# *AN ANALYSIS ON THE SMART COMMUNITY CONNECTING COMMERCIAL AND RESIDENTIAL SECTORS*

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## Overview

Considering the East Japan great earthquake and Fukushima nuclear accident on March 2011, Japan is now revising the long-term energy supply-demand plan and also disscussing the new GHGs reduction target for post-Kyoto. Anyway, Japan must intensify her GHGs reduction measures basically in the long-run, because she already agreed 50% (or 80%) reduction of GHGs in 2050 in the past Summits etc.

The first commitment period of Kyoto Protocol finished in 2012. We must say that Japan could not achieve a domestic reduction target in this period except in 2009 after the Lehman Shock. Specially speaking, the continuous increases in GHGs emission in the commercial and residential sector were largely influenced to the nonattainment of domestic Kyoto target.

In recent years, the progress of information and communication technologies is remarkable. The storage system of electricity is also being made a progress. Therefore, in this study, we would like to analyze economics of smart community connecting the commercial and residential sector using photovoltaic cell and electricity storage system under various conditions.

## Methods

In this study, we made economics simulations on the introduction of smart facilities such as photovoltaic cell and electricity storage system as important functions of smart community. First of all, the average electricity demand pattern in a house and an office building was estimated by month based on the METI survey report [1], EDMC survey data [2] and Cogeneration Comprehensive Manual [3]. We also surveyed present situations on photovoltaic cell, and electricity storage system [4, 5].

The number of house holds in the residential sector was assumed to be 5,000 and the total floor area in the commercial sector was also assumed to be 300,000 $m^2$. The capacity of electricity storage system was changed from 0 kWh to 120,000 kWh every 40,000 kWh in the simulation. The capacity of photovoltaic (PV) cell for each house in the residential sector was assumed at 4 kW. The capacity of photovoltaic cell in the commecial sector was also changed from 0 kW to 75,000 kW every 25,000 kW. In addition, the various differences of electricity charge between daytime and night were assumed.

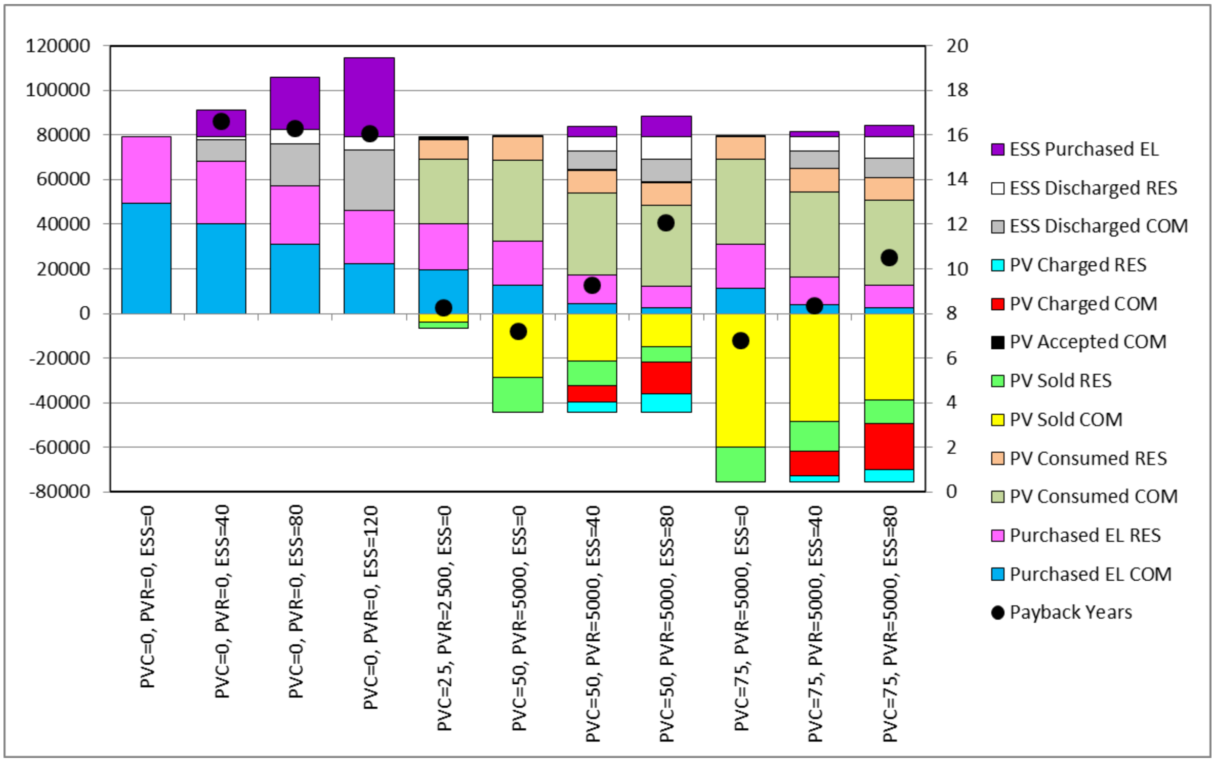
The economics of the introduction of smart facilities is judged from the simple payback years which is calculated by dividing the net initial cost (excluding cost covered by the subsidy) of necessary equipments by the annual profit brought by the reduction of purchased electricity.

## Results

Figure 1 shows the estimated results on changes in economics of smart community using photovoltaic cell and electricity storage system under various cost conditions. The increase on the capacity of electricity storage system is quite important to reduce purchased electricity by using photovoltaic cell effectively in the smart community. Based on these results in this study, the purchased electricity could be largely reduced if the size of electricity storage system becomes larger.

However, under the present cost conditions such as the photovoltaic system cost 400,000 Yen/kW and the electricity storage cost 150,000 Yen/kWh, the economics of smart community become worse rapidly, judging from the payback years. It is considered that the infiltration of smart communities would be quite difficult in the present stage, because the cost burden of introducing smart facilities, especially the electricity storage system is too large.

The introduction of the electricity storage system only is not largely contributed to improve the economics of smart community, as shown in Fig. 1. The intoroduction of the photovoltaic cell can improve the economics of smart community, but as the scale of the electricity storage system becomes larger , the economics of smart community becomes worse, also as shown in Fig. 1.




(Note) RES: Residential sector, COM: Commercial sector, EL: Electricity, PV: Photovoltaic cell and ESS: Electricity storage system.

Fig. 1 Changes in electricity supply-demand in the smart commnity and changes in economics

## Conclusions

The electricity storage system has the largest problem of economics in smart community functions. Under the present cost situations on the electricity storage system, total economics of smart community become worse, as the size of electricity storage system becomes larger.

For the expansion of smart communities, the cost reduction of smart facilities are important as a future subject. Of these, the cost reduction of the electricity storage system would play a key role particularly from the viewpoint of technology.

It is quite essential to strengthen peoples' incentives to the introduction of smart house from the viewpoints of policy. It is also required to look FIT system over more carefully. The smart community would be expected to influence to peoples' life style in the future.

## References

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