"Needs Survey" under the Governmental Commission on the Projects for ODA Overseas Economic Cooperation in FY2012

Summary Report

Solomon Islands, Republic of Maldives, and Republic of Seychelles

Needs Survey on Introducing Technologies & Expertise on PV Power Generation Systems for Islands Area by Okinawan Small & Medium-Sized Enterprises (SMEs)

March, 2013

Okinawa Enetech Co., Inc.

Introduction

Notably in recent years, the issues of environmental consideration, energy, and waste processing are becoming the world's primary concerns. In Japan, concerns over energy sources have particularly garnered broad public attention in the aftermath of the Fukushima nuclear disaster. Under these circumstances, renewable energy (RE) offers marked potential as a significant energy supply source.

Regarding energy supply, isolated areas particularly remote islands or areas with similar geographical conditions have inherent structural disadvantages in securing sufficient energy supplies. Typical problems include the high costs of fuel transport, and the low rates of energy conversion efficiency that are a consequence of the smaller scale. As a major pioneer model for island energy systems, Okinawa has years of experience in pursuing endeavors to mitigate energy related disadvantages from earlier stages. A primary focus of such endeavors has been to harness RE. Notably, a multitude of PV systems are in place in Okinawa, where small & medium-sized enterprises (SME) work extensively on all aspects of the industry from planning, design, construction and operations. Consequently, Okinawa's SME have years of experience and sophisticated technical capabilities in introducing PV systems into small remote island grids. Meanwhile, developing countries with remote island reaches face energy concerns markedly similar to those of Okinawa, along with similar concerns over how the rises in resource supply costs greatly affect the local economy.

In this context, it is expected that the techniques and technologies developed by Okinawan SME to best introduce PV systems to small remote islands, have significant potential to contribute to solutions in this arena, as well as to the market expansion for our country's SME business programs.

Under such conditions, this survey reviews 'promoting introduction of PV Systems appropriate to smaller scale power grids in island areas' as its subject, considering the effective use of Japanese SME technologies and products in the Solomon Islands, the Republic of the Maldives, and the Republic of Seychelles. It examines ODA program measures which can contribute to achieving these targets, and what is required in terms of surveys of local needs and utilization possibilities for appropriate technologies, and other requirements to properly execute an ODA project.

I. Analyses of Japan's SME Technologies

(1) The needs in private sector utilization of SME technologies

Okinawa's SME have long years of experience and sophisticated technologies in introducing PV systems into smaller, remote island grids. They can be expected to propose PV systems suitable and appropriate for specific island needs based on their experience and capabilities, as well as serve vital roles in practical incorporation and expanding use of PV systems by providing system design-build services.

(2) The status of SME technologies

Okinawan SME have applied themselves not only to PV system design, equipment procurement, construction and installation, operation and maintenance (system integration), but also to the work with project development phases such as planning and proposing the PV system introduction to the end users. However, the conditions facing such work in Okinawa are more challenging than in Japan's other prefectures, in terms of: (a) relatively higher material costs; (b) needs for rack systems to support PV Panels; and (c) the subsidy for new PV system and the system unit cost per kW is higher than in other prefectures.

(3) Potential advantages of utilizing Okinawan SME

Okinawan SME are particularly experienced and have a broad range of sophisticated capabilities in introducing PV systems to smaller and isolated subtropical zone islands. Specifically, their capabilities are strong in terms of (a) experience and knowhow in examining a PV system's impact on power quality; (b) proven experience in system construction for consecutive operation and maintenance aspects; (c) solutions and countermeasures against typhoons and strong winds; (d) countermeasures against salt corrosion; and (e) solutions and countermeasures for small animal incursions.

(4) The issues facing SME in overseas business development

Three main concerns were cited in interviews with Okinawa's SME regarding overseas business developments: (a) lack of personnel with foreign language skills; (b) limited prior experience with overseas projects; and (c) concerns on project implementation structure appropriate to local conditions. To resolve these concerns, a survey on project materialization should be conducted, to provide more detailed information about local conditions to the SME.

(5) Positive Impact on local Economy derived from Overseas Business by Okinawan SME

The overseas business ventures by Okinawan SME are likely to contribute to the local economy in the following venues: (a) maintenance and expansion of employment opportunities, (b) human resources development, and (c) expansion of business opportunities.

II. Solomon Islands

(1) Identifying current conditions and needs in the Solomon Islands

The Solomon Islands archipelago is comprised of six main islands and some 1,000 other islands, supporting a population of 536,000. Approximately 50,000 live in the capital, Honiara. The level of global solar radiation hitting the Solomon Islands is 5.52kWh/㎡ per day, is 1.4 times more than in Okinawa, providing a natural environment suitable for PV implementation. Also, the government is promoting policies of expanding RE applications, such as their "National Development Strategy." The nation has prior experience in introducing stand-alone PV systems such as home solar generation systems. However, there is no experience to date in introducing a grid-connected system.

The Solomon Islands Energy Agency (SIEA) is developing a draft of regulations and technical conditions for grid connection of dispersed power systems, with the draft pending government approval. The legal basis for broad based grid-connected systems is now being developed. A Feed-in Tariff system for RE is not currently mandated, however economic incentives will work well in tandem consequent reductions of energy costs since charges for electric power are quite high. These imply that RE applications will be more readily adopted over time. However in expanding the utilization of grid-connected systems, certain challenges are evident: there are no distribution routes, and there are insufficient personnel having the needed technical skills and experience because the country has no prior experience in adopting such systems.

(2) The possibilities of utilizing SME technologies in ODA projects

Using Okinawa's SME with grant aid to implement construction and installation for a grid-connected PV system in the capital Honiara can be beneficial to promoting the spread of PV power generation in the Solomon Islands, and provide the win/win of creating international business venues for Okinawan SME. In doing so, the electric utility of the Solomon Islands and local industry will obtain knowledge and experience with grid-connected systems. Also, if Japan helps provide the initial grid-connected system in the Solomon Islands, this initial system will be the default format to be followed by systems installed later. Accordingly, Okinawa's SME will be able to shape the long term course by providing the initial PV introduction.

The systems as proposed by Okinawa's SME combine multiple marketed power conditioners and can be applied not only to small scale consumption such as residential use but also to large scale operations such as offices and factories. Also, with increased consumption by local enterprises means securing distribution routes will be easier and the delivery system will be established in comparatively earlier stages.

(3) Business possibilities in utilizing SME technologies

Implementing an ODA project utilizing Okinawan SME technologies will broaden the use of grid-connected PV systems, and provide a significant business venue for Okinawan SME. Furthermore, the potential business will not be limited to the Solomon Islands, but can also include countries with similar geographical and climatic conditions in Oceania.

Solomon Islands

Status

- Natural conditions suited to PV power generation.
- Local government is promoting introduction of renewable energies.
- Current utility charges are high.
- No prior experiences with grid-connected PV generation.

ODA Project Implementation

- Building a grid-connected PV power generation system in Honiara by Okinawan SME using grant aid.

Widespread dissemination of PV in Solomon islands

- Electric utilities and workers in the Solomon Islands will gain knowledge and experience in grid-connected system.
- If Japan implements the first grid-connected system in the Solomon Islands, this will be the default format and later systems will follow. Therefore, Okinawan SME will be able to help shape the expansion of the PV introduction.

Business Development in Oceanic Countries

- Okinawan SME can accumulate experiences in overseas business development with the help of grant aid in the Solomon Islands, the potential business scope will involve not just the Solomon Islands but also countries with similar geographical and climatic conditions.

III. Republic of the Maldives

(1) Identifying current conditions and needs in the Republic of the Maldives

The Republic of the Maldives is an archipelago nation of atolls positioned southwest of India and Sri Lanka. Of these islands, 194 have a population of 330,000. There are about 100 'resort islands' which have only resort hotels on them. There are power stations on each inhabited island, providing power by DG generation. The level of global solar radiation is a very high 5.85kWh/m^2 per day, about 1.5 times that of Okinawa, providing a natural environment suitable for broad-based PV introductions. The government of the Maldives has publicly pledged to achieve carbon neutral emissions by 2020, and in October 2010, released the "Maldives National Energy Policy and Strategy." The government is promoting RE applications based on this policy, and a grid-connected PV system has been built in the capital of Male with Japanese grant aid.

Conversely, the initiative to bring PV power generation to small remote islands located in the country has just begun. To introduce PV generation to small remote islands at a high rate, systemic combinations of DG and PV will be needed to meet supply and demand adjustments, electricity quality assurance etc. To achieve this, the knowledge of hybrid system construction which has been accumulated in Okinawa should be applied. Also, since the Maldives has SME with sophisticated DG technologies, business can be smoothly developed in the collaboration between local firms and Okinawan SME.

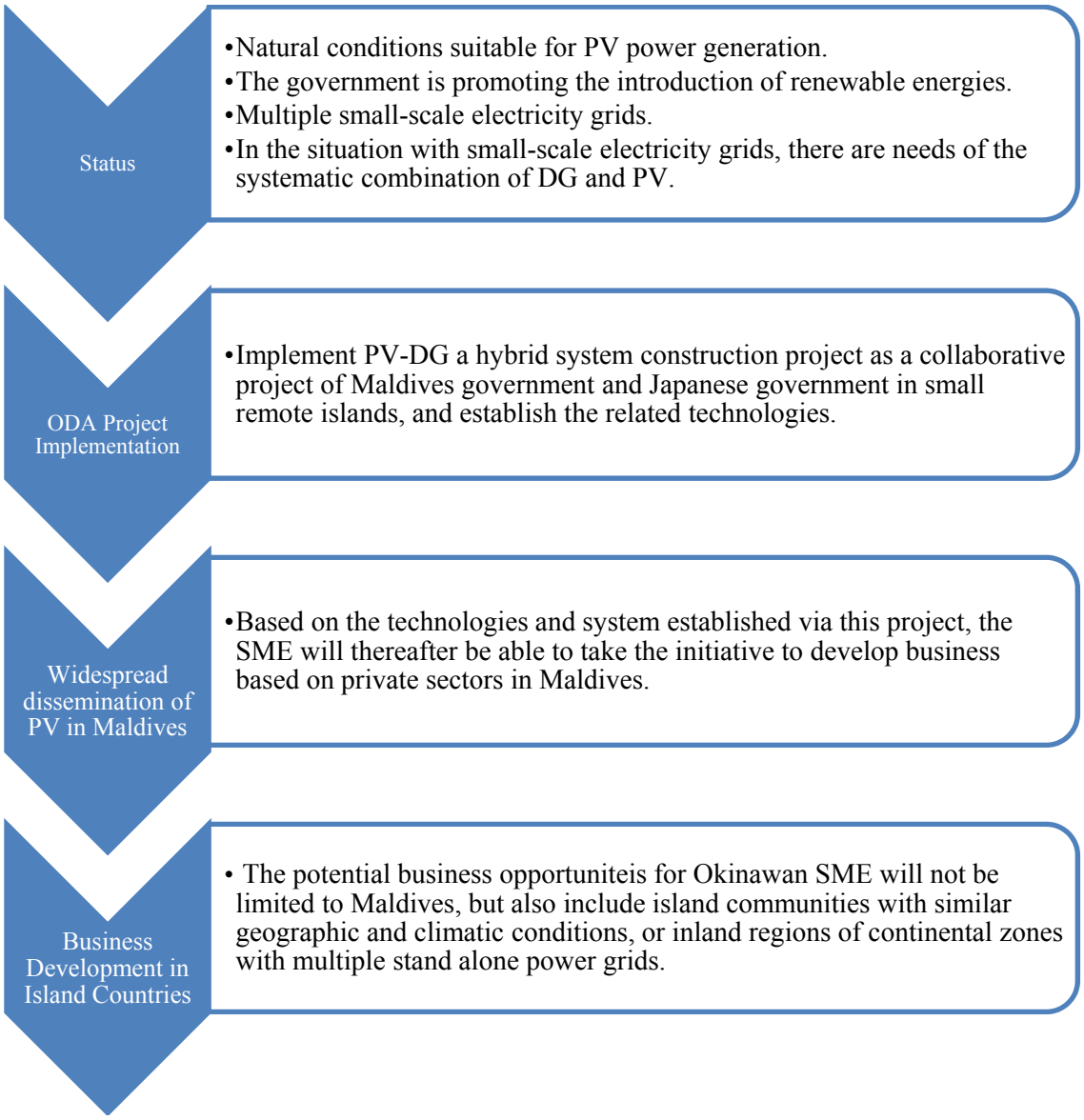
(2) The possibilities of utilizing SME technologies in ODA projects

We propose to implement PV-DG hybrid system project and establish proper technology transfer by collaboration between the Maldives and Japanese companies, for small remote islands currently on the power station relocation plan, e.g., Gaafaru island. Based on the technologies and system established for the project, the SME will take the initiative to develop business based on the private sector in the Maldives. A system produced by combining multiple marketed power conditioners, as proposed by Okinawan SME, uses products comparatively facile, making system construction rather easy. The ease of replacement in case of malfunctions makes the system particularly beneficial. In addition, if a power conditioner breaks down, the continuous operation of other power conditioner will raise the operation rate, another advantage.

(3) Business possibilities in utilizing SME technologies

If a hybrid system construction technology is established in the Maldives, the potential business development will not be limited to only the Maldives, but possible in island countries with similar geographical and climatic conditions, or inland continental reaches using multiple independent electric grids.

Republic of the Maldives



IV. Republic of Seychelles

(1) Identifying current conditions and needs in the Republic of Seychelles

The Republic of Seychelles spans an island archipelago of 115 islands with a population of 90,000; 95% live on one of the three main islands of Mahé, Praslin, and La Digue. In the more remote islands, electricity comes from DG, but with the high generation costs derived from the high price of fuel. The level of global solar radiation is a high 5.8kWh/m^2 per day, 1.5 times that of Okinawa, providing natural conditions conducive to PV implementation. The Seychelles government has recently been active in pursuing the adoption of REs, setting a stepwise goal to increase the power obtained from RE by 5% in 2020, and 15% by 2030. At this juncture, no legal system for RE has been yet developed, however regulations relating to grid-connected system and feed-in tariffs are slated to be developed based on the Energy Law of December 2012.

Regarding an ODA project, the Seychelles is a high-middle income nation, with the per person GNI at a high US$10,530. Therefore, utilizing grant aid mandating Japanese SME products and technologies could be difficult.

Six MW-scale wind turbines are now being built, and will precipitate a need for grid stabilization measures. This is the country's first major introduction of a large scale RE installation, making the Seychelles interest in technology acquisition of grid stabilization solutions, micro-grids and smart-grids management, quite strong. To further broaden RE adoption, technical assistance on grid stabilization from Japan could be key. To ensure continued utilization of RE, maintenance operations will be important and for this aspect too, technical assistance will be required.

In regards to academic field, the University of Seychelles is a new institution marking its third year since establishment. There have been some requests for assistance because the research environment, particularly essential when training professionals, is not yet sufficient.

(2) The possibilities of utilizing SME technologies in ODA projects

The current Seychelles environment is not conducive to expanding the RE use, due to lack of facilities in the legal system and insufficient technological expertise. Therefore to commence, supporting the needed developments to help expand RE use is important, in terms of developing better conditions for SME to deploy their services.

As one idea, we propose that electric power companies should provide technical assistance regarding grid stabilization, e.g., providing training and/or dispatching experts, and support development of a master plan for hybrid system installations in remote islands.

Also, Okinawa's SMEs have proven performance in design, construction and maintenance of PV systems. This reason underlies our proposal to provide technical training in the Seychelles to build the capacities of PV related technicians, in collaboration with universities and educational facilities around the African region.

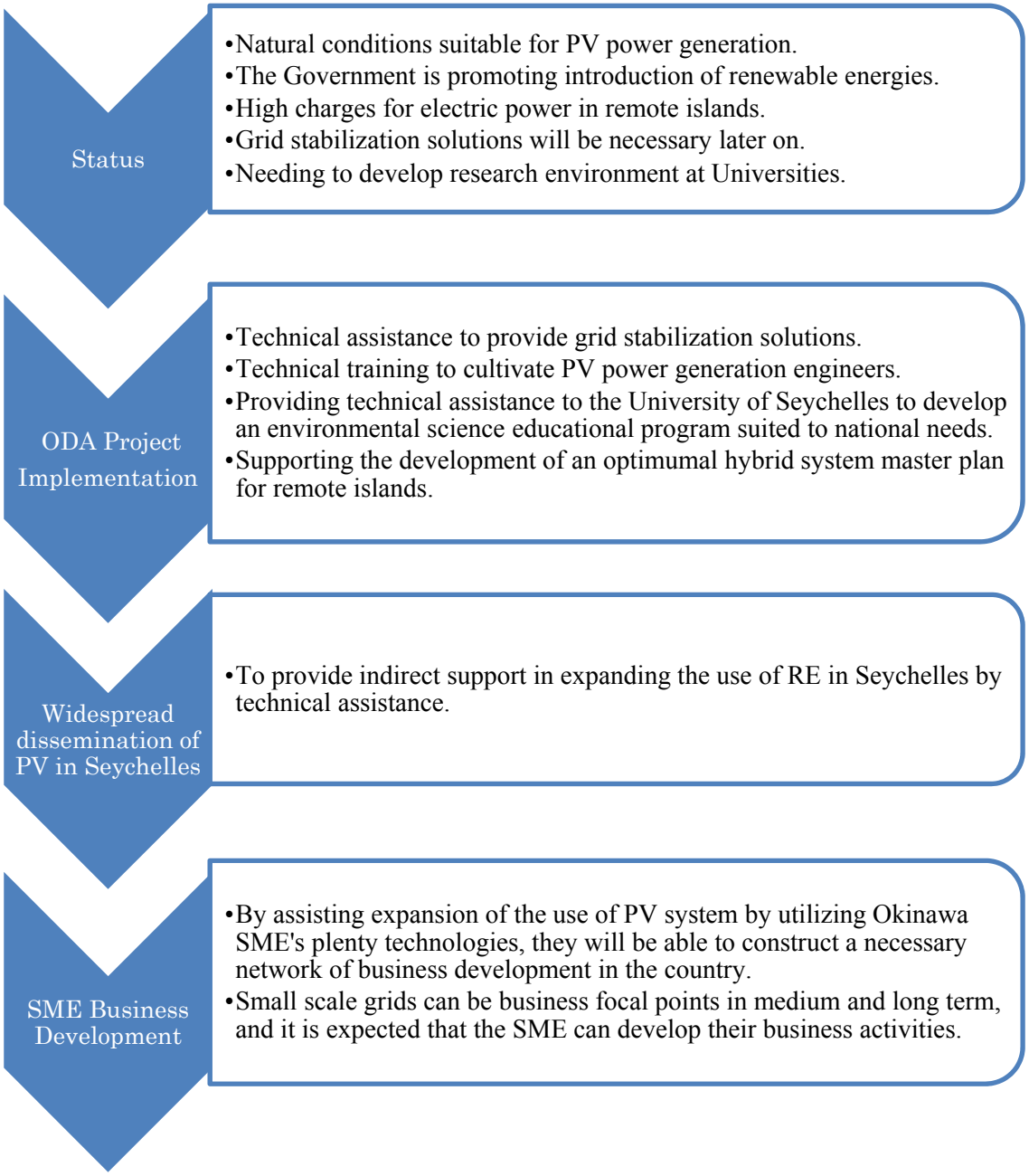
Moreover, a team of engineering, science, and education department personnel from the University of the Ryukyus can survey the current environmental, societal, and economic conditions in the Seychelles, and provide the technical assistance needed to better develop the environmental sciences program of the University of Seychelles.

(3) Business possibilities in utilizing SME technologies

By expanding the use of PV systems through tapping the rich scope of capabilities of Okinawan SME, it will be possible to build the network needed for further business development in the country.

The Republic of Seychelles has many small remote islands. These small scale grids offer business opportunities, where the SME can develop their activities over the medium and long term.

Republic of Seychelles



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Needs Survey on Introducing Technologies & Expertise on PV Power Generation Systems for Islands Area by Okinawan Small & Medium-Sized Enterprises (SMEs)

SMEs and Counterpart Organization

- Proposing Company / SMEs : Okinawa Enetech Co., Inc. / Okinawan PV Generation SMEs
- Location of SMEs : Okinawa Prefecture
- Sites, C/P Organization: Solomon Islands ; Ministry of Energy and Rural Electrification
  Republic of the Maldives; Ministry of Environment, Energy and Water
  Republic of Seychelles - Seychelles Energy Commission

Concerned Development Issues

- With the continued rise in fuel costs for remote islands, power generation costs have risen.
- Environmentally friendly, stable power sources that do not rely on fossil fuels, are essential.
- At the 6th Pacific Islands Leaders Meeting, Japan publicly pledged to address climate change and common issues, tapping experience in Okinawa.

Products and Technologies of SMEs

- Tapping Okinawan SME expertise, technical proposals for island areas that do NOT rely on storage batteries will be possible .
- A system combining small, off the shelf products can be quickly recovered from malfunctions.
- Reduced replacement cost by using simplified systems.

Proposed ODA Projects and Expected Impact

- Introducing power generation systems with grant aid and introducing the regulations and standards that will be needed to implement grid-connected PV system as technical assistance.
- By accelerating the PV power generation systems introduction of the selected countries, the nationals will be able to operate and maintenance without depending on other countries.

Future Business Development of SMEs

- Utilizing the Technologies of Okinawan PV Generation SMEs / Overseas Business Development