

**"Feasibility Survey and Pilot Project for
Disseminating SME's Technologies to
Developing Countries" under the
Governmental Commission on the Projects
for ODA Overseas Economic Cooperation
in FY2012**

Summary Report

(Philippines)

(Type (Feasibility Survey and Pilot Project)

**Demonstration experiment on
photovoltaic system (solar panel) as
power source for milk fish production in
the Philippines)**

April, 2013

(Power Bank System, Inc.

Nomura Research Institute, Ltd.)

This report is a summary of a feasibility survey and pilot project disseminating SME's technologies to developing countries conducted by the contractor, under the Governmental Commission on the Project for ODA Overseas Economic Cooperation, commissioned by the Ministry of Foreign Affairs of Japan in Fiscal Year 2012. It does not necessarily represent the official views of the Ministry of Foreign Affairs of Japan.

Summary

Background and Objectives

The overwater photovoltaic (PV) or solar power system developed by Power Bank Systems Co., Ltd. (PBS) is an aeration system for use in aquaculture. It was developed as stand-alone power generation system which can be used over ocean where power is difficult to secure. The system's future target area is South-East Asia, where aquaculture is widely practiced.

The milkfish is highly familiar to residents of the Philippines, where it is raised in aquaculture all over the country. It is an indispensable source of protein for those living below the poverty line. This project investigates the capabilities of an aeration system using PBS-manufactured solar panels installed on milkfish aquaculture lots in Laguna Lake, the Philippine's largest lake. It provides an evaluation of the necessity of maintenance as well as a review of the economic effects of the system and the required conditions for its installation. Based on the results, this paper also aims to provide a review of the project's prospects for ODA approval, with the ultimate aim of widespread practical application of the system.

Chapter I – Issues and requirements of aquaculture industry in the Philippine

(1) Trends of the Philippine economy

The Philippine economy has maintained its stability despite global economic downturn and the chronically bad weather that has frequently plagued the country with disaster after disaster. According to the World Bank, the savings rate in the country currently exceeds investments, and its workers are in high demand globally.

A constantly recurring issue for the Philippine economy is the improvement in the daily lives of its citizens who live below the poverty line. Each Filipino requires approximately PHP 974 (approx. JPY 2,230) a month in order to adequately provide for a month's worth of sustenance, but close to 50% of the country's population is unable to achieve this income level.

(2) Current situation and issues in aquaculture

According to the 2004 Food and Nutrition Survey (FNS), the quantity of fish and fish product intake for the bottom 30% of those who live below the poverty line is at an average of 42.2g, which is approximately 40% more than the entire segment. For the poorest people in the country, fish is a valuable source of daily protein.

Fishing holds the No. 2 spot next to farming as the biggest contributor to GDP in the agriculture and forestry industry, and comprises up to 20% of the whole. In recent years, fish production via aquaculture has seen a more rapid growth rate compared to offshore fishing, coastal fishing, and deep-sea fishing. Of the 2.6 million tons produced via aquaculture in 2011, fish, crustaceans and

other types of fish comprised 29% of the output produced by the aquaculture industry, while seaweed and its derivative products comprised the remaining 71%. The top 5 aquaculture products produced in the Philippines are seaweed, milkfish, tilapia, prawns and shellfish. Of these, milkfish production quantity via aquaculture is 2nd only to seaweed production. Milkfish production is stable and is on the rise. Milkfish is produced mainly in brackish fish-breeding ponds, but production via ocean fish cages is also doing well.

One of the issues fishermen are facing with is the constant and effective management and harvest of the fish. However, the unstable climate, local breeding technology, and the construction of infrastructure that impact the fish's survival and production are also affecting water quality. In Laguna Lake's case, the deteriorating water quality is a primary contributing factor to the massive fish die-off it has been experiencing. The rising water temperature in the summer due to unusual weather patterns, the blocking of seawater caused by the construction of the Napindan Water Pressure Control Mechanism, and increased predation brought about by these environmental changes are all well-recognized issues and challenges for Laguna's aquaculture industry.

Chapter II – The Practical Availability of Technology and Prospects for Future Project Expansion

(1) Proposed enterprises and practical applications anticipated from the proposed product/strengths of the technology

The world's production of solar cells continues to grow by 40~50% per year thanks to the existence of support measures. On one hand, the share of Japanese solar panels in the world market is only 18%. Demand is heavily influenced by the debt crisis in Europe for instance, and the industry's big players do not always make a healthy profit.

According to estimates by Nomura Securities, the global solar cell market will be worth JPY 9.2 trillion in 2015, and JPY 25.4 trillion in 2030, rivaling the production scale of semiconductors.

PBS is in the business of producing the core module process of PV system, and is classified as a solar cell manufacturer. The company entered the industry as an emergent manufacturer in 2011. Although its profit margins are extremely small at present, it is well-known for its unique products. Its latest product is a bubbling system called the "*Ukishima*" (floating island) which is intended for use in aquaculture, and does not appear to have any competitor at present. In particular, solar panels are differentiated via ☐ resistance to salt-water damage and ☐ portability, which are the PBS products' greatest strengths.

Although there are several products made by overseas makers that tout aquatic usability as a feature, these can only be installed in freshwater facilities such as ponds and dams and are not appropriate for use over ocean. Furthermore, their accessories and peripheral equipment need to be installed on land. In contrast, PBS's *Ukishima* is a self-contained device that can produce and manage power as an independent power source even at a remote offshore area far from land.

(2) PBS's overseas advancement in its business expansion

The company is beginning its preparations to offer its products in Asia and the rest of the world in the future. Due to the Philippine's remarkable growth, the company plans to not only sell its products in the country, but also respond to each area's needs by establishing a manufacturing, maintenance, sales/support hub in the Philippines due to its geographic location and low-cost human resources.

(3) Assumed business structure

For PBS, creating a local subsidiary, establishing a factory, and expanding its sales hubs would be difficult shortly in terms of the required human resources and capital. Because of this, it becomes important for first, have the system recognized by Philippine government agencies, local government, fishermen associations, aquaculture industry players and potential local partners by obtaining ODA recognition. Further, it then needs to find a partner that will take responsibility for handling the brand overseas, and the company will then need to export the product to the local partner.

(4) Outreach activities implemented for the project

Project introduction to counterpart organizations has been implemented. The implementation areas will be the following:

- Aquaculture Division of Philippine Bureau of Fisheries and Aquatic Resources (BFAR)
- Fishery Sections of Laguna Lake Development Authority (LLDA)
- Rizal Province
- Binangonan Municipal Office

Interest in the project from the destination areas is high, with proactive offers made the BFAR and fishing industry groups in Rizal which have expressed interest in observing the project. However, all agencies have expressed reservation in adopting the system pending positive results on affordable pricing.

(5) Response to risks during project period

☒ Technology from rival countries: according to an interview with the local fishing resources bureau, there are no products or competitors that are similar to the system at this point in time.

☒ Specification of pilot model installation site: installing the system onto a fish pen fence provided aeration for the entire pen, and improving the survival rate of the fish fry.

☒ Intellectual property protection and other legal risks: the company is currently in the process of acquiring a patent for the panel's production process. No risks were identified in terms of movements from companies in rival countries during the experiment period.

☒ Human risk: no reviews could be made on whether evacuation can be done in a timely manner in case of emergency, as no major typhoon has made a direct hit on Laguna lake during the period. Also, the risk of children playing with the device did not materialize. There were initial concerns on whether daily feeding activities or data measurement can still be performed with the device, but no risk materialized due to the consistency of guidance provided during the start of the experimental period.

☒ Piscine disease: in terms of piscine disease, contagious diseases or lethal disease caused by poisoning was cited as a risk, but these were averted through strict enforcement of daily monitoring and observation.

Chapter III – Review of the local compatibility of the product/technology

(1) Reduced fry fatalities

The final survival rate for the fries is estimated to have increased to 50%. The month of December has always been regarded as the worst (regarded as “killing month”) in terms of survival at a maximum of 10%. During the experiment period, the fish fry managed to maintain their survival rate of a little over 50%, greatly exceeding expectations.

(2) Water quality improvement

According to the results of water quality tests conducted at the start of the experiment and during system uninstillation, there were observable improvements in the oxygen supply, BOD5, water clarity, and phosphorous content. This leads to the conclusion that the system can significantly contribute to improving the water quality in Laguna lake.

(3) System utilization

The system operated according to plan with no trouble whatsoever. However, continuous bad weather reduced the system's bubbling effect. This effect is a natural consequence of solar power however, and is not considered as a problem.

(4) Feasibility of maintenance by local fishermen

The only maintenance work that required due to long-term operation of the system would be

battery replacement (every 3-5 years) and cleaning of the bubbling equipment. These can be adequately handled by local fishermen as the tasks do not require significant time or labor.

(5) Profitability

It has been pointed out that a majority of the aquaculture operations in the Philippines are run by small-sized operators, who will likely not be able to purchase a system that requires roughly JPY 300,000 (around PHP 150,000) per unit. However, we have received comments from the operator who have used the system during this project that he would be willing to pay up to PHP 100,000 for the system. For his case, due to the abundance of bamboo and lumber in the area, there is little need for the fibre-reinforced base, so the price commented by him would cover the cost for the solar panel, battery and bubbling system only.

Chapter IV – Developmental effects in the Philippines and proposed business project expansion through ODA approval.

4-1 Consistency of the proposed product/technology with development issues

(1) Consistency with national physical development plans

One of most influential strategies under the country's national physical development is enhancement of industrial cluster. For this policy, milkfish cluster is placed in Region I, and industrialization as well as increasing milkfish production is considered as an essential development for the strategy.

(2) Consistency with social welfare and health objectives

This project's ultimate goal (which is the increased efficiency of aquaculture projects) adequately conforms to the Philippines' nutrition intake goals and its fulfillment of its Millennium Development Goals.

(3) Consistency with national energy policy

This system also makes it possible to generate power over the ocean, which until now has not been cited as a potential power source. This makes the system potentially adaptable with the country's power generation projects.

4-2 Developmental effects of the practical use/application/adaptation of the product/technology in the Philippines via ODA approval

This system is capable of generating power over water, which until now has proven to be difficult. It can also be used to reduce power costs through its use as a stand-alone power source. Moreover,

it can potentially be used as a power source for isolated islands with no current power infrastructure.

4-3 Developmental effects in case of PBS's business expansion

The system can be used not just for aquaculture applications, but for other consumer applications as well, such as:

- Lifeline preservation during times of natural disasters
- Night lighting for guard houses and over-ocean tourist facilities
- Income improvement and welfare programs for residents of isolated islands

Furthermore, if PBS decides to expand overseas, plenty of other Japanese companies will converge on its supply chain for additional profit opportunities.

Chapter V – Concrete Proposal for ODA approval

5-1 Expecting ODA scheme

PBS has reviewed ODA selection guidelines and determined that the following three facilities have the best chance for application. However, since the last two are at the organization planning level, some details may change.

- (1) Pilot Survey for Disseminating SME's Technologies to Developing Countries (Proposal type)
- (2) Grassroots technical assistance project
- (3) Private sector linked volunteer cooperation

5-2 Proposal as Pilot Survey for Disseminating SME's Technologies to Developing Countries (Proposal type)

After reviewing the three schemes above, the project was listed as an example of the Feasibility and Pilot Study of SME's Products and Technologies in ODA Project: Phase 2 (see main volume of this report). Following this, the following ODA schemes should be used to further increase worldwide recognition of this solar generation aquaculture system:

- ☑ Information dissemination to the world via the Third Country Training Program of Triangular Cooperation
- ☑ World-wide implementation and dissemination of the solar power aquaculture system using 2KR projects

, The proposed project under Pilot Survey for Disseminating SME's Technologies to Developing Countries (Proposal type) can be linked with OISCA mangrove-planting activities in Mindanao, assistance to MILF areas in Mindanao provided by the MINSAT (II) through international yen loans, or assistance provided to the Pangasinan area via the Philippine Department of Trade and Industry's

manufacturing industry formation project.

Type (Feasibility Survey and Pilot Project)
Demonstration experiment on photovoltaic system (solar panel) as power source
for milk fish production in the Philippines

SMEs and Counterpart Organization

- Name of SME: Power Bank System, Inc.
- Location of SME: 1572-19, Uchida, Kagami-machi, Yatsushiro City, Kumamoto, Japan
- Survey Site • Counterpart Organization: Laguna Lake (Brgy. Gulod, Binagonan, Rizal Province) / Bureau of Fisheries & Aquatic Resources, Dept. of Agriculture

Concerned Development Issues

- Establishing Industrial Cluster on Milkfish Production
- Improvement of Protein Deficiency Diseases
- Production of Renewable Energy Sources
- Lowering of Electricity Expense

Products and Technologies of SMEs

- Corrosion-proof Quality provided by Salinity Tolerated Materials enables electricity generation even on the sea.
- Thin, Light, and Installable to Anywhere. It conforms to Aquaculture.
- Flexible and Easy to Process to Any Shape

Proposed ODA Projects and Expected Impact

- Increase of income by the Grass Roots Grant Aid Project which provides the system to two poor community sites.
- Continuation of Feasibility Survey/Pilot Project and upgrading of Aquaculture technology at the site of the Grass Roots Grant Aid Project mentioned above, which is realized by the Dispatch of Japanese Expert.
- Cognition of effectiveness of the system to the world through the Third Country Training by Triangular Cooperation and Promulgation of the System through KRII Scheme.

Future Business Development of SMEs

- Conclude Sales Contract with local company within 1 year and find the opportunity of local production while selling the product.

