

Feasibility Studies with the Aim of Developing a
Joint Crediting Mechanism in FY2017

Feasibility Study for Floating PV Generation Projects at Existing Hydroelectric Dams in Vietnam

New Energy and Industrial Technology Development Organization (NEDO)

Green Pacific Co., Ltd., Maeda Corporation and Kyoraku Co., Ltd.

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Conducted by: Green Pacific Co., Ltd. (Lead), Maeda Corporation, Kyoraku Co., Ltd.

Study Outline

Summary

This study examines the feasibility of a project to introduce floating photovoltaic (PV) generation systems to existing dam reservoirs in central and south-central Vietnam. Until now, conventional floating PV systems with capacities of several megawatts have usually been placed on stable pond sites. In this study, the proposed floating PV system possesses a larger capacity of 10 to 20 MW to address the technical issues described below and encourage the dissemination of project results to areas elsewhere in Vietnam with dam reservoirs.

Needs of partner country

Because of increasing electricity demand and the cancellation of a planned nuclear power installation in Vietnam, the revised version of its 7th Power Development Plan calls for large-scale renewable energy development and includes an ambitious target for PV power generation. Vietnam has also established a feed-in tariff scheme for PV systems. Vietnam's central to southern region, which suffers from a limited electric power supply, receives a high level of sunlight and has many dams. This region therefore has a high need for a project of this type and could greatly benefit from it. Vietnam's Ministry of Industry and Trade (MOIT) and Vietnam Electricity (EVN) have both welcomed the implementation of the feasibility study.

Technical issues

- 1) Issues specific to dam reservoirs: significant water depths (tens of meters) and fluctuations in water level (several meters), need for sediment treatment, need to avoid damage caused by driftwood, and need for an anchoring method to address these issues
- 2) Issues of natural/regional environment: implementation of environmental impact assessment, impact on local fishery resources
- 3) Issues related to power generation system and float: damage mitigation and submergence of float module, safety of electric power equipment

Prospects of dissemination

There are 69 hydropower generation dams in Vietnam, with 49 located in the central to south-central region. As the floating PV system covers 25-50% of the water's surface, the applicable area is 58-116 km². With a floating PV system capacity assumed to be 0.83 kW/10 m², the total capacity for electric generation would be 4,800-9,700 MW.

The feasibility study concluded that a demonstration project should be carried out which would contribute to the dissemination of new sources of electric power that are supported by combination of superior Japanese technologies in the areas of civil engineering and manufacturing. The results of the study indicate that this technology can also be applied to countries elsewhere in Southeast Asia with large numbers of dam reservoirs.

Estimated reduction of greenhouse gas emissions

- 1) Estimates for project carried out at Tri An dam reservoir:
 - Generation capacity: 10 MW
 - Generation volume: 15,637 MWh/y
 - Emissions reduction: 15,637 MWh/y × 0.333 tCO₂/MWh* = 5,207 tCO₂/y
 - (*CO₂ emissions factor (CEF) used in JCM Methodology VN_AM007)
- 2) Reference: Estimation of reduction using official grid CEF-published by Vietnamese government in 2015
 - Generation volume: 15,637 MWh/y
 - CEF: 0.8154 t CO₂/MWh (as published by Vietnamese government)
 - Emissions reduction: 12,750 t CO₂/y

Technology Outline



Photos of Tri An dam
and dam reservoir



1) Characteristics and effects of core technologies in this feasibility study

The core technologies described in this feasibility study are the main unit of the floating PV system and the method of anchoring the unit in the dam reservoir.

The floating PV system lowers the temperature of the main unit due to evaporation and increases the effectiveness of power generation by approximately 15%. In addition, the solar power generation technology is in high demand with great dissemination potential to similar areas elsewhere in the country. In particular, the feed-in tariff scheme for PV which MOIT established in 2017 should act as a trigger to promote the dissemination of PV technology in Vietnam.

2) Technical issues regarding utilization of surface of dam reservoir

Typically, floating PV systems are located on stable pond sites such as those used to store water. In this study, the proposed project for a 10-20 MW PV system was to be carried out on the surface of a dam reservoir. Technical countermeasures were considered for a reservoir water depth measuring about 100 m and for significant water level fluctuations measuring several meters.

Multiple anchoring methods were considered to address the water depth issue. Improving the flexibility of joint parts used for the float was considered to address fluctuations in the water level.

With regard to the environmental impact on aquatic organisms living in the reservoir, such an impact is expected to be minimal because of the limited number of species found at the reservoir. However, before the project design can begin, detailed study will still be required in conformance with national and provincial regulations for environmental impact assessment.

3) Linkage between superior Japanese civil engineering and manufacturing technologies

The feasibility study aimed to link civil engineering technologies offered by Maeda Corporation, which has considerable experience with constructing dams in Vietnam, and Kyoraku Co., Ltd., which manufactures high-quality float devices which conform to the requirements of the Food Sanitation Act. If the technical issues described above can be effectively addressed, floating PV system projects such as this one could be realized in the future and disseminated as other JCM projects.