



The Portrait of Activities and Learning

**Assistance Program for Solar Power Plant (PLTS) Management
in Small and Populated Outer Islands**

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The Portrait of Activities and Learning

Assistance Program for Solar Power Plant (PLTS) Management in Small and Populated
Outer Islands

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FOREWORD

A lesson in assistances

The word “facilitator” in the activities of small outer islands (PPKT) which are populated in this case can be referred to as a facilitator, cadre, *setrawan*¹ or other terms that are currently being widely used in community empowerment programs. In general, the purpose of this assistance is the occurrence of a creative process of change initiated by the community itself, indicating the existence of a process of initiative in the form of actions undertaken by the community without external intervention.

A facilitator is a friend to the community, where he has a dual function. At one time the facilitator will be tasked to guide. At other times he/she will become an enabler or an encourager and at other times he/she will become an expert. However, facilitators within the scope of community empowerment need to be aware that their primary role is the community learning. Knowledge that has been studied as a provision to be a facilitator is undoubtedly expected to be applied in the community assisted.

A total of 25 PPKT locations are the objectives of the PLTS facilitation program in cooperation with various institutions according to their respective roles and responsibilities. The facilitators had been provided with the necessary knowledge and skills related to the development of solar power plants (PLTS) in PPKTs. However, each island has different characteristics of society. Some are quick to receive, others require a long process to implement the PLTS program. Some are easy to absorb knowledge, but others take longer to understand that knowledge. Therefore, the art in facilitating the community is critical.

The ability of a facilitator to create cadres who come from a community group is itself a major indicator of his/her success as a facilitator, and not the other way around. Because the assistance process is not to create a new dependency for a community group. This book is a lesson in providing community assistance in the PLTS program in PPKTs that can be used for future planning in similar programs.

Jakarta, September 2016

The editorial team

¹ *Civil Servants who are equipped with special skills to carry out the task of village development assistance*

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GLOSSARY

AD	: <i>Anggaran Dasar</i> – Statutes
ADD/DD	: <i>Alokasi Dana Desa/Dana Desa</i> – Allocation of Village Funds/ Village Funds
APBD	: <i>Anggaran Pendapatan dan Belanja Daerah</i> – Regional Revenue and Expenditure Budget
ART	: <i>Anggaran Rumah Tangga</i> – Bylaws
BUMDes	: <i>Badan Usaha Milik Desa</i> – Village Owned Enterprises
DKP	: <i>Dinas Kelautan dan Perikanan</i> – Marine and Fisheries Office
DFW	: Destructive Fishing Watch
Distamben	: <i>Dinas Pertambangan dan Energi</i> – Mining and Energy Office
Dpl	: <i>Di atas permukaan laut</i> – Above Sea Level
EnDev	: Energising Development
GIZ	: <i>Deutsche Gesellschaft für Internationale Zusammenarbeit</i>
Kemendesa	: <i>Kementerian Desa, Pembangunan Daerah Tertinggal dan Transmigrasi</i> – the Ministry of Villages, Underdeveloped Regions and Transmigration
KESDM	: <i>Kementerian Energi dan Sumber Daya Mineral</i> – the Ministry of Energy and Mineral Resources
KKP	: <i>Kementerian Kelautan dan Perikanan</i> – the Ministry of Marine Affairs and Fisheries
KP3K	: <i>Kelautan, Pesisir, dan Pulau-Pulau Kecil</i> – Marine, Coastal and Small Islands
KPDT	: <i>Kementerian Pembangunan Daerah Tertinggal</i> – the Ministry of Development of Disadvantaged Regions
kWp	: kiloWatt peak
Pemda	: <i>Pemerintah Daerah</i> – Sub-National Government
Permen	: <i>Peraturan Menteri</i> – Ministerial Regulation
Permendagri	: <i>Peraturan Menteri Dalam Negeri</i> – Regulation of the Minister of Home Affairs
Permendesa	: <i>Peraturan Menteri Desa, Pembangunan Daerah Tertinggal dan Transmigrasi</i> – Regulation of the Minister of Villages, Underdeveloped Regions and Transmigration
PLTS	: <i>Pembangkit Listrik Tenaga Surya</i> – Solar Power Plant
PNS	: <i>Pegawai Negeri Sipil</i> – Civil Servants
PP	: <i>Peraturan Pemerintah</i> – Government Regulation
PPKT	: <i>Pengelolaan Pulau-Pulau Kecil Terluar</i> – Management of Small and Outer Islands
PTO	: <i>Petunjuk Teknis Operasional</i> – Technical Operations Guidelines
RPJMDes	: <i>Rencana Pembangunan Jangka Menengah Desa</i> – Village Medium Term Development Plan
SD	: <i>Sekolah Dasar</i> – Elementary School
SMA	: <i>Sekolah Menengah Atas</i> – Senior Highschool
SMK	: <i>Sekolah Menengah Kejuruan</i> - Vocational Highschool
SMP	: <i>Sekolah Menengah Pertama</i> – Junior Highschool
SWOT	: Strengths, Weaknesses, Opportunities, Threats
TNI	: <i>Tentara Nasional Indonesia</i> – Indonesian Armed Forces
TPLD	: <i>Tim Pengelola Listrik Desa</i> – Village Electricity Management Team
Wh	: Watt-hour

PART I. INTRODUCTION

1.1. Background of the Program

In February 2015, GIZ (Deutsche Gesellschaft für Internationale Zusammenarbeit) through the Energizing Development (EnDev) Indonesia signed a cooperation agreement with the Directorate General of Marine, Coastal and Small Islands (DG MCSI), the Ministry of Marine Affairs and Fisheries (MMAF), and DFW (Destructive Fishing Watch), on strengthening community participation through effective assistance to the PLTS program on the outer populated islands.

The scope of the support of GIZ in this program to include an increase in capacity of the facilitators commissioned by the MMAF to assist PLTS beneficiaries in 25 outer small islands (PPKT). All of the PLTSs were built by the Directorate General of New and Renewable Energy and Energy Conservation (DG NREC), the Ministry of Energy and Mineral Resources (MEMR). The facilitators were deployed to the field to help the community to utilize the PLTS in a sustainable manner.

GIZ focused on the capacity building support through a series of activities as follows:

- Training for facilitators on PLTS management and maintenance,
- Training for facilitators on community business capacity development,
- Assistancess of field facilitators in three islands.

As a result of these activities, a Book on the Portrait of Activities and Learning of the Solar Power Plant Management (PLTS) Assistance Program on the Outer and Populated Small Islands.

The activity scheme can be seen in detail in **Diagram 1**.



Figure 1 The activity scheme of EnDev in providing support related to the Solar Power Plant (PLTS) Management in PPKT

In order to improve the effectiveness of the technical assistance for the stakeholders in PPKT, three locations were chosen as a pilot in the implementation of the PLTS program facilitation. In accordance with the agreement of the program actors, **Kawaluso Island** and **Matutuang Island**, in the District of Sangihe Islands, North Sulawesi Province and **Larat Island** in West Southeast Maluku District, Maluku Province were selected as the pilot locations of the facilitation.

1.2. Development of Centralized Solar Power Plants within the Nawacita Policy framework

The proclaimed Nawacita (Nine Hopes) Policy is aimed at building a sovereign Indonesia politically, economically and culturally. This policy has 9 work programs, one of which is to **develop Indonesia from the peripheries by strengthening the regions and villages**. This policy aims to defend the sovereignty of the Republic of Indonesia through the improvement of the welfare of people living in border areas and outer islands which are highly vulnerable to outside influences.



Figure 2 – The 50 kWp capacity of Solar Power Plant (PLTS) in Kawaluso Island provides electricity for 153 families

In the framework of the program implementation, the Nawacita Policy is derived in the form of Roadmap for the Development of Independent Populated Small Outer Islands (PPKT) in 2015-2017,

prepared by the Directorate of Small Islands Utilization, DG MCSI ², of the MMAF. This Roadmap aims to encourage the strengthening and acceleration of development of 31 (thirty one) populated outer islands as outlined as follows: providing direction, principles, performance, indicators and guidance to be achieved by ministries / agencies in building independent and prosperous PPKTs.

One of the indicators in the roadmap is the availability of adequate basic and supporting facilities and infrastructure (sarpras). To accomplish this, in 2014 the MMAF and the MEMR were working together to meet the energy needs of 25 (twenty five) outer islands through the development of centralized PLTSs. Solar power is considered suitable to be built on the outer islands, especially those with high intensity of sunlight. In addition, the power generated from PLTS is expected to support the development of the domestic economy in order to improve the welfare of the community. This will certainly be very helpful in the food security and resilience of the country. The manifestation of Nawacita in the context of PLTS development can encourage the capacity building and economic development, specifically in the outer islands of Indonesia.

In relation to the achievement of indicators, the MEMR focused on the development of electricity based on renewable energy on the number of electrical connections in PPKTs. The following is the description of the achievements of renewable energy infrastructure of the MEMR related to the development of PLTSs in PPKTs:

Table 1 – Renewable energy infrastructure in PPKT in 2014-2016

INDICATOR	2014	2015	2016	TOTAL
Centralized PLTS facilities in the outer islands (units)	25	8	8	41
Cumulative capacity (kWp)	1,100	415	420	1,935
Energized connections (homes and public facilities)	3,508	1,679	1,759	6,946

Source: Materials for the Regional Workshop on Facilitation of Assistance in Management of Potential Resources of Small Outer Islands, MEMR, 2016

² Currently changed to the Directorate General of Sea Space Management (DG SSM), MMAF

1.3. The Role of Facilitators in the Development of Centralized Solar Power Plants (PLTS)



Figure 3 – Field study in the training for facilitators

Facilitators are a very important part of the centralized PLTS development program in 25 PPKTs. PLTS built on these outer islands are full of high technology that demands certain usage behavior in order to run properly. In a plain view there is a problem of compatibility between PLTSs and coastal communities that must be addressed. There is a process of "trade-off" which needs to be done so that this technology is acceptable and running properly. The process of negotiating, learning, and mobilizing the community needs to be guarded. The placement of facilitators in PLTS sites is expected to be

able to bridge the needs of the PLTS and recipient communities, in addition to the management of social dynamics that arise from the introduction of this technology.

To mobilize the facilitators, the Directorate General of MCSI under the MMAF was working with partners engaged in monitoring fisheries utilization and fisheries development, i.e. DFW Indonesia. A total of 25 facilitators had been recruited through a selection process participated by 400 applicants. These applicants came from various disciplines and universities, including University of Indonesia, Gadjah Mada University, Hasanuddin University, Sam Ratulangi University, Riau University, Brawijaya University, Haluoleo University and Padjadjaran University, and the representative of the Technical Implementation Unit (UPT - Unit Pelaksana Teknis) of the MMAF.

These facilitators will be tasked to facilitate PLTS recipient communities so that they will be able to manage the PLTS properly. These tasks to include social preparation, to build an agreement, to facilitate the formation and the capacity building of the Village Electricity Management Team (TPLD - Tim Pengelola Listrik Desa), to promote the formulation of rules and mechanisms of the rules in community institutions, to coordinate with sub-national governments (district / city), sub-district governments and village governments, as well as other stakeholders, and identification of productive economic activities undertaken by communities in the utilization of PLTS in the outer islands.

The role of the facilitators is crucial in encouraging the implementation of development policies at the local level. However, it is not uncommon for the facilitators to encounter difficulties in elucidating these policies. When it comes to technical and non-technical problems, it is often difficult for facilitators to solve quickly because of waiting for further instructions. The facilitators' creativity is crucial in encouraging problem solving, but not all facilitators are able and willing to take the risk.

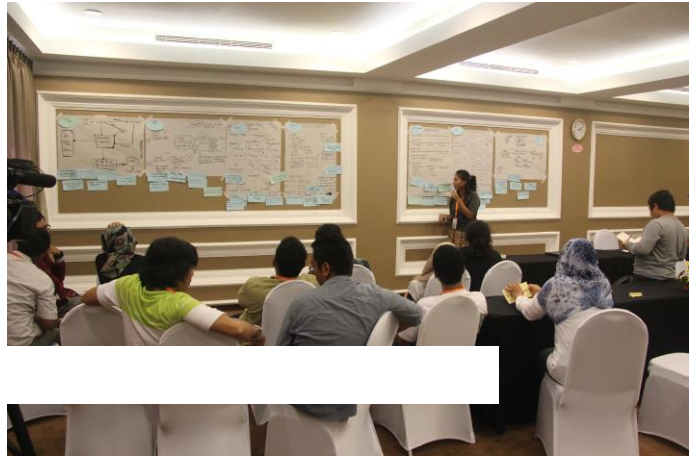


Figure 4 – Presentation and discussion in the training for facilitators

Involvement of facilitators starts from the preparation, implementation, up to post-development. Despite the fact that involvement in these processes varies, in the facilitators' job description there are several points that can be synchronized with the development planning processes that took place in the village. For example, the preparation of economic profiles and the assessment of the condition of the village is a necessary process in formulating the village planning. Both of these processes are critical points needed to understand the condition of the village and will greatly influence how the development will be implemented. Where if both points are implemented correctly with the village community, it can lead to the strengthening of the village governance process. By all means, in the end this process will encourage integration of activities into the village governance. So that knowledge and facilitation skills in the field of village governance is absolutely necessary for a facilitator.



Figure 5 – Inauguration party for Facilitators of 2016

Before leaving to the area of their duties, the facilitators were equipped with knowledge in organizing the community and PLTS technology in general through a training of facilitators with the theme of "Community Based PLTS Management Program on Small Outer Islands". The training was conducted by the MMAF in cooperation with GIZ and DFW on 19-25 April 2015³. One of the training focuses is the TPLD training module developed by GIZ was based on years of experience supporting the capacity building of TPLD. Methods used in the training included active learning, simulation, case studies and field trips.

After the training, the facilitators were officially deployed by the MMAF and the MEMR. Technically, the deployment process of the facilitators was coordinated by DFW. The facilitators were deployed in the outer islands to handle one to three islands to be facilitated. The hard duty of these field facilitators requires cooperation and collaboration between sectors in the MEMR, the MMAF and sub-national governments, consultants, and of course the recipient communities in the target locations.

³ This is the batch 1 of the training for the facilitators sent to 25 outer islands in 2015

Box 1. Facilitators' Work Output

- The socio-economic profile of the island people where the focus of assistance and community groups who manage the facilities and infrastructure of small islands.
- Report on the assessment of the status and condition of the facilities and infrastructure of small islands.
- The TPLD is established with a clear organizational structure and the board and has the legality of the Decree of the District Head (Bupati) at the program site.
- The preparation of the Statutes (AD - *anggaran dasar*) and Bylaws (ART - *anggaran rumah tangga*) of the PLTS management team.
- Establishment of rules for the management of community-based facilities and infrastructure (the mechanism /standard operating procedure (SOP) and other regulations in the management of the facilities and infrastructure), establishment of the group business plan, establishment of the group economic development proposal.
- Implementation of capacity building trainings for human resources of the facilities and infrastructure management group.
- Report on the results of meetings and coordination of groups, communities, the government and other stakeholders.
- Report on analysis of monitoring, supervision and evaluation of the performance of the facilities and infrastructure management.
- Complete (comprehensive) report on the implementation of facilitation of the facilities and infrastructure management.

PART II. METHODOLOGY

The writing process of this book was done through several phases. Each phase consisted of several activities that were considered necessary in preparing and executing the writing of the book. The phases are illustrated in the following chart:

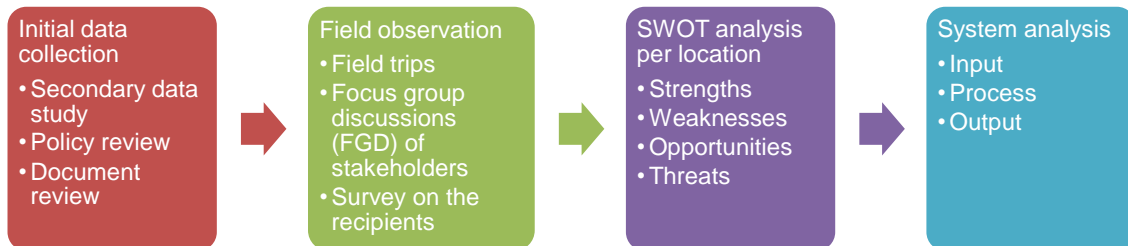


Figure 6 - The process of writing of the Book on the Portrait of Activities and Learning

2.1. Initial Data Collection

The data collection was conducted in several ways, including through interviews, document review and secondary data studies. In addition, meeting with the facilitator became one of the important ways to collect actual data. Focused discussions were conducted with stakeholders relevant to the program, such as the Marine and Fisheries Office, the EMR Office, the MEMR, the MMAF, the village government as well as the PLTS management group.



Figure 7 – Meeting with the MAF Office of Sangihe Islands District

2.2. Field Observation

Field observations were conducted through visits to three locations, i.e., Kawaluso, Matutuang, and Larat Islands. During the field visits, there were discussions with stakeholders, including sub-national governments (the EMR Office, the MAF Office), village government, the PLTS management group, and the community. In addition, focused discussions with stakeholders were also conducted.

To strengthen information in the field related to the utilization of PLTS, interviews with the recipients were conducted. This interview used questionnaires that include the respondents' profile, the socio-economic condition of the community, location of natural resources utilization, environmental condition, knowledge of PLTS, PLTS management, and others.



Figure 8 – Field observation with the facilitator

Field observations were also conducted on the ecological and social aspects of the community. The observations indicate the presence of abundant potential in the coastal areas. The livelihoods of most of the fishermen are very dependent on the coastal resources. When the condition of the sea is bad because of the weather, some people cultivate agricultural land or plantations. The result of field observation was then consulted with the Village Head, the EMR Office and the MAF Office to get input related to the condition of the PLTS and its management in the future.

2.3. SWOT Analysis

SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis was conducted to identify various factors systematically to formulate the strategy of the activities. SWOT analysis plays an important role in planning the activities by looking at the strengths and weaknesses of a program, its opportunities, and its threats. In the context of the preparation of this book, SWOT analysis is used to obtain an overview of the conditions of the PLTS sites.

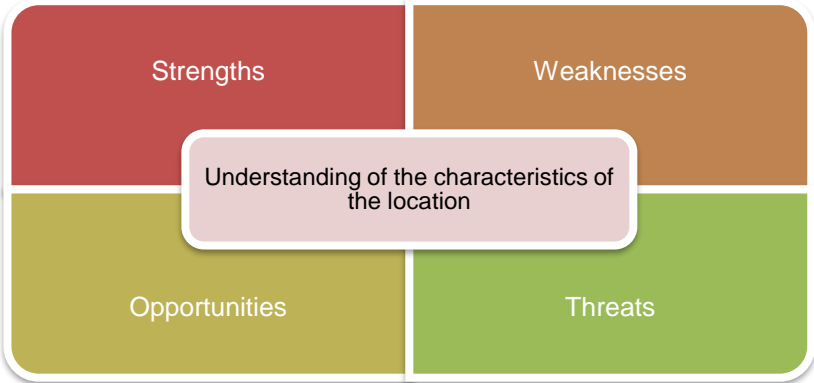


Figure 9 – SWOT analysis to understand the characteristics of the location

2.4. Analysis of the Input, Process, and Output System

This analysis relied on the assumption that all activities are a system consisting of three sub-activity blocks in the order of inputs, processes, and outputs. The factors of each block were identified through

a focused group discussion between the field team and the GIZ team. In Chapter IV all of these processes are integrated into the discussion by type of activity.



Figure 10 - Three main blocks in the analysis of the Solar Power Plant (PLTS) development system in PPKTs

The system analysis was used to comprehensively assess whether or not the input given and the applied process is in accordance with the expected output. The contents of these input blocks were built together in a simple scoping process. The aspect of process was observed from field reviews and interviews, while the output block was constructed using perceptions of “ideal conditions to be achieved with the PLTS”. This built-in model was then agreed upon and used as the basis for the development of lessons learned, shown in Figure 10 - Three main blocks in the analysis of the Solar Power Plant (PLTS) development system in PPKTs above.



PART III. GENERAL DESCRIPTION OF THE LOCATIONS

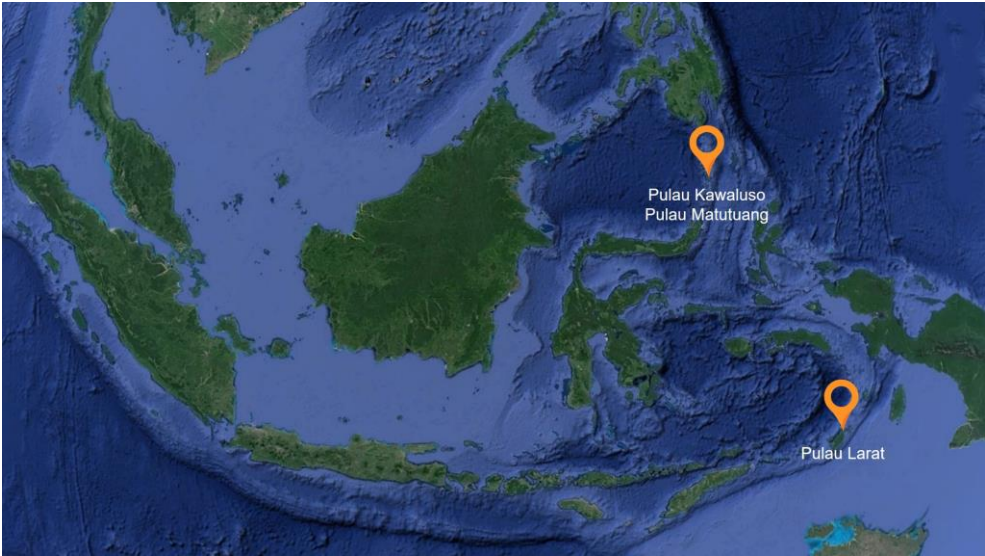


Figure 11 - Location of three islands of assistance



Figure 12 – Boats are the only access to small islands

3.1. Kawaluso Island (SulUtS05)

Ekologi

Kawaluso Island is located in Kendahe Sub-District, Sangihe Islands District, North Sulawesi. This island has an area of 1.22 km² with a height of 0-100m above sea level. The condition of the beach is partly black sands, partly rock cliffs and volcanic rocks. In several locations, there is a coral reef formation in the outer shore that forms the fringe reef. This fringe reef breaks big waves, but also blocks large boats to dock, except through the jetty. The productive vegetations found in Kawaluso Island are the nutmegs, coconuts, sagos, tubers, oranges, fishes and food crops which are very limited because of the soil conditions that contain coral and rocks.

Socio-economic

This hilly island has a population of 618 people, of which 322 are male and 296 are women scattered in several villages. The livelihoods of the population are as farmers (20 people), fishermen (190 people), traders (5 people), civil servants (9 people), and a member of the Indonesian Armed Forces (1 person)⁴. There is one elementary school (SD) on the island with a total of 74 students, managed by 6 teachers, but only 2 units of official houses for them, and that one is in poor condition.

The coastal waters look productive, where the people use it as a source of food. Various reef fishes and pelagic fishes seem to be utilized by the people. The sandy tidal area is covered by several seaweed (seagrass) species, but there is no mangroves in the coastal area of the island.

Nutmeg is an important economic product for the people of Kawaluso Island. So that when the nutmeg season arrives, the activities of the people will be centered on the management of the harvest such as picking, peeling, and drying up to sending nutmeg when the ship arrives. Concrete streets on the island turned into a place of sunning. The people who walk there also have to wriggle between the stretch of nutmegs.

Transportation and accessibility

The distance of Kawaluso Island which is relatively closer to Sangihe Island and the surrounding islands (e.g. Kawio Island) makes easier for people to travel, although with a pump boat they must be willing to get wet for at least three hours in a fine weather. In addition, Pioneer Motor Boats are also regularly anchored here. The line served by these four ships is an important vein for the distribution of logistics.

This is so important, as if every boat anchored is an important social event. When a boat arrived, people from all villages gathered at the harbor. Mothers use this occasion to make various kinds of cakes and food for sale to fellow islanders or passengers aboard.

⁴Source: *Sub-District of Kendahe In Numbers, 2016*



Figure 13 – An overview of socio-economic conditions in Kawaluso Island

Infrastructure and electrification

The island has a hilly characteristic that requires a strong effort in the preparation of PLTS infrastructure including the transportation of materials from the pier up to the installation of electricity in each home and in public facilities. The PLTS infrastructure development is assisted by the local people. With a power of 50 kWp, the PLTS is connected to 195 households, lighting for public facilities (schools, the village hall, the community health center/puskesmas) as much as 9 connections, and rural businesses as much as 12 connections. Currently the energy allocated for each house is 450 Wh.



Figure 14 – The 50 kWp capacity of Solar Power Plant (PLTS) in Kawaluso Island

3.2. Matutuang Island (SulUtS06)

Ecology

Matutuang Island is located in the Sub-District of Marore Islands, Sangihe Islands District, North Sulawesi. The area of Matutuang Island is 0.31 km² (31 ha). Matutuang Island has 2 ha of coral reefs forming a fringe reef, and there is 1.5 ha of seagrass at sandy tidal location and white sands of 250 meters. The outskirts of the island are white sandy area, rocky cliffs and coral reef formation. The altitude from sea level is 0-75 meters above sea level. The vegetation found in Matutuang Island is coconut and banana plants that grow well with few food crops (cassava, sweet potato). The source of water is very

limited, where there are two really fresh water sources in the hills (about 750 m from the settlement) specifically for drinking purposes. In the long dry season, these freshwater wells are dry so people are forced to use brackish wells owned by each resident.

Socio-economic

Matutuang Island has a population of 475 people, with 245 male and 230 female residents. Some residents are migrants from the Philippines who have kinship with the residents of Matutuang. Border crossers are common there, even some residents born in the Philippines. Their main jobs are fishermen (80 people), traders (5 people), and civil servants (7 people)⁵. Most of the residents are Elementary School (SD) graduates (267 people), while a few of them are Junior High School (SMP) and Senior High School (SMA) graduates which are 5 and 3 people. For religious purposes, there are 1 church and 1 mosque.

On the island of Matutuang, the available road is a series of paths along 240 meters, while the hardened soil path along 1,500 meters, and the port is currently in the process of development. On this island there is one elementary school with 43 students and one Junior High School (SMP), State Junior High School (SMPN) 6 Tabukan Utara with 25 students. This educational facility is accompanied by 3 Elementary School teachers and 2 Junior High School teachers. In addition, the Indonesia Mengajar Program also placed its volunteers until 2015. To overcome the drinking water issues, in 2014-2015 people of Pulau Matutuang received an assistant in the form of a water desalination unit.

At the time of the visit, the condition of this desalination unit was still very good and functioning. This desalination unit uses osmosis technology is driven by a special PLTS and provides drinking water supply to the people of Matutuang. According to the MMAF ⁶ with the peak capacity of 9,000 liters per day, this unit provided enough drinking water for 470 families per day. The management was done in groups, where water purchases were recorded and kept by the manager. According to the manager, the proceeds from the sale of water were allocated for the operator's salary and light maintenance, such as to clean the solar panels, piping, and the replacement of water filters. When the team stopped for a while at the desalination site, there was a record of purchases and stock of water filters.



Figure 15 – The atmosphere of Matutuang Island

The limited land area of the island makes agricultural activities to be limited. Currently, the residents of Matutuang Island farms only when the sea weather is not friendly to go to sea. Farming becomes a side job, not a permanent job. Plants that are widely grown are cassava, sweet potatoes, and plants of daily necessities. In addition, Matutuang Island has the potential for the development of banana plants, and there are coconut plantations, and clove plantations. The marketing objectives of these farms and plantations are the Philippines and Tahuna, the capital of the Sangihe Islands District.

Most of the residents of Matutuang Island depend their livelihood on catch fishing, so that the commonly owned fishing gear is the long line, fishing line, and the surrounding net (jaring lingkari), by means of

⁵ Sub-District of Marore Islands in Numbers, 2016

⁶ Reflection on Marine and Fisheries Development in 2014 and the 2015 Outlook

pelang boats and pump boats. Generally, Matutuang Island fishermen do their activities to hunt shark species because although some sharks have been protected, shark fins have high selling value.

The catch is usually sold directly to the market or to fishermen from the neighboring country, the Philippines, who have large capital and far more advanced processing technology. The fishing is still done traditional, all relying on outboard engines (outboard engines 14-20 PK) or katinting engines (6 PK). Sometimes pump boats use these two engines to compensate for the increase in the boat size, payload and range.

Transportation and accessibility

The most common means of transportation for public transportation is pump boats that can carry only 4-5 people. For transportation to the district capital there is a Pioneer Motor Boat that serves passenger and freight transportation connecting the islands in the Marore Islands Sub-District. The islands visited by Pioneer Motor Boats are Kawio Island, Matutuang Island and Marore Island. The route taken is a ring route (not back and forth per destination), with a 2-week interval per boat. So that with the capacity of four Pioneer Motor Boats ready, on average one ship is confirmed to anchor per 1-2 weeks.



Figure 16 – The *ketinting* boat as one of the means of transportation in Matutuang Island

The handling of security and order in Matutuang Island is still the working area of the security apparatuses located within the region of the Marore Islands district administration. But on Matutuang Island there are Indonesian Army officers from Battalion 712 as many as 5 members. There is a lighthouse to guide the sailing and an SSB (Single Side Band) radio for communication with the district government.

Aspects of infrastructure and electrification

The island has hilly characteristics that require strong efforts in the preparation of PLTS infrastructure including the transportation of materials from the pier up to the installation of electricity in each home and in public facilities. The development of PLTS infrastructure is assisted by the local people. With an installed power of 30 kWp there are 109 HHs connected, as well as lighting for public facilities (schools, the village hall, the community health center/puskesmas) as much as 9 connections, and the connected rural ventures as much as 3 connections. Currently the energy allocated for each house is 200 Wh. It is possible that there are remaining energy that can be utilized for other purposes (public facilities or economy). The commissioning of PLTS was conducted on December 4, 2015.



Figure 17 – The Solar Power Plant (PLTS) powerhouse in Matutuang Island

3.3. Larat Island (MaIS13)

Ecology and socio-economic

West Lamdesar village is located on Larat Island, North Tanimbar Sub-District, West Maluku District, Maluku Province. The area of North Tanimbar sub-district where the construction of PLTS is: land area of 1,075.74 km² and sea area of 4,567.10 km², so that the total area is 5,642.84 km².

The population of Larat Island is 13,901 people consisting of 6,895 male and 7,006 female residents. There are 17 Elementary Schools, 8 Junior High Schools and 7 Senior High Schools in the sub-district. While the residents who specifically live in West Lamdesar village are 316 male and 353 female residents⁷.

The village of West Lamdesar has the potential of abundant coastal resources. The stretching white sand, spreading of varied seaweeds, coral reefs and mangrove forests along the coastline of the village show a very promising coastal potential. The natural potency that has been managed for the improvement of the people's economy in West Lamdesar Village is the cultivation of seaweed, peanut plantation, and soybean farm, the Tanimbar typical food made from sago as well as the typical weaving craft of Tanimbar.



Figure 18 – Means of transportation

⁷ Source: North Tanimbar Sub-District in Numbers, 2016

Transportation and accessibility

To get to West Lamdesar Village from North Tanimbar sub-district (Port of Larat), it can be done by land and sea route. But mostly people use the sea transportation route since the land access to West Lamdesar Village is still bushes and rocks. The travel by sea can be reached approximately in three hours, and if by road trip it can be taken for about five hours by using a four-wheel drive vehicle or large truck.

Infrastructure and electrification



Figure 19 – A 50 kWp capacity of Solar Power Plant (PLTS) in Larat Island

The preparation of PLTS infrastructure that includes the transportation of materials from the pier up to the installation of electricity at houses and public facilities were assisted by the local people. Currently the PLTS capacity of 50 kWp is connected to 163 HHs, lighting for public facilities (schools, the village hall, the community health center) of 5 connections, and rural enterprises of 8 connections. Each house gets energy supply of 260 Wh. There is still the remaining energy that can be utilized for other purposes (public facilities, such as street lighting, church lighting and electricity for the auxiliary community health center). The PLTS commissioning took place on February 1, 2015.

3.4. The Mapping of Conditions of the Development of Solar Power Plants in Three Islands

The input-process-output analysis in the following table shows the comparison of important aspects of the PLTS development process on the three islands that became the object of learning. The implementation of development based on the input-ouput approach, can be seen as follows:

Table 2 – The mapping of input-process-output of facilitation activities on solar power plants

	Criteria	Kawaluso	Matutuang	Larat
1. Input	Social and economic conditions	Most of the residents are small fishermen, who also work as a farmer when they do not go to sea	Most of the residents are small fishermen, who also work as a farmer when they do not go to sea	Most of the residents are small fishermen, who also work as a farmer when they do not go to sea
	• Commodities of the island	Coconuts, nutmegs, reef fishes, and deep sea fishes	Coconuts, nutmegs, reef fishes, and deep sea fishes, and sharks	Cloves, peanuts, vegetables, and deep-sea fishes
	• The mode of distribution of the commodities	Pioneer sea lanes and people's voyages	Pioneer sea lanes and people's voyages	Combination of road and sea
	Technical Aspects of PLTS			
	• Capacity	50 kWp	30 kWp	50 kWp
	• Energy allocation	450 Wh/house/day	200 Wh/house/day	260 Wh/house/day
	Financing of PLTS	The Ministry of EMR	The Ministry of EMR	The Ministry of EMR
Facilitator				

	Criteria	Kawaluso	Matutuang	Larat	
	<ul style="list-style-type: none"> Number 	1 person	Facilitated by the facilitator of Kawaluso Island	1 person	
	<ul style="list-style-type: none"> Educational background 	S1 (Bachelor degree)		S1 (Bachelor degree)	
	<ul style="list-style-type: none"> The work area 	2 islands		1 island	
	<ul style="list-style-type: none"> The scope of work of the infrastructure facilities 	Limited, especially transportation & communication		Limited, especially transportation & communication	
2. Process	PLTS construction budget	2014	2014	2014	
	Start operation (commissioning)	04/12/2015	Data is not available	01/02/2015	
	Mobilization of the facilitator	April 2015	April 2015	April 2015	
	Community preparation process (who does what?)	Community involvement in early socialization and development of PLTS	Community involvement in early socialization and development of PLTS	Community involvement in early socialization and development of PLTS	
	The process of formation of institution				
	<ul style="list-style-type: none"> Initiator 	The Village Head	The Village Head	The Village Head	
	<ul style="list-style-type: none"> The formation meeting 	TPLD members are appointed by the village head and approved by the community through deliberation	TPLD members are established on the appointment of the village head and agreed upon through the village meeting	TPLD members are established and appointed by the Village Head	
	Training of the village electricity management team (TPLD)				
	<ul style="list-style-type: none"> Technical 	Conducted briefly by the PLTS contractor during the PLTS construction	Conducted briefly by the PLTS contractor during the construction (it did not accompanied by the facilitator)	Conducted briefly by PLTS contractor during the PLTS construction	
	<ul style="list-style-type: none"> Operations and management 	Conducted by the facilitator and the PLTS contractor	Conducted by GIZ team and the PLTS contractor	Conducted by the facilitator and the PLTS contractor	
The RPJMDes (Village Medium Term Development Plan) facilitation process to ensure the sustainability of the PLTS	Not available	Not available	Not available		
3. Output	The community involvement in the PLTS management process				
	<ul style="list-style-type: none"> Implementation of the PLTS rules 	A confusing situation had occurred due to differences of information from the contractor and the facilitator regarding the use of electrical appliances; but it was resolved on the second visit	It was started to be implemented after the repair on the second visit; the rules regarding contributions and sanctions are applied	It has been well implemented; funds and sanctions for violations by recipient households	
	<ul style="list-style-type: none"> The electricity rate per month 	Rp. 6,000 per house	Rp. 10,000 per house	Rp. 10,000 per house; the average funds collected is Rp. 1,680,000 / month	
	<ul style="list-style-type: none"> The pattern of contribution payments 	Less obedient; not all customers are paying the contribution in due time; there is a confusion of the rules of PLTS KPDT that are specific to social events, but it has been resolved	Obedient	Obedient	
	<ul style="list-style-type: none"> Number of connections 	195 HHs	109 HHs	163 HHs	

	Criteria	Kawaluso	Matutuang	Larat
	• Institutional	The TPLD is not yet a legal entity (not yet authorized by a notary) but already has the Statutes and Bylaws (AD / ART)	The TPLD is not yet a legal entity (not yet authorized by a notary) but already has the Statutes and Bylaws (AD / ART)	The TPLD is not yet a legal entity (not yet authorized by a notary) but already has the Statutes and Bylaws (AD / ART)
	• Number of members of the board	6 people	5 people	5 people
	• Capacity of the board	The managerial skill is sufficient, but the expertise for maintenance is inadequate, and it was only for the turning on and off the PLTS	It was not firmly observed because of problems on the PLTS that ever been damaged long enough in 2015	The managerial skill is sufficient, but the expertise for maintenance is inadequate, and it was only for the turning on and off the PLTS
	• Honorarium / remuneration for the board	Chairman: Rp.100,000 Secretary: Rp.100,000 Treasurer: Rp.100,000 Operation coord.: Rp. 200,000 Operator 1: Rp.100,000 Operator 2: Rp.100,000	Chairman: Rp.150,000 Secretary: Rp.150,000 Treasurer: Rp.150,000 Operator 1: Rp.300,000 Operator 2: Rp.300,000	The amount of honorarium was arranged directly by the Village Head
	• Savings status	<Rp. 2,000,000	Not available (just started its re-operation)	No explanations
	• Availability of additional funding for the PLTS needs	It was not enough to repair the damage	It was not enough to repair the damage	It was not enough to repair the damage
	The existence of energy-based productive enterprises	Ice beam production, wood planing shop	Ice beam production	Ice beam production
	Operational status of the PLTS	Operational	Ever broken down in 2015 but it has re-operated	It was broken down after the 2015 Christmas, but it has been repaired

After mapping the aspects of input, process, and output in the table above, a SWOT analysis was conducted for Kawaluso Island, Matutuang Island, and Larat Island where there are some prominent similarities and differences. The following table describes the results of the SWOT analysis.

Table 3 – SWOT analysis in the three islands

Island	Strengths	Weaknesses	Opportunities	Threats
Kawaluso	<ul style="list-style-type: none"> The Sub-National Government or the SNG (Bappeda, the EMR Office and the MAF Office) support in monitoring is good because the location is relatively closer to Tahuna and the sub-district capital There is a vocational school in the field of electricity and a small-scale (household) PLTS located in Tahuna (the district capital) There are several PLTS locations in Sangihe Islands so that the management between the PLTS can support each other 	<ul style="list-style-type: none"> The knowledge and expertise of the management on PLTS is still limited Coordination between implementing agencies in the field is still not solid Inter-island transportation facilities are not available on a regular basis No cell phone network The condition of the island is mountainous and has rocky areas 	<ul style="list-style-type: none"> The sub-national government response on the adoption of PLTS maintenance fund is positive The PLTS management team is interested in improving its capacity The community is willing to participate in the PLTS program There is a Vocational High School in the field of electricity in Tahuna which is quite close to the location of the PLTS 	<ul style="list-style-type: none"> The handover process is unclear, so that management problems may arise in the future Logistical uncertainty due to the rapidly changing sea conditions People are concerned about territorial security issues (intrusions, piracy, etc.) The SNG has not been optimal because of more administrative matters in the district

Island	Strengths	Weaknesses	Opportunities	Threats
Matutuang	<ul style="list-style-type: none"> • Support from the sub-national government (Bappeda, the EMR Office and the MAF Office) in terms of monitoring and guidance • There is an experienced vocational school in the field of small-scale / household PLTS electricity • There are several PLTS locations in Sangihe Islands so that the management can support each other between the PLTS • The community strongly supports the PLTS • Open and tolerant society • Relation between members of the management team is good 	<ul style="list-style-type: none"> • The knowledge and expertise of the management team on PLTS are very limited • Coordination between implementing agencies in the field has not worked properly • No cell phone network • The hilly and rocky contours of the island tend to be difficult for business development (e.g. agriculture) 	<ul style="list-style-type: none"> • The sub-national government's concern to support the budgeting of PLTS maintenance • The community is concerned about the existence of PLTS • Experts at the district level are available mainly from Vocational High School graduates majoring in electrical • Stipulation of Marore Sub-District as a Special Border Area will encourage serious attention from both the central government and the sub-national government 	<ul style="list-style-type: none"> • The full handover process has not been done • PLTS spare parts are not available locally, that makes it difficult to repair the damage • The sub-national governments' attention to PLTS management is not yet optimal
Larat (West Lamdesar)	<ul style="list-style-type: none"> • The MAF Office support, in the development of PLTS is good • The island is quite large with abundant natural resources, both land and sea • A strong customary institution that controls social institution 	<ul style="list-style-type: none"> • Remote location • Inadequate transportation infrastructure • The capacity of the community in PLTS management is still low • No cell phone network • The community is sceptical of PLTS, as they see failure in other areas 	<ul style="list-style-type: none"> • The community still applies the <i>sasi</i> / local wisdom that can be applied also for the management of PLTS in a sustainable manner • The PLTS management team is interested in increasing its capacity • Agricultural and fishery products can be developed to become the island's main business • Has the <i>RPJMDes</i> (Village Medium Term Development Plan) and is open for improvement 	<ul style="list-style-type: none"> • The full handover process has not been done • Violation of agreement on utilization of PLTS which disturbs the PLTS performance • Parts are not available locally • Conflict of interest between the manager and the village apparatuses

The above table shows that although each location has its own SWOT characteristics, there are similar patterns between the three locations, including the remoteness of the location that is the main cause of access, defense and security issues and human resources capacity issues. The problems or challenges that appear from the SWOT analysis will be a provision in dissecting the implementation of the PLTS development in the outer islands. For this program, the way of thinking has to be changed by considering the program as an activity carried out in a special place (i.e. in the outer islands) which has enormous challenges and needs a special solution. PLTS in the outer islands cannot be simply compared with PLTS in Java, for example, given the large differences in the location characteristics.

PART IV. LESSON LEARNED FROM THE ASSISTANCES

4.1. Community Participation in Institutional Establishment

A facilitator plays an important role in the process of activating community participation in the development of PLTS. Some of the steps that the facilitator needs to take in assisting the community are, first, go to the Village Head and village apparatuses to coordinate and communicate the process that needs to be done in the construction of the PLTS, then with the Village Head to socialize the initial development of the PLTS in their village. After the socialization, the facilitator should encourage the implementation of discussions and deliberations, both for institutional establishment and the determination of the electricity tariff.



Figure 20 – A discussion with the Solar Power Plant (PLTS) management team of Kawaluso

From the survey results in three islands, it appears that the level of public understanding about PLTS is considerably high. This is evidenced from the number of respondents (86%) who stated that they know what a PLTS is, the benefits of PLTS, and also the role of the management team. Basically, the community is ready to receive the program, only at the implementation stage of the development, the level of community involvement is not significant.

Some of the things that cause this condition to happen are:

1. Delayed presence of the facilitator at the PLTS site due to limited access and transportation to the target village. This affects the process of socialization and assistance during the construction,
2. The existence of two islands facilitated by one facilitator as happened in Matutuang Island and Kawaluso Island. This makes it difficult for regular assistance, especially the transportation access between the two islands is difficult,
3. The central role of the Village Head in regulating the existing processes in the village has minimized people's participation. While it may be understood that the Village Head takes the role because of the need to establish a PLTS management team quickly,
4. The community considers that the PLTS is a central government aid project with advanced technology, so they do not dare to contribute to its development,
5. Socialization that was only conducted twice at most, is felt not enough to provide knowledge about the importance of their involvement in the management and maintenance of the PLTS. Therefore it is necessary to socialize and discuss with the community more intensively, especially during the PLTS development stage. The lack of socialization is also related to the limited time between the community preparation and the construction of the PLTS.

Basically, the community was enthusiastic to get involved, but not all villages conducted a deliberation to select the PLTS management team due to the urgency of time, as happened in Matutuang Island, where the PLTS management team was appointed and determined directly by the Village Head. This was slightly different from the process that took place in Larat Island and Kawaluso, where the management team was selected by the Village Head, but later on approved by the community through deliberation.

Considering the level of community involvement, there is a need for more fundamental efforts to enable the community to actively participate in the development of PLTS through:

- **Deliberation.** Deliberation is needed to get an overview of the program and in order that the community has the sense of belonging over the program because they are involved from the beginning, where it can contain the socialization of the program. This stage should be done before the construction is done.
- **Establishment of a group.** The community is involved in the process of establishing a management group so that it is not only decided by the Village Head but it is determined through a deliberation and decided together. The establishment of this group should also be done before the construction is carried out or along with the construction work.
- **Planning.** At the planning stage, the community is involved in the planning process of the PLTS development activities, including the activities to be undertaken and when they are implemented and the persons in charge.
- **Implementation.** At this stage, the community is involved in the implementation of the PLTS development, not only in transporting the material to the PLTS site, but also in the PLTS development level. Installation of components is carried out by a company, but how the PLTS works in general in general needs to be understood by the community.
- **Monitoring.** The community is actively involved in monitoring the management of the PLTS after the construction, so the community can provide input when there are problems with the PLTS or the management team.

4.2. The Handover Process and the Level of Ownership of Solar Power Plants

The level of ownership of the PLTS that is driven through the work of the facilitator is also influenced by the ownership status of the Sub-National Government. If the Minister of Energy and Mineral Resources Regulation No. 10/2012 concerning the Implementation of Physical Activity in Utilization of New and Renewable Energy underlies the development of PLTSs in the three islands, it appears that the participation of SNGs in efforts to develop and utilize renewable energy is crucial.

Article 7 paragraph 2d states that the District Head / Mayor must include a written statement concerning the readiness to receive and manage the results of the physical activity in the utilization of new energy and renewable energy built through the State Budget fund of the MEMR. Furthermore, Article 13 paragraph 1 states that the Governor or District Head / Mayor in accordance with the authority shall determine the manager of the results of the physical activity in the utilization of new energy and renewable energy that has been handed over. The manager of the results of the physical activity as mentioned shall include the establishment of a management institution that can be in the form of a joint business group, a cooperative, *paguyuban* (*gemeinschaft* (a partnership)), a non-government organization or a customary group.



The mechanism and stages of the implementation of the PLTS program from the MEMR cover the application, evaluation, determination, procurement, construction, up to handover processes. The description of the processes can be seen in the following diagram:

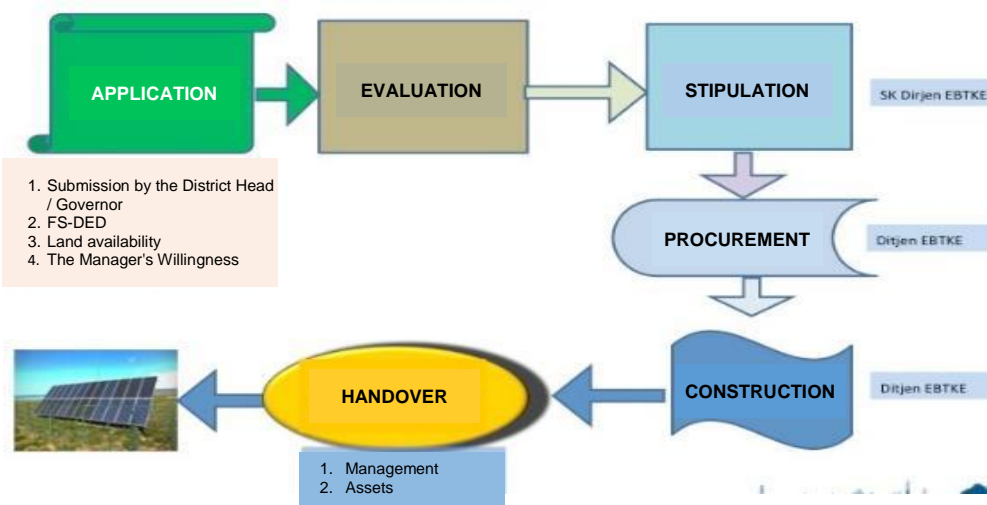


Figure 21– The mechanism and phases of the implementation of the Solar Power Plant (PLTS) program

Source: Presentation materials of the field manager and community facilitator training, the Ministry of EMR, 2016

In the asset handover process, the stages to include the recording in the information system, the commissioning test, and subsequently the asset is handed over to the SNG with the handover documents. The asset transfer diagram can be seen below:

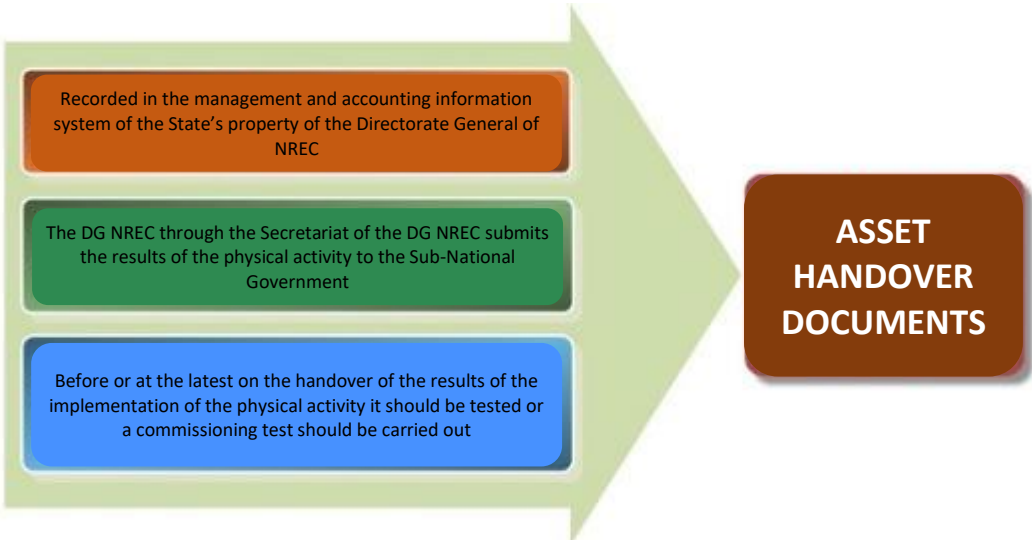


Figure 22 – The mechanism of asset transfer to the SNG

Source: Presentation materials of the field manager and community facilitator training, the Ministry of EMR, 2016

The position of handover in three locations at the time of visit was only at the interim handover or the operational handover stage, which means that the PLTS can already be operated while the full handover process is undertaken. On the one hand this provides an opportunity for the sub-national government to assist the facilitator in strengthening the PLTS management team, but on the other hand the absence of the full ownership status will affect the allocation of the Regional Budget (APBD) fund to assist the smooth operation and maintenance of the PLTS.

Relating to the readiness of the management team, the three PLTS villages have a village electricity management team that has a clear organizational structure and can run the management of the PLTS although there is still a need to increase the capacity of the members of the management, especially those related to the management and technical matters of the PLTS. If the PLTS handover is undertaken later on, the village has been able to continue the management of the PLTS that can be integrated with the village development plan. On the other hand, the legality of the management can be strengthened through a cooperative or a BUMDes.

The handover process is the key for the village and/or district to be able to fully nurture and allocate funds for replacement of major parts of the PLTS. For example in Kabupaten Kutai Kartanegara, where the local government signed the minutes of handover of the PLTS project which was then transferred to the Muara Enggelam BUMDes. This scenario can be related to the policy support of the Minister of Home Affairs Regulation No. 114/2014 concerning the Guidelines of Village Development where it is mentioned how the asset management is set forth in the RPJMDes, so that the management of the PLTS in the future can be more clear and the PLTS can operate on a long term basis.

4.3. Solar Power Plant Institutions

Establishment of Institutions

The establishment of the institution of the PLTS management team is one of the prerequisites for the sustainability of PLTS operations. As mentioned in the previous chapter, the establishment of a PLTS management team in Matutuang Island is not carried out by a deliberation for consensus (musyawarah mufakat) but appointed by the Village Head. While at Kawaluso Island and Larat Island, the management team was chosen by the Village Head and approved by the community through a deliberation.

The appointment of PLTS management team personnel in the three islands is positive and negative. It is positive because the management team can be established quickly, but the negative is that this can lead to conflicts between some villagers, both who are in support of the Village Head and those who are not. In Larat Island, the conflict appears stronger when there is a violation of the limitation of electricity usage on each house performed by the management team personnel. This violation is difficult to overcome by the community because of the direct appointment system and the failure of the established rules.

In this case the facilitators are also difficult to facilitate in resolving this conflict, considering they did not have conflict resolution skills. To minimize this problem, the presence of a facilitator is crucial in assisting the participatory selection process of the village management team, with mutually agreed sanctions and mechanisms. In addition, it needs potential and credible human resources with broad insight and have a significant role in running the wheels of the organization.

Box 3. The Definition of Institution

According to Djogo (2003), institutional is “an order and pattern of relationship between members of society or organization of mutual binding that can determine the form of relationship between humanbeings or between organizations which is accommodated in an organization or network and determined by limiting factors and a binding in the form of norm, and formal or informal code of conduct for the social behavior control and incentives to work together and to achieve common goals”.

Institutions can develop properly if the followings exist:

- institutional infrastructure (container),
- institutional arrangements (structure) and
- institutional mechanisms (rules).

The legality of the PLTS Institution in three islands

The institution of the management team of PLTS in Kawaluso Island, Matatuang Island and Larat Island (West Lamdesar Village) is only recognized by the MAF Office in each district. Although the process of

establishing and appointing members of the village electricity manager in three islands is done by the Village Head, in reality this team does not have a Village Head's Decree yet.

The root of the problem is the absence of a handover process from the central government to the district. If the handover is done and the PLTS is legally under the District Head's responsibility, the District Head may issue a District Head's Decree for the legal basis of the PLTS management or transfer its management to the village, so that the Village Head may issue a Village Head's Decree. Currently the management group already has rules and agreements set forth in the form of Statutes and Bylaws (AD/ART) so that it still requires strengthening in supporting the written and legalized rules up to the handover of the PLTS.

The legality of the management team institution is necessary to strengthen its role in promoting the sustainability of the PLTS. By having the legal entity, the PLTS manager can develop the business by working with the banking and other parties, receives the guidance and assistance from relevant offices or ministries, and could be more accountable. Facilitators become a driver for this legalization process, but many are constrained by the short time of the assistance period which is only eight months.

4.4. Electricity Tariffs

For a facilitator, the tariff setting is one of the most challenging matters. The facilitator should change the stigma that has grown in the community that if the PLTS is a government aid project then "it should be free of charge". Of course this is not true. However, changing the stigma is not easy. The facilitator must be very creative and good at finding opportunities to build discussions with the community. It is not necessarily successful as expected. The characteristic of the location as described in the SWOT analysis determines the outcome of this negotiation. An extreme location, with its remoteness and challenging nature and all its problems, requires us to think creatively. Because the logic or normal calculation will not be applicable here, especially for the electricity tariff.



Figure 23 – The village atmosphere at night

Currently there are variations in tariffs / fees paid by consumers. In Matutuang and Kawaluso Islands electricity rates are set at Rp 6,000/month, while in Larat Island the electricity is set at Rp 10,000/month. As for the payment pattern, in Matutuang the PLTS manager go to the residents to collect contributions, then the proceeds are handed over to the PLTS treasurer. While in Kawaluso, the Head of the Community or the Village Head is appointed to collect contributions to the residents and then the proceeds are handed over to the PLTS treasurer. The position of savings when the survey is conducted in Kawaluso Island was not more than Rp 2 million, in which not all houses pay the contribution on time.

Theoretically the determination of tariffs may take into account the following matters⁸:

- a) Customers pay according to the energy used (kWh), which requires a kWh-meter,
- b) A single rate for specific categories. For example: 220 VA connections pay Rp 50,000/month while 110 VA connections pay Rp 25.000/month,

⁸ Training Guide for the Village Electricity Management Team: A practical guide for facilitators and trainers of rural electrification (GIZ, 2014)

- c) A single rate for each type of electrical equipment. For example: the first lamp is Rp 15,000/month, two lamps shall be Rp 20,000/month and next Rp 25,000/month. If you add a 14" TV the rate is Rp 40,000/month and so on. This system is called progressive tariff.



Figure 24 – The energy limiter at Solar Power Plant (PLTS) electricity receiving houses in West Lamdesar, Larat Island

In calculating the cost of electricity, considerations should be given to the estimated revenue, expenditure, lifetime of the PLTS's components, the total cost and total consumption of electricity per year, as well as other external factors. However, the facts on the filed show that the setting of tariffs is done by deliberation and is calculated based on the ability of the community / consumers to pay. Therefore, the setting of the real tariff is based on the willingness to pay, while the economic and sustainability aspects become the secondary considerations. This tariff agreement will be renegotiated to raise the tariff to support the management of the PLTS in accordance with the community's ability.

The most common way that the facilitators do to introduce the electricity tariff is to compare the PLTS tariff with the costs incurred to turn on the generators that are the sources of the public's lighting all this time. For example, in Matutuang, people have to pay up to Rp 50,000/month to buy fuel. It turned out to be very burdensome, because the income of the residents as fishermen is very small, let alone the use of electricity is limited from 18:00 to 23:00 Central Indonesia Time.

Therefore, the PLTS tariff of between Rp. 6,000 to Rp.10,000 should be able to be borne by the recipient community. Even if it must rise up to Rp 15,000 to Rp. 20,000 at least it could still be paid by the local community. Another way is to compare the electricity contribution to the price of cigarettes. Generally, the price of cigarettes in the three islands is around Rp 15.000/pack, so if they are able to buy cigarettes, then by stopping the consumption of cigarettes, residents can set aside money to pay the electricity contribution.

Then, for what exactly the money received from the electricity contribution? The amount of the tariff can affect the management of village electricity. The money received from the applicable contribution is used to hire operators, the treasurer, the secretary, and the village electricity management team leader. In addition to the operation and maintenance, the rest is for the purposes of purchasing minor spare parts and minor repairs. Therefore, the smooth collection of contribution is very important in order to ensure the electricity remains on because the PLTS equipment is not cheap, so it requires the willingness of the beneficiaries to participate in maintaining and preserving.

One of the uses of the contribution money is to compensate the work of members of the manager. As for the institutional in the management of village electricity, generally it consists of a chairman, a secretary, a treasurer, and operators. The composition of team membership varies between the three islands. In Kawaluso Island, the members consist of a chairman, a secretary, a treasurer, an operator coordinator and two technicians. Whereas in Matutuang Island, it consists of a chairman, a secretary, a treasurer, and two technicians.

These managers receive various remuneration, such as for Kawaluso Island, each of the chairman, the secretary and the treasurer receives Rp 100,000/month honorarium, the operator coordinator receives Rp 200,000/month, and each of the two technicians receives Rp 100,000/month. While in Matutuang,

each of the chairman, the secretary and the treasurer receives Rp 150,000/month, while each of the two technicians receives Rp 300,000/month. The allocation of the remuneration is determined by the Village Head.

4.5. Non-Tariff Sources of Funds for Maintenance and Repair of Solar Power Plants

Infrastructure of PLTS that has been built and runs in Kawaluso Island, Matatuang Island and Larat Island (West Lamdesar Village) should be followed by the process of transfer of authority, so that the sub-national government can immediately allocate budget to maintain the operational sustainability of the PLTS.

The condition of PLTS in Larat Island since December 2015 until August 2016 experienced an inverter damage, resulting in the non-functioning PLTS where people could not enjoy the lighting. Both the village government and the district government at the Mining and Energy Office of West Nusa Tenggara could actually buy the damaged components through the existing budget (the APBD or the ADD/DD), but due to the ownership constraint, neither the district government nor the village government can buy the damaged components, and consequently the PLTS could not be repaired and the electricity did not energize the residents' houses.

If the PLTS has become a district asset (in this case the Mining and Energy Office), then the district can allocate the budget for the maintenance of the PLTS or may also hand over the PLTS asset to the village.

With the new regulation on villages, Law No. 6 of 2014 concerning Villages and its derivative regulation (PP No. 47/2015 and Permendagri No. 114/2014), PLTS activities have actually been included in the Village Development Sector which may be proposed to be allocated through the ADD/DD (Alokasi Dana Desa/Dana Desa – Allocation of Village Funds/ Village Funds) in case of any damaged component. Through the Permendesa (Peraturan Menteri Desa, Pembangunan Daerah Tertinggal dan Transmigrasi – Regulation of the Minister of Villages, Underdeveloped Regions and Transmigration) concerning priority use of village budget, it has also enabled the use of Village Funds for PLTS related activities that cover the livelihood of the people.

The ownership of PLTS is an important value for the sustainability of the PLTS in Kawaluso Island, Matatuang Island and Larat Island. The RPJMDes in the three PLTS locations has yet to include the PLTS into its document. The village still believes that the existing PLTS in the village is the property of the central government and has not belonged to the region or the village, let alone as a village asset that needs to be funded through the regional budget or the village budget. Therefore, it is important to consider the matching fund scenario with the Village Fund where the facilitator can facilitate this process in the future.

Box 4. Integration of PLTS Activities into the Village Development Planning

If the handover process of the PLTS in Kawaluso Island, Matatuang Island and Larat Island from the MEMR to the district (the EMR Office) has already taken place and the district then handover the PLTS to the village as its asset, the PLTS will become the village asset.

In the Minister of Home Affairs Regulation No. 114/2014 concerning the Guidelines of Village Development it states that village assets are village property derived from village assets, purchased or obtained at the expense of the Village Revenue and Expenditure Budget or other legitimate rights, and the Regional Budget of the district / city and shall be used to finance the implementation of village administration, the implementation of village development, village community development, and empowerment of rural community.

If the PLTS in the three islands has become the village asset, the village can allocate the budget for the management of the PLTS through the Village Government Activity Plan (the RKPDes in accordance with the Regulation of the Minister of Villages, Underdeveloped Regions and Transmigration No. 8/2016 concerning Amendment to the Regulation of the Minister of Villages, Underdeveloped Regions and Transmigration No. 21/2015 concerning Prioritization of Village Fund Usage In 2016) has been directed to the typology of coastal villages in accordance with the village conditions and has been decided in the Village Planning Deliberation.

4.6. Setting the Rules

Setting the rules is important to encourage good management of the PLTS. The stipulation of the rules is set forth in the Statutes / Bylaws (AD/ART) of the management of PLTS in the village. The function of the Statutes / Bylaws is a working guideline in running the organization, in this case the management of village electricity. In addition, the Statutes / Bylaws has the function as a material planning, direction, supervision of the board and utilization of the village electricity system. The rules must be obeyed by the board and members or beneficiaries of the village electricity. Some important parts of the rules are the organizational structure, the rules of operation of the village electricity system, the connection of electricity, electricity fees, the fund management, the violations and sanctions, and other matters agreed upon by the community and the management group. It is appropriate if the rules which are made and agreed upon in a deliberation are then disseminated to all residents of the beneficiaries of electricity.

The rules will work well if the electric manager implements and obeys them well. However, electricity theft and violations of the limitation on the use of lights in each of the houses that occurred in Kawaluso Island, Matatuang Island and Larat Island have made the rules are neglected by all consumers.

The role of facilitators to strengthen the role of society as a controller of the rules becomes crucial. This task must be done in the early period of the PLTS development along with the socialization activity. Considering that the traditional wisdom at some islands of is still well implemented, actually the facilitators can approach the community from this point. In the case of the three islands, it cannot be done well, given the delay of the facilitator entering the site. The facilitators together with the village officials, assisted by the SNG officials should have encouraged the use of the PLTS electricity wisely in order to meet the common interests.

4.7. Capacity Building of the Managing Team

Managerial skills of the managing team

The village electricity management team (TPLD), consists of a chairman, a secretary, a treasurer, and operators / technicians, has the duty and responsibility in maintaining the smooth operation of the PLTS. These tasks include planning, office administration and financial arrangements, and reporting which must be done on a regular basis. Therefore, all members of the TPLD must obtain sufficient provision so that they are skillful in operating and managing the PLTS, including handling constraints that may arise quickly and accurately.

TPLDs in Kawaluso Island, Matatuang Island and Larat Island have good means, structures and rules. However, skilled and credible as well as broad-minded human resources are not available in each of the management teams. As a result, in addition to the PLTS had been broken down long enough, the electricity fees are not collected properly. In addition, there is also theft of electricity and violations of the limitation of the use of lights in each house. Lack of competence and credibility of the TPLD is very influential on the quality of energy generated and supplied by the PLTS.

The root of the problem of the weak PLTS management is the lack of socialization as well as the limited time available for deliberation, in addition to the lack of the management training provided. This has an impact on the quality of skill and the selection process of the TPLD which is not entirely come from a community deliberation. In the three islands, the conditions vary, depending on the condition of the village people and the desire of the village government to undertake the PLTS development planning process along with the community. In principle, the PLTS is owned by the community so it needs to be managed together, and the readiness of the management group should be maximized.

Box 5. People's Knowledge on Selection of the Village Electricity Management Team

In West Lamdesar village, respondents' knowledge on how the selection of the TPLD was made in their village was 57% through village meetings, 14% through the Village Head's appointment, and the rest (29%) did not respond. According to the interviews to the respondents in Kawaluso, the selection of the TPLD was done through a village deliberation (89%), and 11% of respondents stated that they were chosen by the Village Head. While in Matutuang, the results of interviews to the respondents stated that the selection of the TPLD was done through a direct appointment by the Village Head (73%), and 18% of respondents stated that the TPLD was chosen through a community deliberation, and 9% of respondents did not answer.

Technical skills of the managing team

In a PLTS management, a function that has a vital task is the operator / technician function. Operators must work all the time to operate, monitor the power supplied, and repair the damage, so that generally in one TPLD there are two or more operators / technicians. Of course it is very important for operators to get a sufficient technical training to become skillful in operating and maintaining the PLTS, including handling constraints that may arise quickly and appropriately.



Figure 25 – The operator explained on how a Solar Power Plant (PLTS) works

In average, the PLTS operators in the three islands are high school educated and have only minimal technical knowledge of electricity. They are chosen because they have the will to help in providing lighting for the community. Prior to work, these operators had been trained by the PLTS contractor, in accordance with the terms of the PLTS construction contract. However, the training provided was limited on how to turn the PLTS on and off, so a special training on PLTS components and how a PLTS works, the potential damage and improvement efforts is needed.

The very high dependence on technicians from the central makes the broken down PLTS has to wait for some time for repair, for

example in the case of the power outages in PLTS in Matutuang and Larat. Even the repair of PLTS in Larat took more than six months. In addition to the need for optimization of the contractor's assistance to the TPLD, another thing that can improve the operators' working speed in repairing the PLTS is the availability of operation and maintenance manuals issued by the manufacturers of the PLTS components in Bahasa Indonesia. Currently all manuals are still in English and German, makes it difficult for the manager to understand them.

With regard to the technical assistance in the three islands, the implemented process is as follows: the contractors assists the operator from the beginning of the construction of the PLTS until the PLTS is in operation. Then in the midst of the development until after the construction of the PLTS, the operator is assisted by a facilitator. From the field observation, the facilitator does not understand the PLTS in detail, so when the problem occurs, the facilitator often has to contact the contractor and the EMR Office at the district or the MEMR at the central government. The pattern of relationship between the facilitator and the contractor is more dependent on interpersonal relationships. There are no specific guidelines used in this case.

4.8. Troubleshooting and the Existence of Solar Power Plant Technical Service Providers

The PLTS in West Lamdesar village (Larat Island) runs well until December 2015 when the power went out as a result of short circuit due to the operational error (human error). The electricity was in operation again in October 2016, after the facilitator attempted to contact the contractor and the presence of donors who assisted in purchasing the spare parts. In Matutuang Island, the PLTS was also went out, but now it is in operation again. While the PLTS in Kawaluso Island, it never experienced damages and went well.

PLTS is a new technology that has not been well understood by the community, either in Kawaluso Island, Matatuang Island or Larat Island. Although some residents work on building the PLTS from the beginning of the construction up to installation in houses, it may take a longer time for the community to understand how it works. The residents in Kawaluso Island are more familiar with a PLTS because they have received this kind of generator from the program of the Ministry of Development of Disadvantaged Regions (*Kementerian Pembangunan Daerah Tertinggal – KPDT*) several years earlier.



Figure 26 – Posters of Solar Power Plant (PLTS) troubleshooting to help the operator

The PLTS management team needs to be trained in stages on how to operate, maintain and improve the PLTS. This training should be carried out by the MEMR as the owner of the PLTS project. After the training, the PLTS management team needs to have the contact number of parties that can be consulted on the management of the PLTS. The PLTS management team also needs to be advised on where to buy PLTS spare parts if damaged.

Technical support for the TPLD in Kawaluso Island, Matatuang Island and Larat Island has not been fully implemented by the SNG, in this case the district level office. This is because the authority on the PLTS is still held by the central government (the MEMR) and has not been fully transferred to the SNG. Prior to the handover, the technical team from the central government needs to conduct routine monitoring to keep the PLTS is handed over in good condition.

Another thing that needs to be noticed of is the handling of batteries that will expire in the next few years. Based on the discussions with the Energy and Mining Office (Distamben) in Larat Island and Matutuang Island, it is known that replacement of batteries takes time and a long bureaucracy process. Among others, to report it to the district Distamben, then the district Distamben will report it to the MEMR. Subsequently, the MEMR will contact the contractor or provider of goods to provide the goods. The whole process takes around three to six months time.

With the absence of technical support, the TPLD in Kawaluso Island, Matatuang Island and Larat Island will encounter difficulties in addressing the problem. Therefore they need to get directions on the battery replacement procedure. Another solution that can help the TPLD is the provision of supporting infrastructure at the local level. The transfer of expertise and knowledge is made to the existing educational and training institutions to trigger local PLTS businesses. Along with this, a guideline is developed so that a standard supply chain is occurred and accompanied by environmentally friendly

practices. Vanuatu is a small island nation that can be an example of developing the handling guide for a PLTS and its batteries.⁹

Box 7. The Dilemma of PLTS Battery Management

In a PLTS, the battery has an irreplaceable role but has a certain lifetime. The power storage capacity will continue to decline and usually after five years the battery will be damaged. The one that needs to be considered in addition to the cost of replacement is how to handle the used up batteries. Removing the battery directly at the location on the island is a dangerous move. In addition to damage to the ecosystem of the island, valuable and limited freshwater will be polluted. The small size of the island has little assimilation capacity and will not be able to absorb and assimilate the lithium, lead and strong acids contained in the battery. In the long run, the chain of waste absorption should be considered. When compared with conventional batteries, battery traders are willing to accommodate and buy used batteries. So at least we have to think about the same thing while considering that the economic aspects of used batteries of the PLTS will not be able to compete with the aspect of remoteness and other difficulties that characterized the 31 populated outer islands. So the use of available technology (i.e. using local battery) as much as possible is one of the interesting options to be considered.

4.9. Development of Energy Utilization for Productive Enterprises

Electrical energy generated from a PLTS is expected to encourage community economic development activities, in addition to lighting houses, public roads, houses of worship and lighting of health posts. This increase in income is closely related to efforts to increase their paying ability, which in turn will increase the savings of the TPLD as well.

Facilitators, in the midst of the field assistance, receive small business development training as a provision to encourage people to utilize electricity for economic activities. This training is in line with the productive economic business program implemented by the MMAF, where the MMAF distributes various production tools, among others seaweed processing tools, shredded fish, and fish crackers. Indeed, some of these tools do not require electricity, considering the limited capacity of the PLTS, as in Matutuang Island which currently only enough to power 109 houses and 9 public facilities. The residents of the island hope that the Government can increase their electricity supply enough to encourage productive businesses from the PLTS.

As in the other two islands, the development of productive businesses by utilizing electricity is directed to the business of making of ice cubes and wood planing. Beyond that, several other productive businesses have also evolved, i.e., the manufacturing of bottled peanut and dried nutmeg. Facilitators in both islands have been successful in encouraging people to improve small economic enterprises, but there are still many challenges to be faced, such as the lack of training to improve the quality of and the selling power of the products, the difficulty of packing the products because the packaging and labelling are not available on site, and the difficulty of market access. It is advisable that the development of electricity-based productive economy to be included in the design of the development of PLTS or rural electricity.



Figure 27 – Bottled peanuts produced by the people of Larat Island

⁹ Government of the Republic of Vanuatu. 2014. *Environmental Code of Practice (Used Battery Disposal) For Rural Electrification Project Vanuatu*. Department Of Energy. http://www.ura.gov.vu/attachments/article/105/VREP_Draft%20_ECOP.pdf



Figure 28 – Handling peanuts for snack products



Figure 29 – The seaweed harvest in Larat Island

PART V. RECOMMENDATIONS

The PLTS development program in outer islands is a program that needs to be seen from various aspects, beyond the aspect of energy supply. For example, the defense and security aspects and aspects of improving the quality of life of the residents of the islands in general, in which the pattern of approach must be the multi-stakeholders. This is because the location is very challenging and the required investment tends to be large. The following are some of the contributions related to the assistance activities for the sustainability of the PLTS program, which is obtained after going through the processes of observation, analysis, and input from various parties.

5.1. The Draft of *PRAKARSA* Program

The facilitators posted in the outer islands are the spearhead of the successful implementation of the PLTS development program. They have worked optimally to bridge communication between stakeholders. Although a series of trainings have been received by the facilitators before and during their work, there are some knowledge and skills that need to be deepened, such as the PLTS working system, the resolution of conflict, and the village development process (through the RPJMDes). Understanding of the village development process and RPJMDes is needed to facilitate the internalization process of the PLTS management and maintenance program into the village planning.



Figure 30 - The facilitator became the bridge of communication between the parties

Other matters that also need to be noticed of shall be the short working time of facilitators on an island and also the assignment of several facilitators to more than one small island. This greatly affects the intensity and effectiveness of assistance. The facilitators are currently working for only eight months, where the first two months are generally utilized to introduce themselves and gain public trust and the sub-national government apparatuses. Considering the “single-year” funding system that constrains the mobilization of the facilitators, it is expected

to propose a multi-year “PRAKARSA” program funding. Another way that can be taken is to encourage the MAF Office to allocate funds for local facilitators, whose appointments are in line with the MMAF facilitators’ working period in order to make a smooth transfer of knowledge.

The lesson learned from the PNPM-LMP¹⁰ related to the mobilization of facilitators is the issuance of Operational Technical Guidance (PTO - *Petunjuk Teknis Operasional*). This PTO is important to provide clear steps to the facilitators at the sub-district, district, provincial and central levels in doing their work. In the PTO, in addition to the provisions and guidance for facilitation, there are also the parties responsible for the program both at the central and provincial, district, sub-district and village levels.

Establishment of a joint secretariat of which function is to establish coordination in exercising the technical guidelines is highly recommended, where this function will act as the coordination point, problem-solving center and consultation of facilitation. In this joint secretariat, multi-sector experts and practitioners will always be ready to assist when a problems arises.

¹⁰ Program Nasional Pemberdayaan Masyarakat Lingkungan Mandiri Perdesaan - the National Community Empowerment Program for Rural Independent Environment

5.2. Presenting Local Solar Power Plant Technical Facilitators

The presence of a technical facilitator as a co-facilitator of the MMAF's empowerment is urgently needed to help the community to solve technical problems of maintenance and repair of the PLTS. Considering that the MEMR mobilized facilitators do not overlap with the MMAF's facilitators where they have a similar mandate to MMAF's facilitators, another effort is needed to fill this shortcoming. One of the ways that the MEMR can take is to add one requirement in applying for the PLTS development in the MEMR Regulation No. 10/2012 relating to the willingness of SNGs to assign local facilitators or technical assistants.

In an effort to fulfill the requested requirements, SNGs may propose a Village Technical Infrastructure Engineering Assistant recruited through the village assistance program, of the Ministry of Villages, underdeveloped Regions and Transmigration (*Kemendesa - Kementerian Desa, Pembangunan Daerah Tertinggal, dan Transmigrasi*) as the PLTS facilitator. In this case, it needs the cooperation between the MEMR and the *Kemendesa*, as well as inter-related agencies at the provincial level for the synergy for facilitators work is made possible. Furthermore, the cooperation of the two ministries should also be done at the stage of training of facilitators, so that the components and working system of PLTS can become one of the training topics. In addition, all procedures of the local technical facilitator work must be clearly and firmly specified in the standard operating procedures, so that the accountability can be maintained.

5.3. Encouraging Cooperatives and BUMDes as a Solar Power Plant Management Institution

The institutional aspect becomes one of the most important matters in achieving PLTS operational sustainability. The failure of PLTS development, is often influenced by the failure of the establishment of a reliable and accountable management team. Experience has taught that establishing something new is something with a big risk and takes a long time to nurture.

To minimize risks such as mobilization of local technical facilitators, what needs to be done in the future by the MEMR is to add the provision in the Regulation of the Minister of EMR No. 10/2012 relating to the willingness of SNGs to appoint institutions that have legal entities (cooperatives or BUMDes) as a PLTS manager in the proposal for the PLTS application in their working areas.

This policy can be harmonized with the policies set forth in the Village Law No. 4/2014, in which each village is encouraged to establish a BUMDes as a step in local economic empowerment, such as through the village electricity business. Another option is through the appointment of cooperatives that have been established in the PLTS development areas.

5.4. Development of Productive Economic Enterprises in the Development of Solar Power Plants

The MEMR, through the projects of production equipment assistance and training for small business development for facilitators, has sought to synergize the development of PLTS with the development of productive enterprises. This is also evidenced in the PRAKARSA program achievement indicator that determines the 100% establishment of small enterprises managed by PLTS recipient communities. In the implementation there are some obstacles, such as the unsuitable time between the distribution of production equipment and the working period of the facilitator, so that the production equipment came only a month before the facilitator's assignment is finished. Other constraints relate to the limited capacity of PLTS, where all the energy is allocated for home lighting and public facilities.

In the future, efforts should be made to design a PLTS development program that is integrated with the development of community enterprises and community assistances, so that all resources can be allocated properly, including the most simple thing, i.e., the training for facilitators. With the blueprint of the integrated PLTS development program, the materials provided during the training for facilitators can be sharper and suitable with the needs of the field.

5.5. Actuating Local Solar Power Plant Technical Service Providers

Local PLTS technicians, spare parts sales points, and workshops are three things that need to be encouraged at the district or provincial level, in an effort to shorten the repair time and replacement time of spare parts for broken down PLTSs. For this purpose, there are several ways that can be done: (1) the MEMR encourages the SNG to cooperate with the Vocational High School (SMK), polytechnic or university, in developing curriculum related to PLTS, (2) to encourage national service providers to open branches in the capital districts or provinces; (3) to enable local PLN¹¹ technicians who have retired to assist the PLTS management team; and (4) to establish a communication path between technicians and the manager.

5.6. Strengthening Coordination between ESM Office and MAF Office

Cooperation between the Mining and Energy Office and the Fisheries and Marine Affairs Office is very important to facilitate the handling of PLTS that is built on small islands, considering the assistance of facilitators in the three islands is still focused on the completion of the physical development and improvement of PLTS. At the central level, this cooperation is contained in a memorandum of cooperation between the MEMR and the MMAF, but at the sub-national level, this cooperation can be encouraged through meetings of the Sub-National Working Units (SKPD)

Discussions on cooperation between agencies often constrained by the handover process, so that the status of the PLTS, legally, has not become the property of the SNG. Therefore, it is necessary to encourage the handover process to be conducted soonest. In addition, at the beginning of the development process, the SNG, in this case Distamben (the Mining and Energy Office) or the EMR Office must be actively involved, in order to participate in monitoring the development of PLTS.

¹¹ *Perusahaan Listrik Negara* (the State Electricity Company)

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