

Economic Impact of Efficiency Improvement of Converters in Power Systems by Japan Energy Scenario

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Introduction

Solar photovoltaic (PV) is decentralized connected to distribution grids. Some microgrid systems are expected to appear that only PVs and battery storages in the local area manage to cover the electric demand in the area called as Utility microgrid. In Japan, the laws with distribution business license are being prepared for microgrid business. In the system, power converters are essential to trade renewable energy on the grid, the advanced converters may need to be more efficient.

This poster shows estimation result of the impact of the efficiency improvement of converters used by Japan energy scenario.

Japan's future energy scenario

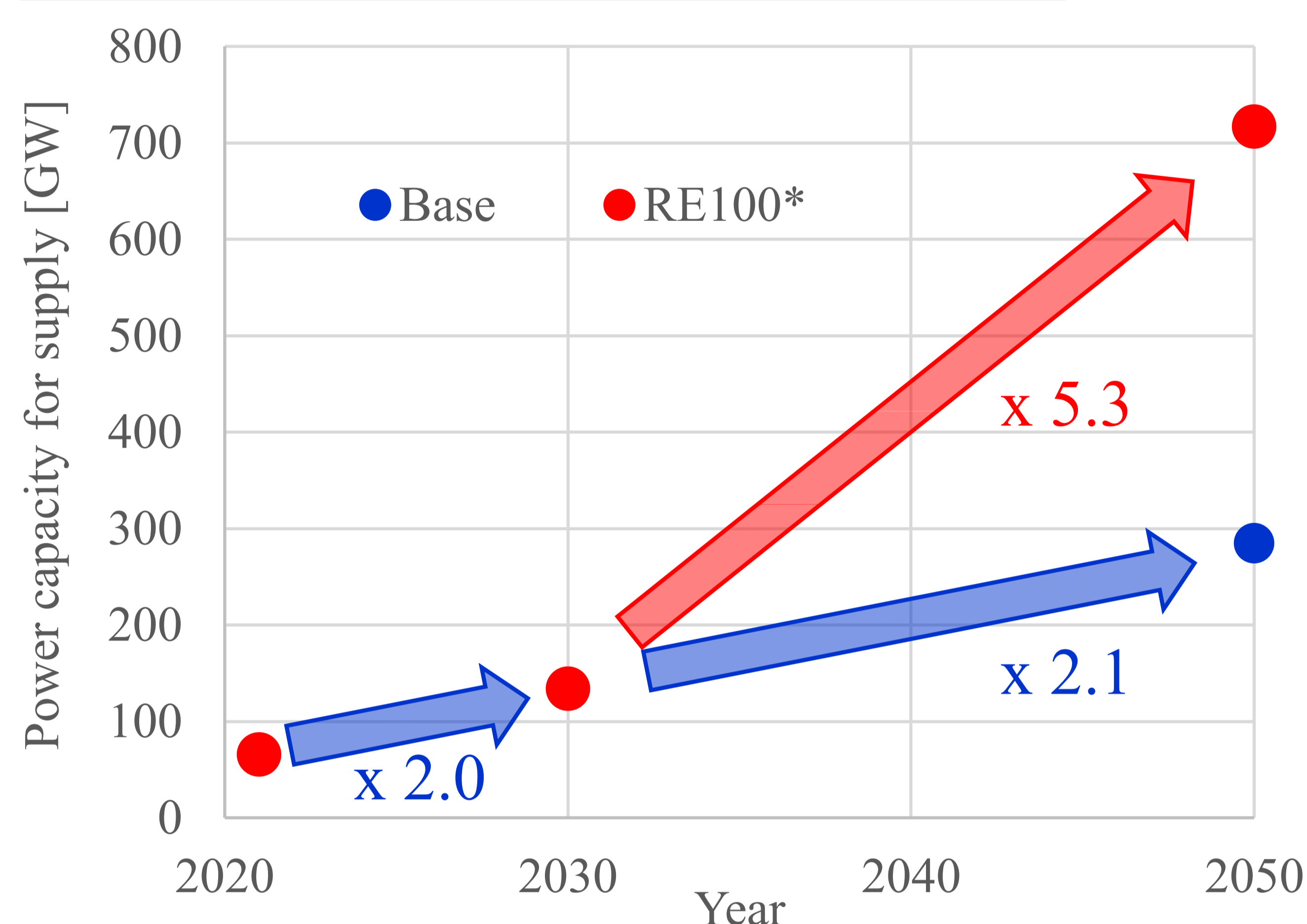


Fig. 1 Installation power capacity scenario of PV/WT.

Base: the case when thermal power generation can be used
RE100*: the case when all electricity demand is supplied from renewable energy

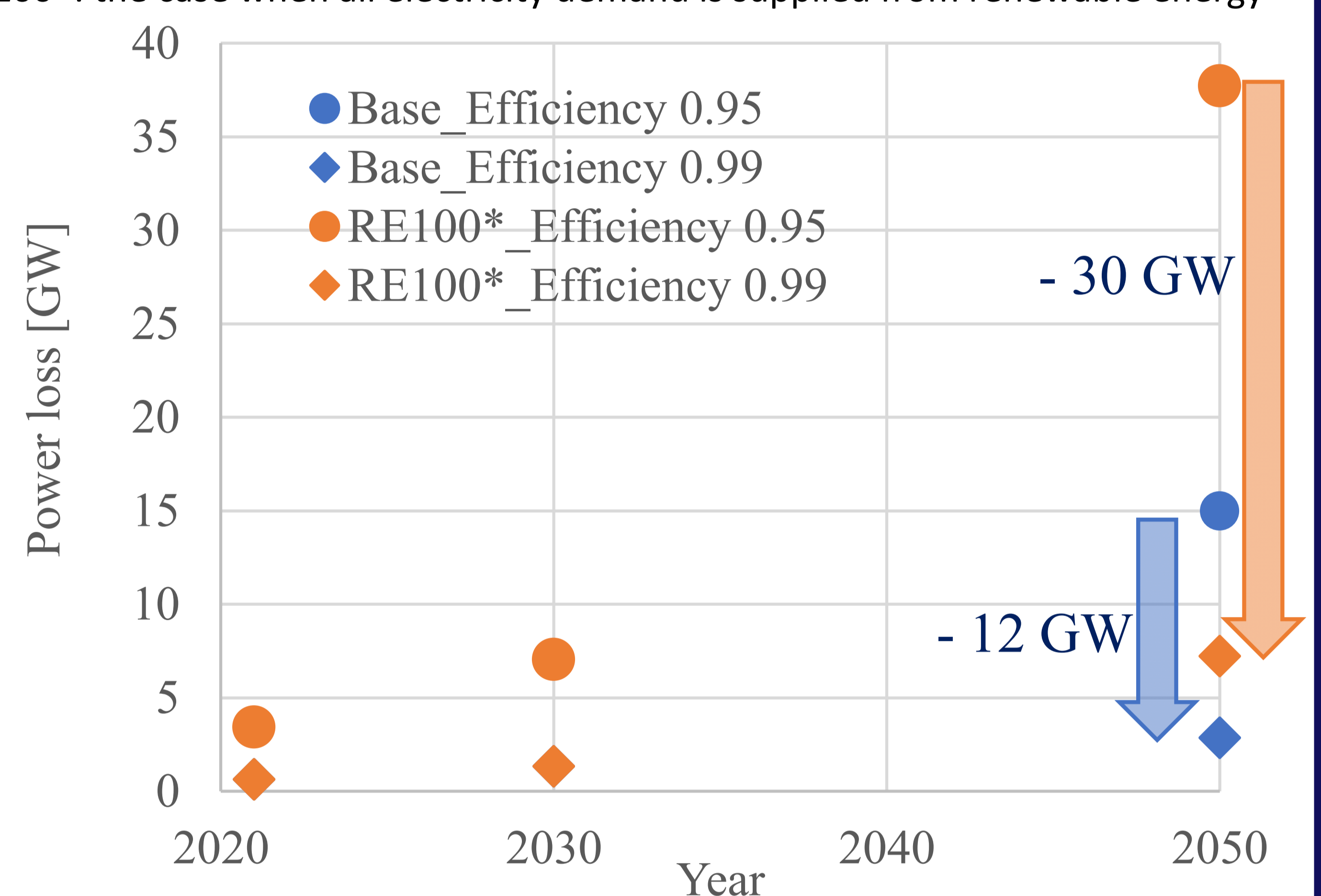


Fig. 2 Power loss of Power converter for PV/WT estimation.

The installed power capacity of PV/Wind Turbines (WT) will be twice from 2021 to 2030, and will be 5.3 times from 2030 to 2050 on RE100* scenario.

If efficiency of the advanced power converter is improved to 0.99 from 0.95, power loss will be reduced about 30 GW in 2050 "RE100* scenario". It also means that the advanced power converters have potential to decrease the required introduction capacity of PV panels connected to them by 30GW because of their efficiency improvement.

Cost estimation

We estimated roughly the economic impact of avoiding the installation of 30GW of PV panels.

- Utilization ratio of PV : 15 %
- Electricity fare : 20 JPY/kWh

$$30[\text{GW}] \times 8760[\text{hours}] \times 0.15 \times 20 [\text{JPY/kWh}] = \mathbf{788 \text{ billion JPY}}$$

Expected yearly cost reduction

Conclusion

In this poster, the authors introduced the results of cost reduction effect of the advanced PCS based on Japan's future energy scenarios.

The calculated annual cost savings effect of 788 billion JPY is about 5% of the annual cost of power supply in Japan. The following two points must be as prerequisites for this estimation.

- All other measures on the power grid side are advanced so that PV and WT are introduced according to the scenarios.
- The efficiency of the advanced PCS should be improved from 95% of the conventional PCS to 99%.

If these conditions will be realized, it can be said that the development of the advanced PCS have the large economic effect.

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