electricity consumption differed depending on region and cases. And as a result of examining whether there were differences in effects of the photovoltaic system according to the existing electricity consumption amount, it was confirmed that the samples which had greater annual electricity consumption showed the greater outcomes of the photovoltaic system.

Conclusions

It is found that ordinary households do not much care of how much the photovoltaic panel generate, once it is installed. The electricity produced by the photovoltaic power generation can be treated like free lunch produced by the government subsidy. The electricity consumption after installing the photovoltaic system was reduced less than expected, which does not correspond to the policy purpose to replace conventional generation to renewable generation and to reduce CO2 emission. Therefore it would be important to make incentive mechanism to encourage for households to have interest in performance of photovoltaic panel. Then it will improve ROI of renewable energy for home use and eventually help to supply renewable energy in ordinary life, we suggest.

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