

Potential Capacity and Cost of Pumped-Storage Power in Japan (Vol. 2)

An assessment was performed of costs and facility capacities that can be developed throughout Japan for the construction of a new pumped-storage power system. The system uses a multi-purpose dam as a lower reservoir, pumping a portion of this water into the upper reservoir to be stored. The assessment model assumes that 30% of the effective water storage capacity of the lower reservoir is pumped into the upper reservoir for five hours a day x 300 days (a facility utilization rate of 17.1%).

- Changing from a conventional reversible system with a single water wheel and pump, to a tandem system, in which they are separated, provides total efficiency improvements of 70% to 85%.
- Furthermore, increasing the amount of water used from 20% to 30% of the effective water storage capacity decreases facility costs. This also reduces power generation costs by 15% to 19.4 JPY/kWh (Figure 1).
- The total storage capacity that can be developed throughout Japan also increases to 2,170 GWh/time (5h)/day if large dams of more than 100 million m³ of the effective water storage capacity are also used.
- The assessment revealed that different sizes of power storage systems are required, depending on if they will be run once a day for peak shifting, or multiple times a day for balancing.

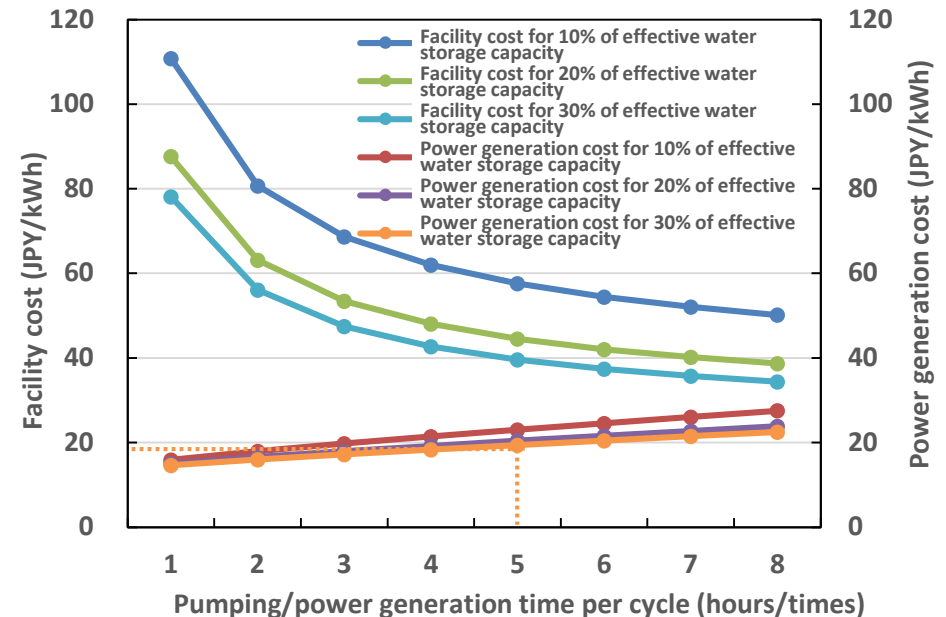


Figure 1: Equipment and power generation costs when pumping/generating at 17.1% of facility utilization.

(The water storage capacity in the upper reservoir is the same but the output of the water wheel / generator differs. There are also differences in the number of times it is operated a day. The larger the capacity of the facility and the greater the number of times it is operated per day, the lower the costs are.)

Proposals for Policy Development

This new pumped-storage power system is promising. The system is expected to have enough capacity to exceed the 510 GWh/day [1] required in 2050 by 900–2,200 GWh/time (5h)/day and for power generation costs to be reduced to 19.4 JPY/kWh.

- 1) Facility design and operational planning for the system must be tailored to match its rollout and to regional characteristics.
- 2) Planning in conjunction with nearby wind, small hydro and biomass power plants is necessary to hold down construction costs.

[1] LCS Proposal Paper for Innovation Policy Development "Economic Evaluation for Low Carbon Electric Power System Considering System Stability (Vol. 2)" Mar. 2018.