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AN ANALYSIS ON CHANGES IN ECONOMICS OF SMART HOUSE USING PHOTOVOLTAIC CELL AND ELECTRICITY STORAGE SYSTEM

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Overview

Though Japan internationally committed 25% reduction target of GHGs from the 1990 emission level in 2020 at the New York UN Conference in 2009, this target commitment was withdrawn because of the East Japan great earthquake and Fukushima nuclear accident and the revised temporal target under no nuclear plants restarted was announced recently. However, 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 6% reduction target in the first period except in 2009 after the Lehman Shock. Specially speaking, the continuous increases in GHGs emission in the residential sector were largely influenced to the nonattainment of Kyoto target.

In recent years, the progress of information and communication technologies is remarkable. The storage system of electricity is also being realized. Therefore, in this study, we would like to analyze changes in economics of smart house using photovoltaic cell and electricity storage system under various conditions.

Methods

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

The capacity of electricity storage system was changed from 4 kWh to 12 kWh every 1 kWh in the simulation. The capacity of photovoltaic (PV) cell was assumed at 4 kW. In addition, the various differences of electricity charge between daytime and night were assumed.

The economics of the introduction of smart house functions 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 house 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 a house. 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 200,000 Yen/kWh, the economics of smart house become worse rapidly, judging from the payback years. It is considered that the infiltration of smart houses would be quite difficult in the present stage, because the cost burden of introducing smart equipments, especially the electricity storage system is too large.

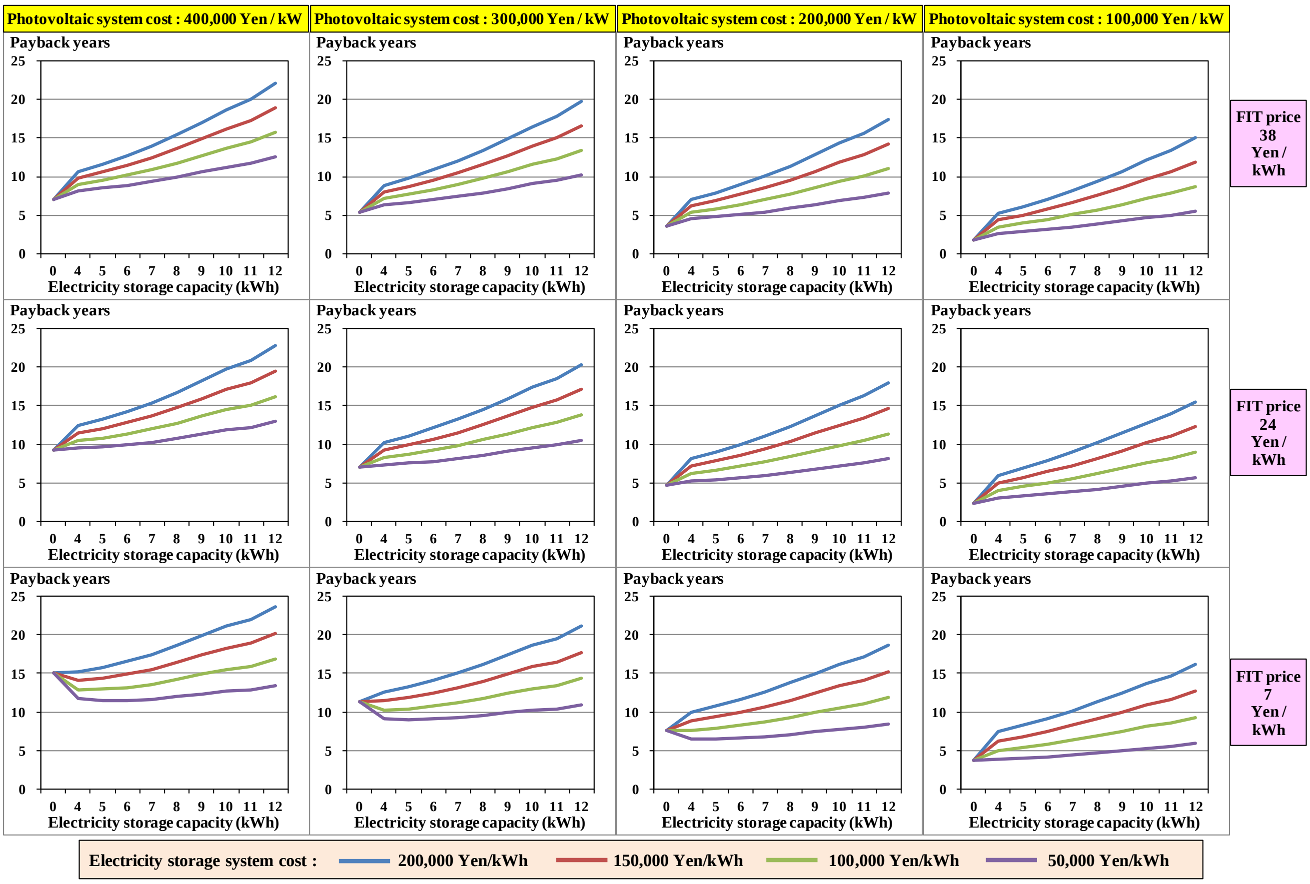

Fig. 1 Changes in economics of smart house under various cost conditions

If the cost of photovoltaic system decreased to less than 200,000 Yen/kWh and the cost of electricity storage system also decreased to less than 100,000 Yen/kWh, the economics of smart house will be improved drastically, as shown in Fig. 1.

Conclusions

For the expansion of smart house, the cost reduction of smart equipment is 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 house would be expected to influence to peoples' life style in the future.

References

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