EnDev Indonesia

Annual Report 2016

energising development

Funded by:

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Directorate General for New,
Renewable Energy and Energy
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EnDev Indonesia

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January 2017

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This Annual Report provides a brief overview of achievements and learnings
for the review year and further information can be obtained from GIZ.

In cooperation with:
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Cover photo caption: Abu Bakar, the initiator of micro-hydro power in Koto Utara, Pasaman Barat, Sumatra Barat, is performing a periodic check of the turbine installed in his village.

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List of Abbreviation

ASEAN	Association of South East Asian Nation
BAPPENAS	*Badan Perencanaan Pembangunan Nasional* (National Planning Agency)
BRI	*Bank Rakyat Indonesia*
BUMDes	*Badan Usaha Milik Desa* (Village-owned Enterprise)
CD	Capacity Development
DFW	Destructive Fishing Watch
DJ EBTKE	*Direktorat Jenderal Energi Baru Terbarukan dan Konservasi Energi* (Directorate General for New,Renewable Energy and Energy Conservation)
DKP	*Dinas Kelautan dan Perikanan* (Local Agency of Marine Affairs and Fisheries)
EnDev	Energising Development
ESDM	Energi dan Sumber Daya Mineral (Energy and Mineral Resources)
FGD	Focus Group Discussion
GIZ	*Deutsche Gesellschaft für Internationale Zusammenarbeit*
ID/IDR	Indonesia/Indonesian Rupiah
IEC	International Electrotechnical Commission
KESDM	*Kementerian Energi dan Sumber Daya Mineral* (Ministry of Energy and Mineral Resources)
KKP	*Kementerian Kelautan dan Perikanan* (Ministry of Marine Affairs and Fisheries)
KM	Knowledge Management
KPI	Key Performance Indicator
KEBTKE	*Ketenagalistrikan, Energi Baru Terbarukan dan Konservasi Energi* (Electricity, New and Renewable Energy and Energy Conservation)
KUKM	*Kementerian Koperasi dan Usaha Kecil dan Menengah* (Ministry of Cooperatives and Small and Medium Enterprises)
kW/kWp	kilo Watt/kilo Watt-peak
LCORE-INDO	Least Cost Renewables Indonesia
MHP	Micro Hydro Power
MW/MWp	Mega Watt/Mega Watt-peak
MSP	Mini-grid Service Package
NGO	Non-Government Organisation
PNPM	*Program Nasional Pemberdayaan Masyarakat* (National Programme for Community Empowerment)/Green PNPM: Green component of PNPM
POME	Palm Oil Mill Effluent
PPHP	*Panitia Penerima Hasil Pekerjaan* (the Work Acceptance Committee)
PPSDM	*Pusat Pengembangan Sumber Daya Manusia* (Centre of Human Resources Development)
PRAKARSA	*Program Pendampingan Efektivitas Sarana dan Prasarana Pulau-Pulau Kecil Berbasis Masyarakat* (Facilitation Programme for the Effectiveness of Community-based Facilities and Infrastructures in Small Islands)
PUE	Productive Use of Energy/Electricity
PV	Photovoltaic
PVVP	Photovoltaic Village Power or known as Pembangkit Listrik Tenaga Surya (PLTS) Terpusat
RE/EE	Renewable Energy/Energy Conservation
RUMI	Rural Mini-grid Management
SDG	Sustainable Development Goals
SI	Social institutions (public facilities serving the community)
SM	Sustainability Monitoring
SME	Small Medium Enterprise
SWOT	Strengths, Weaknesses, Opportunities, Threats
TOT	Training of Trainers
TSU	Technical Support Unit
VMT	Village Management Team

Energising Development is a global energy partnership

to promote sustainable access to modern energy services in developing countries.

1. Introduction

The Energising Development (EnDev) programme is a multi-donor partnership, currently financed and governed by the governments of the Netherlands, Germany, Norway, the United Kingdom, Switzerland and Sweden. Since 2005, EnDev has been promoting sustainable access to affordable and sustainable energy. Working in close cooperation with government and other development partners, EnDev applies a bottom-up approach to transform national policies and local requirements into practical solutions. Typical solutions involve extending and densifying power grids, installing community hydropower and photovoltaic (PV) mini-grids, and distributing domestic pico-solar systems and clean cooking devices. By pioneering innovative approaches, developing new markets, and scaling up successful interventions, EnDev contributes to positive economic, social and environmental outcomes globally. Currently, EnDev is active in 26 countries in Africa, Asia, and Latin America.

In Indonesia, EnDev has been supporting the government's rural electrification efforts since 2006. With partners that include the Directorate General for New, Renewable Energy and Energy Conservation (DJ EBTKE), Ministry of Energy and Mineral Resources (KESDM), EnDev Indonesia is working to fulfil government commitments to increase the national electrification ratio to 96 percent by 2019 and to escalate the share of renewable energy to 23 percent by 2025. EnDev Indonesia implements capacity development, technical assessment and monitoring, and knowledge management services that have supported the development of 309 micro-hydro power (MHP) and 305 photovoltaic village power (PVVP) systems that range in capacity from 5 kW to 400 kW. This community operated and administered systems providing electricity to over 189,000[1] people, 1,500 public facilities—such as schools and health centres—and 2,700 rural businesses.

The year 2016 marks the emphasis to institutionalise the methodologies and lessons learned throughout the years of collaboration between the GIZ and DJ EBTKE. This is reflected through various capacity development measures including training for government personnel on MHP and PVVP technical inspection and training for facilitators assigned in the outer small islands. The project also advised on the improvement of PV mini-grid technical specification, study on technical performance of two PV mini-grids, and monitoring initiative within DJ EBTKE.

[1] Adjustment factor (includes sustainability factor, windfall factor and pre-electrification factor) according to EnDev Global counting mechanism considered

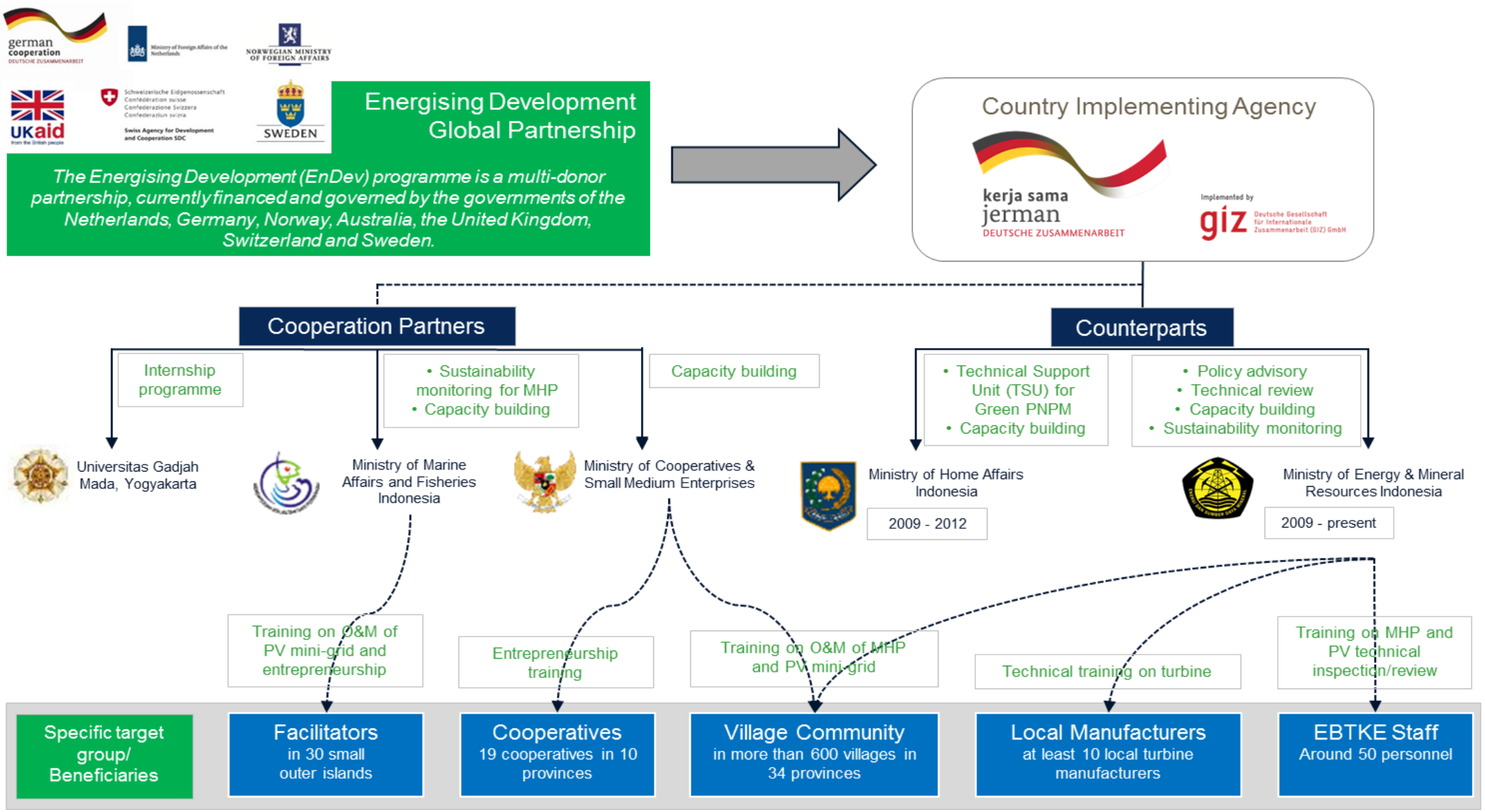

Figure 1 Stakeholders map of EnDev Indonesia

Thanks to the electricity,

Yuliana now can serve buyers in her kiosk at night. She also sells cold drinks which she stores in the refrigerator.

2. Key Indicators Achievements

EnDev Indonesia project has three main objectives: (1) to support access to modern energy to 172,000 people, 900 social institutions and 1,000 rural businesses; (2) to investigate and pursue measures to enhance sustainability of rural off-grid infrastructure; and (3) to institutionalise know-how and experiences in rural renewable energy implementation within DJ EBTKE and other stakeholders.

Based on monitoring measures in the second semester of 2016, EnDev Indonesia has supported **189,477 people** to get access to electricity, **1,537 social institutions** and **2,727 rural businesses**. The electricity is provided from 614 mini-grids, both MHP and PV, installed throughout the archipelago by various government and non-government initiatives. These rural electrification programmes are in line with the Sustainable Energy for All (SE4All) initiative, which one of the goals is to achieve universal access to energy by 2030.

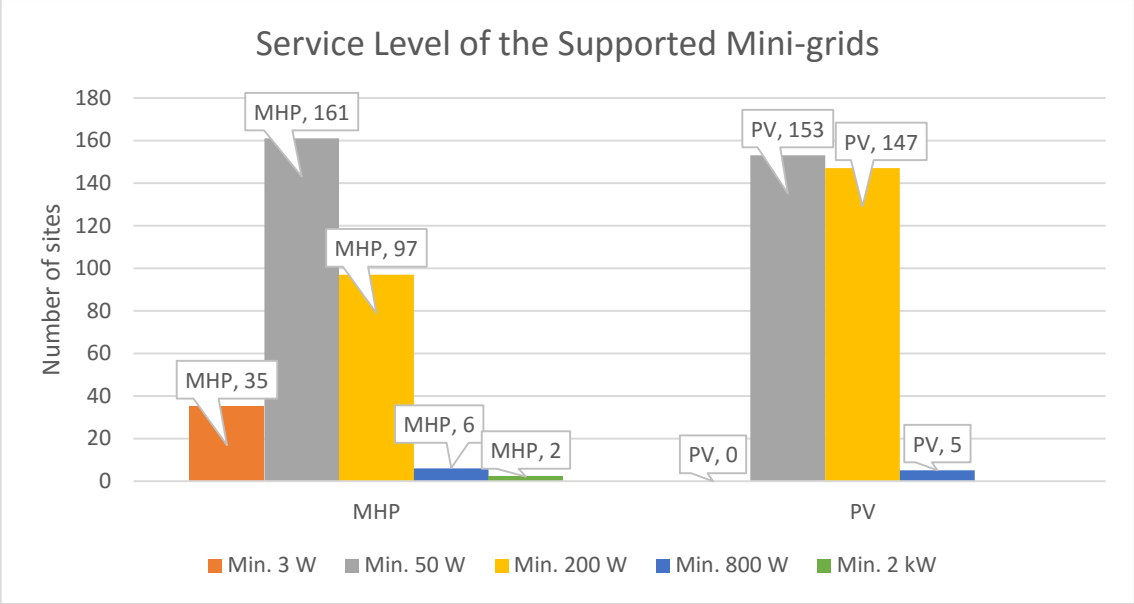

Figure 2 Service level of the supported mini-grids, measured in Watt per household

“For me, the most important thing is that now when my child cries at night, I can just flick the light switch on and see what the matter is. If it wasn’t for the turbine, I’d have to find a torch, or light the kerosene lamp like my mother used to do,”

Ibu Inang, a mother of one daughter in Kinali, Pasaman Barat, Sumatra Barat.

3. Activities in 2016

In 2016, the project put the highlight on sustainability measures and transferring the established methodologies to DJ EBTKE and other relevant stakeholders. The area of actions encompassed capacity development, sustainability monitoring, and knowledge management activities.

Table 1 Summary of activities in 2016

Topic	Code	Activity name	Output*
Sustainability Monitoring (SM)	**SM-1**	Study on technical performance of two PV mini-grids	Report
		Students' research on technical performance of ten PV mini-grids (supervision by EnDev ID)	Bachelor thesis report
	SM-2	Biannual operational status survey for June and December status	Reports
	SM-3	Integrating monitoring process into DJ EBTKE system and supporting to streamline DJ EBTKE process in IT context	Consultation
Capacity Development (CD)	**CD-1**	PPHP training on technical inspection	Training conducted
	CD-2	Facilitator training on small outer islands development	Training conducted
	CD-3	Workshop on economic development in small outer islands through electricity facility	Workshop conducted
	CD-4	Supporting *PPSDM KEBTKE* in capacity development related to off-grid rural electrification	Consultation, under GIZ Energy Programme
	CD-5	Course: The Art of Stakeholder Collaboration	Training attended
	CD-6	Workshop on multimedia and communication	Training attended
Knowledge Management (KM)	**KM-1**	Book: Good and Bad of PV Mini-grid (a guide for local stakeholders)	In progress
	KM-2	Review on PV mini-grid technical specification	Report
	KM-3	Book: Lessons Learned of Facilitation in Small Outer Islands	Report
	KM-4	Study on bioenergy power plant management	Implemented by LCORE-INDO
Pilot Model (PM)	**PM**	Rural Mini-grid Management Model (RUMI-Model): a pilot project to promote an integrated management of village electricity facility	Concept note, meeting notes

*) Output achieved until the end of reporting period

SM-1 | Study on Technical Performance of Two PV Mini-grids

Since 2012 more than 500 PV mini-grids have been installed by DJ EBTKE all across Indonesia. The PV mini-grids are equipped with a remote monitoring system (RMS) which records the system's technical data. Despite of the enormous numbers of PV installation, only few data could be obtained and read from the field. Moreover, only few technical performance analysis of the PV mini-grid in Indonesia are available to date.

Figure 3 The 15 kWp PV mini-grid in Tegal serving 75 households (JaTengS06)

Concerned about the absence of evaluation and sufficient knowledge extracted from the PV mini-grid initiative by DJ EBTKE, EnDev took efforts to collect all available data and evaluate them. DJ EBTKE initiative to boost the numbers of rural PV mini-grids shall be followed by deeper understanding on how the systems behave in rural circumstances. A proper understanding of the systems will improve future endeavour in rural electrification programmes.

The urgency of this study was also triggered by lack of literatures discussing rural PV mini-grids, especially in Indonesia. The PV mini-grids in this study are off-grid systems located in the most remote areas in the country. The setup is quite unique both in technology and socio-cultural perspectives. Meanwhile, most literatures are discussing PV mini-grids in Africa or India which have different implementation setup.

The study on PV mini-grid technical performance aims to:

a. Develop a simple methodology to evaluate the performance of PV mini-grid systems
b. Evaluate the performance of PV mini-grid in Indonesia
c. Introduce the results of evaluation to improve the PV mini-grid technical specification, system sizing, and business process involved.

EnDev conducted the study through a) in-house research as well as b) joint-research involving students in universities. There are two universities involved in this study; Gadjah Mada University (UGM) through Physics Engineering major and Swiss-German University (SGU) through Sustainable Energy and Environment major. The activities were:

a. **In-house research**. Its main purpose was to find indicators of system performance and baseline for similar study. As a result of this activity, there are four indicators of PV mini-grid system performance which comprise: (1) PV module performance; (2) overall module performance; (3) battery performance; and (4) load behaviour. The study analysed two PV mini-grids located in Maluku and Central Java.
b. **Joint-research with bachelor students**. This activity was conducted with the purpose to share and anchor the practical knowledge of PV mini-grid implementation in Indonesian rural context. In the long run, this knowledge will drive better understanding and improvement in the technology and implementation. GIZ advisors played the role as the second supervisor for the bachelor thesis which involved close guidance to the students in conducting the research. The current result of this activity were two bachelor theses from physics engineering students of UGM. Reports both the in-house and joint-research are underway for publication.

Figure 4 The 15 kWp PV mini-grid in Wetar serving 157 households (MalS11)

The study showed there was an imbalance between electricity supply from the PV mini-grid and demand load from the users. The two sites analysed were operating within 20% to 30% of the total system efficiency. There are several factors that might contribute to such condition, among others: insufficient planning and design process, the economic condition of the users, lack of access to electrical appliances, and other potential factors that are still uncovered.

The study needs more samples of PV mini-grid sites to form better conclusion. Current study is still lacking of good and reliable data from the installed systems. There were only 17 out of 75 downloaded monitoring data that can be used for further analyses. In the meantime, reliable data represents good communication between components in the PV mini-grid system. It is recommended that DJ EBTKE could make monitoring data submission as an obligation for the contractors. The data should then be used to validate the installation quality. More recommendations are presented in the study report.

As a follow-up of the study, a knowledge transfer session from GIZ to DJ EBTKE technical staff was proposed to be implemented in 2017. Such initiative will be further pursued as part of promoting the importance of monitoring and evaluation as well as strengthening the technical capacity of all relevant stakeholders. EnDev will also expand its academician network to more universities and technical-vocational colleges.

SM-2 | Biannual Operational Status Survey for June and December Status

GIZ commits to support the Indonesian government in monitoring the rural electrification facilities built through various initiatives. One way to measure the sustainability of the mini-grid systems is by checking whether the systems are still operating and exploring the reasons behind the deficient operational condition. The methods to monitor the operational status comprise field-survey, text messaging communication, and phone-calls. To update operational information of the mini-grids, a biannual monitoring survey is conducted through phone conversation. Results of the survey are documented and analysed to formulate and improve further impactful support and recommendation. Such phone survey has been conducted since 2015 and is continued in 2016.

The operational status survey aims to update the mini-grid operational situation and to get more insights from it. The source of information comprises technical, managerial, as well as socio-economic data which directly affect or are impacted by the mini-grids.

In 2016, the biannual operational status surveys were conducted in July and December 2016 (until January 2017). Both surveys were conducted through phone-calls to accommodate the scattered locations across the archipelago. The survey was performed in collaboration with a local organisation who will anchor the knowledge and practices in monitoring and evaluation for rural electrification. The survey consistently used the same form with previous rounds of surveys. This setup aims to maintain comparable data over the period and between other existing monitoring data.

Biannual survey in the second semester of 2016 had successfully contacted 180 mini-grid operators. The survey was conducted by two surveyors and took two and a half weeks to contact the operators. The result of the survey was resumed in a report which covers several key indicators of a sustainable rural mini-grid.

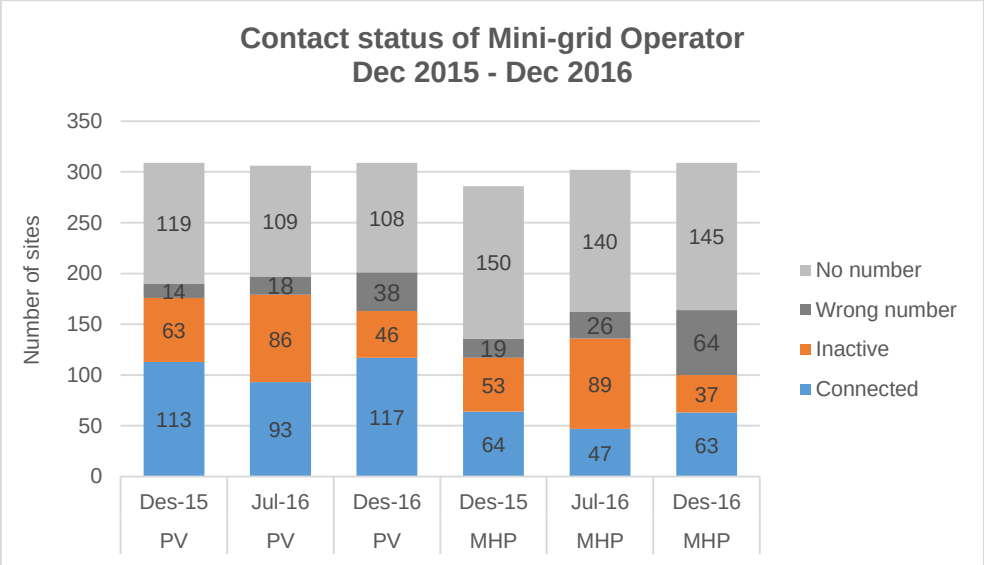

Figure 5 Calling status of mini-grid operators from three biannual phone-surveys

Brief result from the biannual survey shows that from 618[2] rural mini-grid sites, there were only 29% of the sites could be contacted. Most of the sites have invalid phone numbers (41%), connected to someone else (17%), and inactive phone numbers (13%). Respondents of the survey were dominated by PV mini-grid with 117 operators, while only 63 respondents were from MHP mini-grid sites.

[2] From 618 sites there are four sites not visited, which means only 614 sites receive typical technical support by EnDev Indonesia

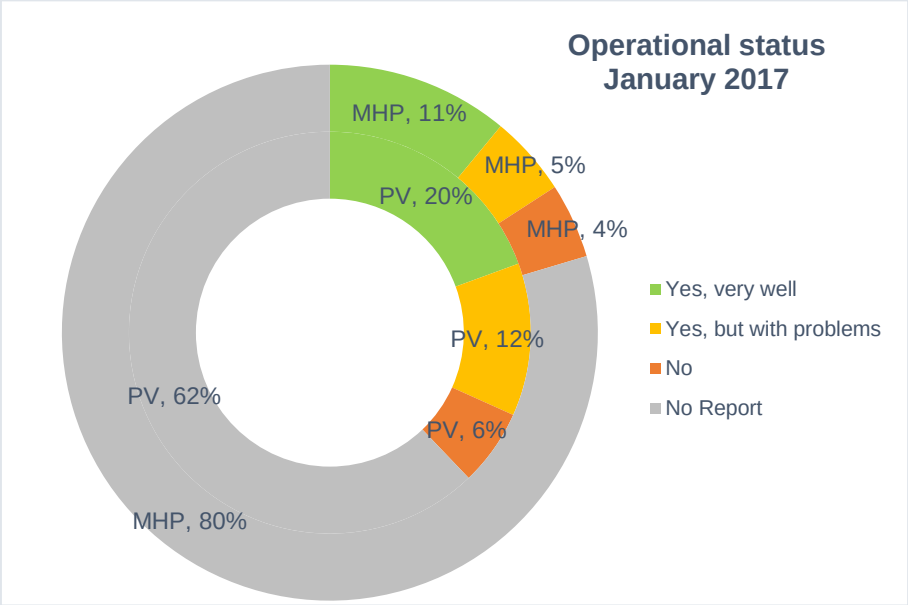

Figure 6 Operational status of mini-grids as per January 2017

Based on the survey, **84% from the 117 contacted PV mini-grids were operational** and 16% of them were not operating at the moment. In the meantime, **78% of the 63 contacted MHP mini-grids were operational** and 22% of them were unable to operate normally.

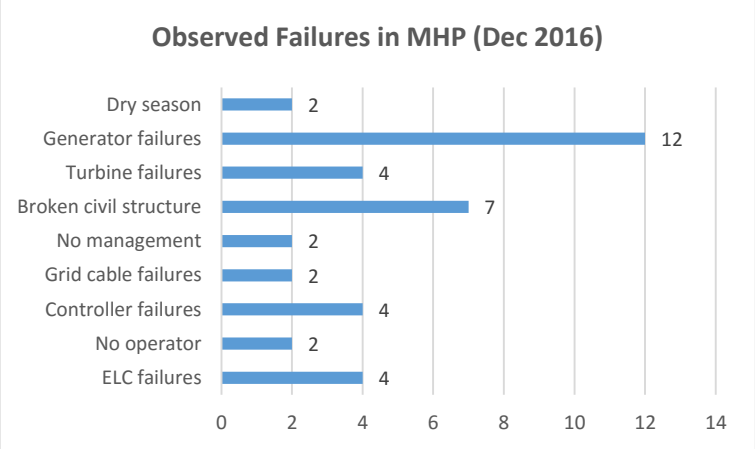

Figure 7 Types of failures observed in MHP systems

The survey noted that MHP customers use more appliances, while most of the PV customers only use electricity for lighting. In terms of power allocation per household, the PV mini-grid customers are very strict on energy consumption for each household. During the operation, there were common failures in each system as shown in the graphs. MHP failures were dominated by the generator and civil works, while in PV mini-grids inverter and battery failures, as well as lightning strike.

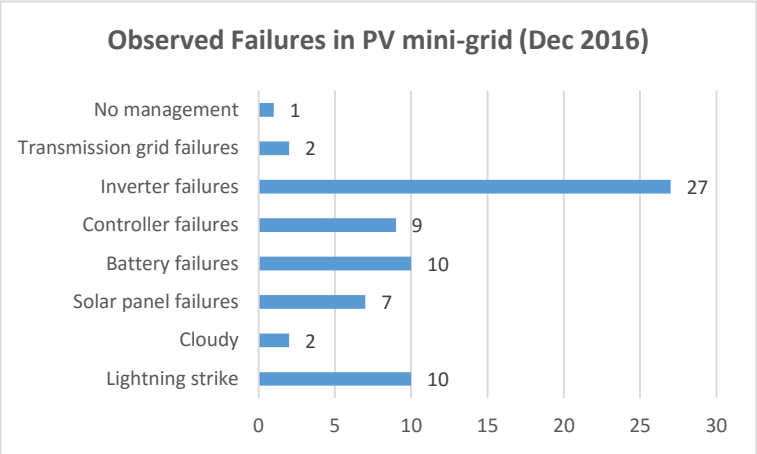

Figure 8 Types of failures observed in PV mini-grids

More insights on the operational status are available in the full report of Biannual Survey Report, 2nd Semester of 2016.

SM-3 | Integrating Monitoring Process into DJ EBTKE System

Monitoring and evaluation are crucial for DJ EBTKE to ensure the systems are able to operate in the long run. Sustainability of renewable energy infrastructures requires close monitoring and evaluation process. To conduct better management of rural electrification within the DJ EBTKE, a management information system (MIS) was developed. This MIS was designed to handle processes from proposal submission to monitoring for rural electrification. With the experience of EnDev Indonesia in conducting monitoring and evaluation for MHP and PV mini-grids since 2012, DJ EBTKE would take up the mechanism and lessons from the approaches.

Since 2015, DJ EBTKE initiated to develop an online platform that covers rural electrification processes from proposal until monitoring and evaluation for new rural mini-grid facilities. It targets provincial government officials as the main users. It aims to substitute the paper-based proposal mechanism which created inefficient workload in DJ EBTKE. EnDev has been supporting in defining and streamlining the required business process flow. It then became a baseline document for the software engineer to develop SINERGI. EnDev also took part in SINERGI's users training for provincial energy bureaus in Bogor and Mataram.

The platform has been used by the provincial government to propose new MHP or PV mini-grid facilities for the budget year 2017. There were hiccups in the implementation, such as the validity of the uploaded documents and insufficient computer skill to operate the application. In 2017, EnDev seeks to implement more comprehensive monitoring and evaluation measures into DJ EBTKE.

Energi Desa

Energi Desa serves as a knowledge and monitoring platform in rural electrification that has been running since 2014. The users, who mainly are rural mini-grid operators, may get regular tips and tricks on how to maintain the power plants as well as basic knowledge of renewable energy. The users are also free to post questions to this platform through SMS[3]. Since 2015, an Android-based mobile application has been released and currently is being developed to serve better the Energi Desa community.

In the future, Energi Desa should ideally be anchored into any relevant local institution covering rural electrification issues, including DJ EBTKE as the first priority. Discussion on Energi Desa acquisition by DJ EBTKE is still underway and needs more deliberation on the alternative options for its implementation. EnDev devised three options for DJ EBTKE to adopt Energi Desa or technology-like service, namely:

a. Public-private-partnership format with the current programme developer organisation;
b. DJ EBTKE to subscribe to the technology platform service;
c. Develop a new system similar to current Energi Desa.

[3] Short Message Service

CD-1 | PPHP Training on Technical Inspection

Figure 9 Participants of PPHP training on MHP inspection

In three consecutive years (2013 to 2015), GIZ undertook the technical review and baseline survey of 112, 110, and 83 (respectively) PV mini-grids installed in Indonesia, on behalf of DJ EBTKE. The review findings were evaluated, summarised and submitted to DJ EBTKE for further processing and follow-up.

In 2016, GIZ focuses its support towards institutionalisation of the lesson learned and methods that have been developed in the past three years. This shall include capacity building measures to integrate the established tools within DJ EBTKE system.

One of the conclusions and recommendations from the technical review was for DJ EBTKE to improve its personnel capacity in conducting a technical inspection. Therefore, a training programme on MHP and PV mini-grid inspection for DJ EBTKE internal inspectors known as ***Panitia Penerima Hasil Pekerjaan (PPHP)*** was organised in order to strengthen their skills in conducting such technical field inspection. The training was divided into three sessions, which was implemented sequentially. Two trainings were related to PV mini-grid and the other one was related to MHP mini-grid.

Table 2 PPHP training sessions on MHP and PV mini-grids

Topics	Date	Number of participants	Venue
MHP Mini-grid Technical Inspection	28-29 July 2016	27	Bandung
PV Mini-grid Technical Inspection Batch 1	4-5 August 2016	22	Bekasi
PV Mini-grid Technical Inspection Batch 2	18-19 August 2016	23	Bogor

The technical training was designed for beginners in accordance with pre-training survey result that shows variations of the participants' education and professional background. The training applied adult learning approach by actively involving all trainees in every session. The four methodologies were:

1. Teaching in classrooms by trainers regarding the fundamentals of mini-grids;
2. A case study in groups, using tools developed by GIZ for inspection purpose;
3. Role play, to train critical thinking in doing inspections;
4. A field visit to the MHP laboratory in Cihanjuang, Bandung to provide more practical knowledge about the various technologies in MHP systems (applied only for MHP training).

Training of PPHP on MHP Mini-grid Technical Inspection

A total of 27 trainees participated in this training. Some participants displayed curiosity and great attention throughout the training. This was apparent from the pre- and post-test results which showed score increase in the percentage of correct answers. However, this result only reflects the good level of understanding on MHP components and functions, and could not yet serve as an indicator of the participants' understanding on the inspection methodology and MHP quality assessment.

The topics presented in the training were:

- Basics of MHP (components and function)
- Steps of MHP construction
- Introduction to assessment tool for appraising construction and mechanical-electrical installation progress
- Good and bad of MHP (group exercise)
- Introduction to Technical Review Form
- Tips on taking photos
- Field visit to MHP laboratory

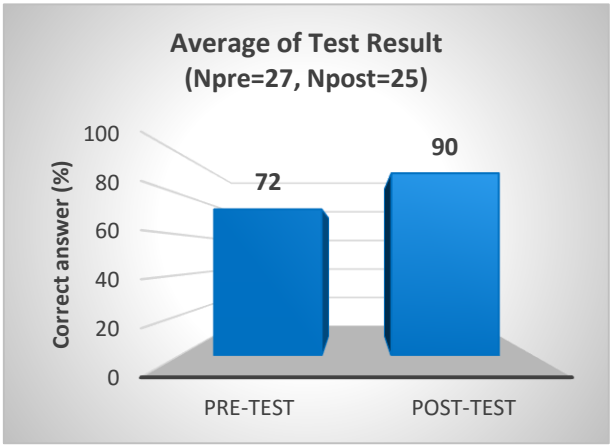

Figure 10 Test result of PPHP training on MHP inspection

Training of PPHP on PV Mini-grid Technical Inspection

The training on PV mini-grid technical inspection was organised in two batches; the first batch was participated by 22 trainees and the second batch by 23 trainees. The tests shows improvement of the participants' knowledge.

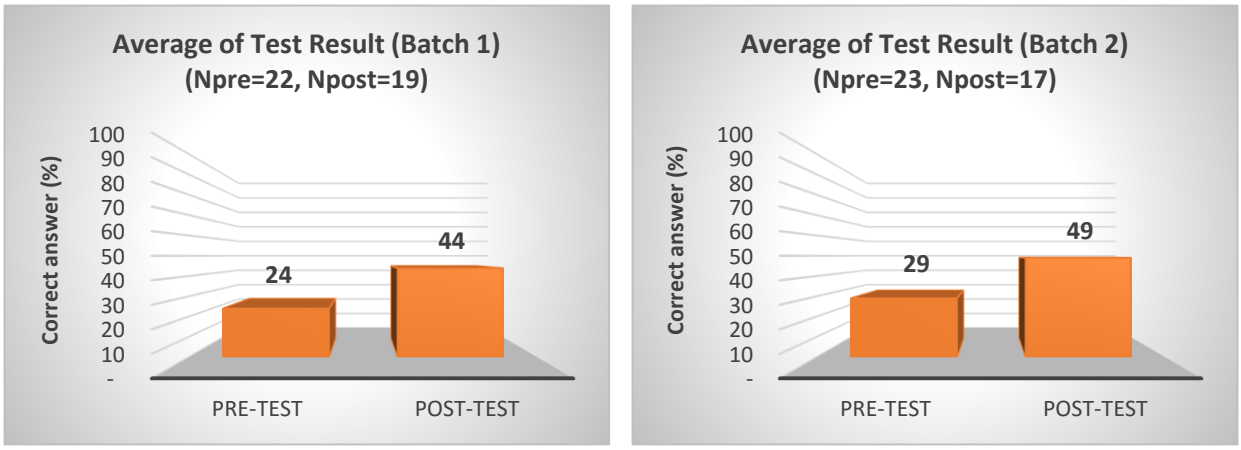

Figure 11 Test result of PPHP training on PV mini-grid inspection

The topics presented in the training were:

- Basics of PV mini-grid (components and function)
- Introduction to checklists: component compliance, workmanship quality, and performance verification
- Good and bad of PV mini-grid (in relation to workmanship quality assessment)
- Tips on taking photos
- Evaluation using Technical Summary Sheet (group exercises)

Additional to the training, the event was also useful to capture the experiences regarding management and implementation of the technical inspection. The results would help DJ EBTKE in strengthening its inspection program. Some learnings and feedback are listed as follow:

1. Given the importance of PPHP's role to get accurate information from the field, a longer duration of training is required so that PPHP could apply the inspection methodology well;

Figure 12 Role play as part of the training method to practice the tasks of PPHP

2. To further improve PPHP's skill, there are at least three follow-up training necessary:
   - Additional technical training for non-technical staff, given the fact that PPHP personnel are coming from diverse backgrounds.
   - Advance training to share knowledge and information among PPHP personnel.
   - Advance training on PV mini-grid technical quality and performance, including techniques to detect improper installation which may have a critical impact on the performance and system safety. Such training should include measurement practices in the field.
3. In regard to inspection administration/management, a technical guideline to implement inspection (i.e. Standard Operating Procedure) should be compiled consisting of among others:
   - A number of people in the inspection team and balanced composition of expertise.
   - Duration of technical inspection in the field.
   - Uniform checklist for technical examination, including measurements to determine the system performance (therefore measurement instruments are necessary).
4. Establishing an internal Technical Evaluation Team who will be in charge in organising and evaluating data and information obtained by PPHP or surveyor. This team could be coordinated by Sub-Directorate for Technical and Environment and is comprised of staff with relevant educational background (e.g. electrical, mechanical and civil engineering) and have experiences in MHP/PV mini-grid technical inspection.
5. The PPHP coordination team responsible for managing PPHP assignment should pay attention on:
   - Scheduling and monitoring the progress of PPHP works; scheduling wherever possible should be managed centrally by the coordinator.
   - Arranging the composition of PPHP teams; each team should comprise at least one technical staff, an administrative staff should be accompanied by a technical staff.
   - Management of inspection process and results documentation needs to be prioritised.

CD-2 | Facilitator Training on Small Outer Islands Development

Figure 13 Inauguration of facilitators to be assigned in small outer islands

In March 2016, EnDev Indonesia in collaboration with Directorate General for Sea Space Management, Ministry of Marine Affairs and Fishery (KKP) and Destructive Fishing Watch (DFW), organised the second batch of 5-day facilitator training in Jakarta. As many as 18 facilitators participated in this training. These facilitators were assigned as part of PRAKARSA. PRAKARSA stands for *Program Pendampingan Efektivitas Sarana dan Prasarana Pulau-Pulau Kecil Berbasis Masyarakat* or the Facilitation Programme for the Effectiveness of Community-based Facilities and Infrastructures in Small Islands, which includes the PV mini-grid facilities installed by DJ EBTKE.

The training was conducted using adult learning methods which proportionally contain lectures, discussions, field studies, and problem-solving practices. In each training session, participants were encouraged to actively be involved and to share their thoughts. In addition, a series of energiser/games were also applied to increase participant's enthusiasm.

The trainers also used a method called "Cycle Learning through Experience", a learning model based on the participants' needs. This cycle employs a series of activity stages organised in a certain way so that the participants will be able to master the competencies quickly and simply. The main benefit of this method is that the participants become highly motivated to learn and follow all training sessions, since they are actively involved in the learning process and have the opportunity to share their knowledge and experience.

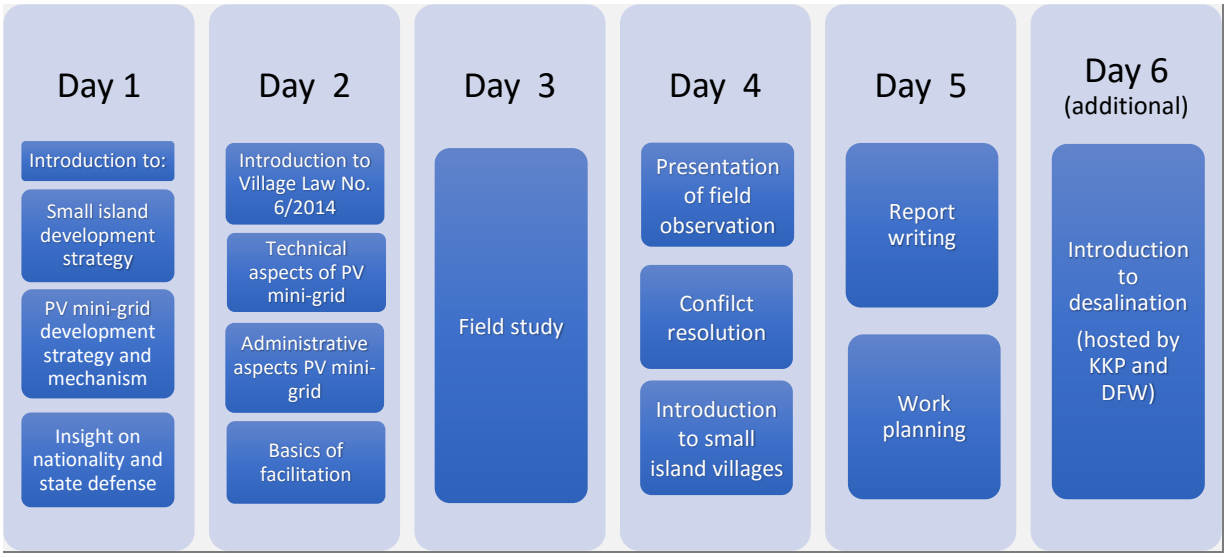

Figure 14 Process of facilitator training

The training has helped the facilitators in performing their tasks in the field. In regard to the PV mini-grid, DFW's field observation showed that from 33 PV mini-grids monitored through the facilitation programme, 24 sites were operational, 6 sites had trouble in its operation, while only three sites were not operational. Concerning legal aspect of the Village Management Team (VMT), KKP encourages all sites to transform their legal status to a Village-owned Enterprise (BUMDes). By the end of 2016, five (5) sites are transformed to BUMDes, while the remaining sites are holding the Marine and Fishery Agency (DKP) Decree, Bupati Decree, Mining and Energy Agency (Dinas ESDM) Decree, or Village Decree. All operational sites are able to maintain electricity dues and the accumulative saving to date is around IDR 200 million.

Figure 15 Locations of facilitation in 33 islands and the operational status (source: DFW)

The facilitator training is part of a support programme under collaboration with KKP which has been conducted since 2015. Additional to the facilitation topic, the facilitators were also trained on business development skill. This was in line with KKP's scheme to support small business development in small islands through a provision of productive appliances. To date, several small businesses are flourishing, i.e. a variety of snacks made from seaweed and mackerel in Pulau Sebatik, shredded fish in Pulau Selaru, bottled peanuts in Pulau Larat, fish ball and shredded fish in Pulau Liki. To improve the product quality and packaging, the facilitators sought support from Dinas for Trade and Industry who organised production and packaging training for the business groups.

Figure 16 Products from small outer islands

CD-3 | Workshop on Economic Development in Small Outer Islands through Electricity Facility

The workshop was conducted in collaboration with the Ministry of Fishery and Marine Affairs (KKP) in Jakarta on 1-3 August 2016. The objective was to strengthen and improve the participation of all relevant stakeholders in relation to infrastructure management (including PV mini-grids built by DJ EBTKE) and economic development of the targeted small and outermost islands.

As many as 67 participants attended the workshop, consisting of facilitators from 18 sites, representatives from DKP, Dinas ESDM, as well as officials from KESDM, Ministry of Industry (Kemenperin), Ministry of Communication and Information (Kominfo), Ministry of Public Works and Public Housing (PUPR), universities, banks, journalists/bloggers, and NGOs.

The workshop was structured into three segments:

1) Data and information sharing from the resource persons from the following organisations: PUPR, KESDM, BRI, GIZ, DFW Indonesia, Swisscontact, HERO, JAVARA Group and Urchin Indonesia.
2) Focus Group Discussion (FGD) which was divided into two groups: the first group discussed the small island economic development or productive economic activities, while the second group discussed issues related to the status of infrastructure in small islands.
3) The last phase was dedicated to small business development in which two start-up businesses, PT. Javara and Urchin Indonesia, presented their program and experiences in helping small business people to improve their product and expanding their business coverage.

Table 3 Resource persons and topics presented in the workshop

Resource Persons/Organisations	Topics
Plenary Session: Part One	
KESDM	Policy on RE utilisation and energy preservation to the augmentation of electrification for under-developed area, border area and the outermost islands
PUPR	Construction of a fishing village infrastructure
DFW Indonesia	Implementation of community empowerment program through partnership and collaboration in small and outermost islands
Plenary Session: Part Two	
BRI	Experience of BRI in supporting fishermen cooperatives and financing SME
Swisscontact- Wisata	Study program on Regional Economic Development (RED) Swisscontact
GIZ (EnDev Indonesia)	Management of rural electrification to support the economy of the island through productive-of-energy approach

Through the FGD, inputs for strengthening small islands development programme were collected. A work plan for the upcoming four months of facilitation was compiled. Additionally, all FGD participants signed an agreement to strengthen and move the stakeholder collaboration forward.

Several conclusions withdrawn concerning PV mini-grid are as follow:

- Infrastructure development is an absolute necessity for small islands and requires collaboration and coordination among all relevant stakeholders;
- PV mini-grid development is the beginning of the series of sustainable development programmes for small islands, therefore it is important to encourage community to manage and maintain the mini-grid among others through better tariff system and training for the management team;

Figure 17 The workshop aims to strengthen the participation of stakeholders in small outer islands

- Besides lighting, rural electricity is one of the important infrastructures to support small island economy which was generally constrained by marketing of the goods or products. Assistance is needed to open up the market for production. Furthermore, energy allocation for only three lamps per house is considered insufficient to boost community economy;
- In Sebatik Island, the management team who serve 172 households has collected dues in the amount of IDR 23 million, but still, there are many houses not connected to the PV mini-grid, so they need to fund its distribution grid on their own. The partnership with BRI can be a good solution for such community, also for developing a business;
- The facilitators shall be able to transfer their knowledge to the community and to find a local champion in the island to be the motivator and later substitute the facilitator's roles.

CD-4 | Supporting PPSDM KEBTKE in Capacity Development related to Off-grid Rural Electrification

GIZ gives emphasis to human capacity development (HCD) in order to accelerate the development of renewable energy application in the country. A wide range of HCD measures are considered and encouraged to be included in all aspects from the policy makers, private entities, technical experts, as well as the community beneficiaries. Therefore, early in 2016 GIZ pursued a collaboration with the *Pusat Pengembangan Sumber Daya Manusia Ketenagalistrikan dan EBTKE* (Centre of Human Capacity Development for Electricity and EBTKE).

The initiative will be lead under the GIZ Energy Programme Indonesia/ASEAN which will comprise cooperation between PPSDM and all projects i.e. EnDev Indonesia, LCORE-INDO, Green Chillers and the new projects which will kick off in 2017; ELREN[4] and REEP[5]. The consultation meetings are still underway and it is expected to be formalised in 2017. One of the activities envisaged under the cooperation is support in training module development and/or refinement related to off-grid rural electrification.

Figure 18 PPHP training on PV mini-grid inspection

[4] Electrification through Renewable Energies
[5] 1,000 Islands – Rural Electrification through Renewable Energies

CD-5 | Course: The Art of Stakeholder Collaboration

Together with the counterparts, GIZ participated in The Art of Stakeholder Collaboration Course in Siem Reap, Cambodia on 10-13 August 2016. The course was organised by the Collective Leadership Institute (CLI), an internationally operating non-profit organisation located in Potsdam (Germany) and Cape Town (South Africa) with focus on educational programmes in the area of Collective Leadership and Stakeholder Dialogues.

The course strongly promotes the 17th Sustainable Development Goals (SDGs) particularly in achieving the target to enhance the global partnership for sustainable development, complemented by multi-stakeholder partnerships that mobilise and share knowledge, expertise, technology and financial resources, to support the achievement of the sustainable development goals in all countries, in particular developing countries.

Officials from DJ EBTKE (Widya Adi Nugroho), PPSDM (Bambang Priandoko), KUKM (Victoria br. Simanungkalit), and ASEAN Centre for Energy (Yudha Siregar), were very excited about the course. The advisors of EnDev Indonesia (Amalia Suryani and Erwina Darmajanti), LCORE-INDO (Tjut Silvana Devi), and ASEAN-RESP[6] (Anant Sukhla), found that the course was very useful to build mutual understanding and benefit with the stakeholders.

Figure 19 Discussing on how to improve the sustainability of off-grid rural electrification

Participation in the course was intended to help the group to better understand the stakeholder landscape and identify opportunities for meaningful engagement that build strong relationships and lead to robust results. Such partnership shall be built upon a shared vision, common goals and commitment.

During the course, the group has agreed to form an **Initial Container Group** for the topic of sustainable off-grid rural electrification using renewable energy, including to highlight the wider perspective of rural energy access to strongly include the economic development agenda by utilising energy facilities as a tool instead of an end-goal. This group will be the mover and leader who will collaboratively move the sector forward.

The key takeaways from the course include the application of the **Dialogic Change Model** (a model developed by CLI to implement stakeholder dialogues in a result-oriented way), business case for co-creative stakeholder engagement and produce a map to prioritise engagement activities, methodologies to create sustainable partnerships, also how collective intelligence, commitment and ownership can emerge.

[6] GIZ's ASEAN Renewable Energy Support Programme

CD-6 | Workshop on Multimedia and Communication

In order to improve the capacity and competence in information and knowledge dissemination on renewable energy and energy conservation through the use of multimedia, GIZ organised a multimedia workshop for DJ EBTKE and KESDM communication personnel.

The workshop was conducted in Bonn, Germany, on 10-14 October 2016 facilitated by Deutsche Welle (DW) Akademie. DW Akademie is a German leading organisation for international media development that supports the development of free and transparent media, quality journalism, and also offers programmes to boost media skills.

Figure 20 Video recording as part of learning from the multimedia and communication workshop

Participants were provided with practical knowledge and were actively involved in the discussion. The personnel in-charge in information technology in DJ EBTKE, (Amanda Stevi Pradipta and Rakhma Wardani Sambodo) and the personnel in-charge in public communication of KESDM, Nur Ali S., were participated in the workshop together with the GIZ's multimedia specialist, Masri J. Vani.

The workshop discussed the best practices of various multimedia elements such as writing for online media (i.e. website, social media), knowledge on how to select, edit, and insert the good sound clips, as well as about recording and editing video. The features used as training tools in the workshop are a mobile phone, digital camera, and camcorder.

Through this workshop, the participants are expected to have a better collaboration between the DJ EBTKE, the KESDM's Centre for Public Communication, and the GIZ to create better multimedia contents for information dissemination on the renewable energy and energy efficiency.

KM-1 | Book: Good and Bad of PV Mini-grid (A Guide for Local Stakeholders)

In recent years, PV mini-grid systems have been taking a significant role in increasing electrification ratio in rural areas in Indonesia. Over the period of six years, several institutions from private and public sectors, particularly DJ EBTKE have been trying to improve the installation quality and reliability of their systems. Based on the results of technical inspection conducted by GIZ in 2013 to 2015, the systems built by DJ EBTKE have shown considerable improvement from year to year. After the technical inspection activities, both DJ EBTKE and GIZ have gained valuable information in the performance and the workmanship quality of all inspected sites that were also captured during the inspections.

In order to standardise the quality among the sites and continue with the growth improvement, dissemination of the lesson learned to the local stakeholders such as DJ EBTKE, contractors, service technicians, and local operators is important to maximise the transfer of knowledge. In this purpose, the best practices guideline in the form of good and bad of PV mini-grid systems book was considered.

The goal is to avoid repeating similar mistakes and use the good ones from the earlier installations as an example to follow. Therefore, the new installation of PV mini-grid will be more reliable, increasing lifetime, and operating efficiently without problems. The book will support the capacity building of relevant stakeholders in the design process, installation, as well as operation and maintenance of PV mini-grid systems.

The writing process including selection of good and bad photos from roughly 300 sites has been started by GIZ since the fourth quarter of 2016 and expected to be published by the end of the first quarter of 2017.

In general, the book will provide countless pictures of good and bad practices of PV mini-grid systems installed by DJ EBTKE within the period of 2012-2014. Each picture will be rated as a good or bad example and is supported with a short description explaining the reason behind it. Since the book is intended to be used as a reference or guideline for different stakeholders, the book will also include:

1. Basic principles of PV mini-grid systems and its components
2. General design and installation principles
3. Tips to avoid mistakes
4. Measuring techniques
5. Simple maintenance and troubleshooting guide for local operator and technicians

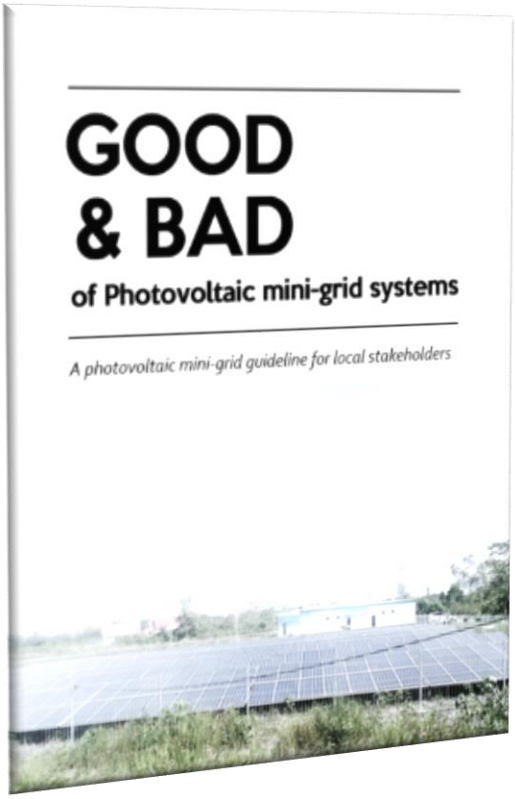

Figure 21 Book cover preview of the "Good and Bad of PV Mini-Grid"

The good examples will demonstrate the proper way to install each component, both hardware and software. Moreover, they will provide a recommendation to achieve a faultless system that meets the designed lifetime and operates without any safety hazard for the operator. On the other hand, the examples of bad installations do not mean to show the poor quality of the installations, but rather to be used as valuable lessons that must to be avoided in the future. Repeating the similar mistakes leads to unsustainable system as well as risking the entire PV mini-grid programme.

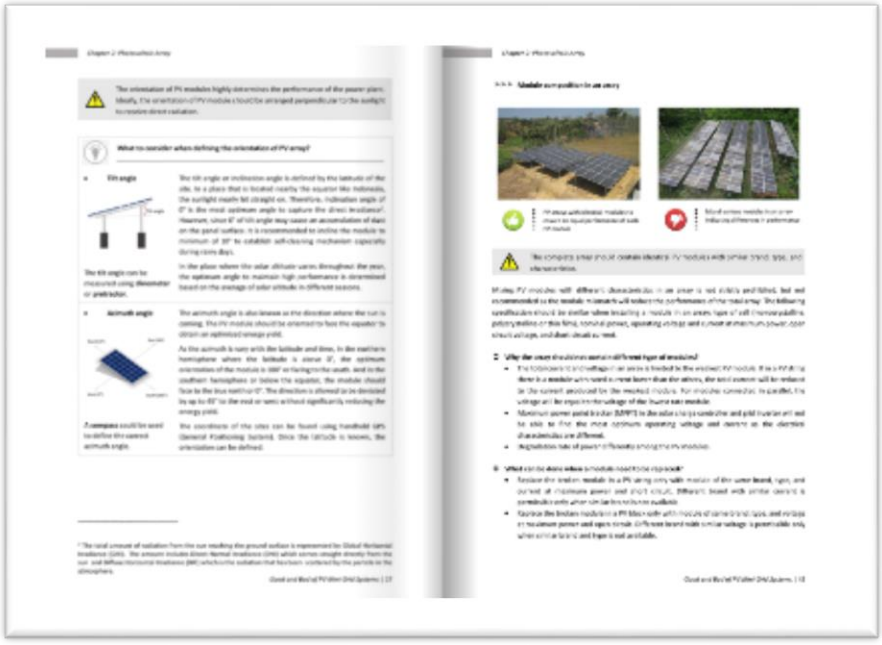

Figure 22 Preview of the book "Good and Bad of PV Mini-grid"

A good design and good workmanship quality are the first attempts to deliver a reliable system. It would not guarantee the sustainability of the system, especially when the system is not maintained properly. Simple regular preventive and corrective maintenance plan must be done at least by local operator after the commissioning. To accomplish this, the operator and technicians should be provided with sufficient knowledge in the basic principle of the overall system, simple troubleshooting, and measuring techniques. In complementary with training, this book is also served as handbook or manual for the local operator.

KM-2 | Review on PV Mini-grid Technical Specification

Over 600 PV mini-grid systems are reportedly deployed by DJ EBTKE to increase electricity access in rural areas in Indonesia during the year of 2012 to 2016. Despite the huge numbers of the installed system, the implementation of PV mini-grid program is relatively new. Through five years of operation, DJ EBTKE experiences problems with the installation quality and operational condition of their systems. There were frequent faults observed, significant deviation from the expected output, fast reduction of a lifetime, as well as safety-related within a couple of years of operation.

Since PV mini-grid technology is also considered as new technology in Indonesia, the situation is not specific only for DJ EBTKE sites. Many installations from different initiatives also encountered a similar problem. There are many causes for a faulty system such as the undetailed requirement in the specification, insufficient design, inadequate commissioning protocol, unestablished performance monitoring system, and limited service and maintenance.

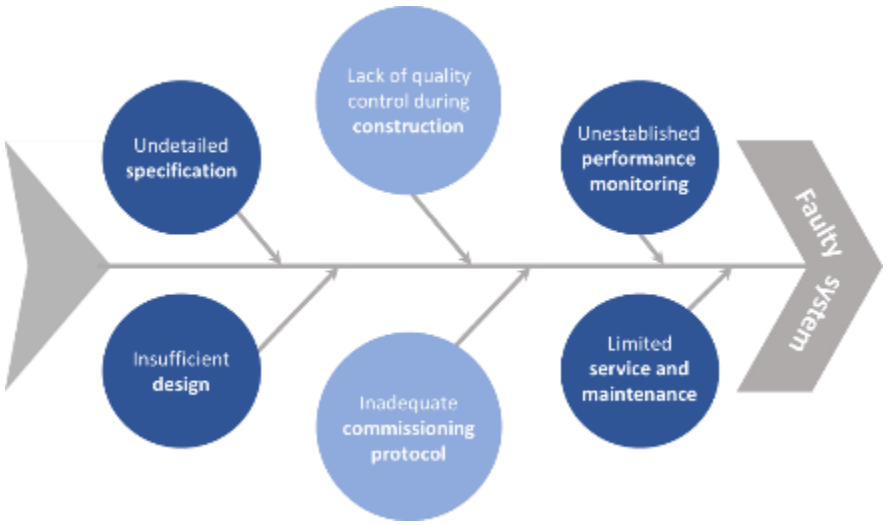

Figure 23 Possible causes of a faulty system

There are many aspects to be addressed to ensure the quality of the PV mini-grid. One of the crucial aspects is to have a detailed and reliable specification describing the minimum requirements that refer to national and international standards. The requirements include the components requirements, as well as its installation which should comply with best practices.

To mitigate the problems from the starting phase of the project, it was recommended for DJ EBTKE to comprehensively review its existing technical tender specification. The review aims to find the gap in the current specification and provide a recommendation to formulate more detailed requirements. Such requirements should incorporate critical thresholds to comply with available technical standards and best practices. Furthermore, DJ EBTKE intends to embrace the refined technical specification as a reference in formulating a guideline for procurement and installation of PV mini-grid systems. The output will substantially contribute to a successful implementation and reliable operation of the system.

In the fourth quarter of 2016, GIZ together with Fraunhofer-Institut für Solare Energiesysteme (ISE) as a consultant in PV systems were requested by DJ EBTKE to review the existing PV mini-grid specification formulated by DJ EBTKE. The assessment covered the overall PV mini-grid system with highlights on the PV module, battery storage, balance of system, safety and system protection, and the quality assurance of the entire project.

Figure 24 Fraunhofer ISE was presenting the preliminary results during focus group discussion

The activities started with a preliminary review of the current technical specification and in parallel compiling the available technical standards. The objective is to find the gap between the specification and an ideal system according to best practices. A gap analysis was performed to four documents namely: master technical specification formulated by DJ EBTKE, proposed specification by the contractors, list of relevant national and international standards, and executive reports of three consecutive years MSP.

To gain in-depth knowledge from the real implementation in the field, site visit to three sites in Riau Province of Sumatra was conducted together with the representative of DJ EBTKE. The on-site inspection enriches the information in the overall system quality, complemented by interviews with villagers and local operator.

A stakeholders meeting in a form of FGD was held to present the first results and to share the information among the stakeholders. The FGD was attended by DJ EBTKE as the programme initiator, Puslitbang[7] KEBTKE and BPPT[8] as research organisations, technical commission of BSN, practitioners, GIZ, and Fraunhofer ISE. The FGD has provided additional insights into the complete process from feasibility study to commissioning, relevant undergoing activities of each stakeholder, and the prospective technical specification of PV mini-grid systems implemented by DJ EBTKE.

Figure 25 Site visit to PV mini-grid system in Riau

From the literature reviews, site visits, and stakeholders meeting, the reviewer has concluded that the Indonesian PV mini-grid programme initiated by DJ EBTKE has been operating well using good quality components and relatively in a good condition in comparison to other PV mini-grid programme in some other developing countries. However, there are still crucial gaps to be addressed to achieve a sustainable system. The findings include the requirement of technical standards for the main components, additional features and correct system sizing, and capacity building of the designer and system installer.

[7] *Pusat Penelitian dan Pengembangan* (Centre for Research and Development)
[8] *Badan Pengkajian dan Penerapan Teknologi* (Agency for the Assessment and Application of Technology)

Table 4 Recommendation for the components and installation

	Recommendation					
Component	**Features**	**Technical Standard**	**System sizing**	**Capacity building**	**Warranty and spares**	**Installation**
PV module	Reduce to 15% efficiency	IEC 61215 and IEC 61646			2% of total module	
Charge controller	Temperature compensation	IEC 62509	>90% PV power	Training from manufacturer		
Grid inverter		EN 50530 and IEC 62109	>90% PV power	Training from manufacturer		
Battery inverter		IEC 61683	Total demand based on feasibility study	Training from manufacturer		
Battery		IEC 60896-21/-22, IEC 61427, IEC 62485	Based on demand & available supply		Reduce to 7 years	
Protection devices	Replace DC* fuse with DC MCB**		150% of nominal			
Lightning protection	SPD*** has to be sized correctly			Concept training		
Grounding	Introduce ring galvanized steel	IEC 60364-5-54				Connect all grounding systems
Cable	UV and water-resistant	IEC 60364-5-52	≤ 4% voltage drop in power house			Include good and bad examples

*DC: Direct Current

**MCB: Miniature Circuit Breaker

*** SPD: Surge Protection Device

The review formulates recommendations for PV mini-grid development as follow:

1. Several important standards were recommended to be introduced in the future tenders to ensure delivery of high-quality products. The list of standards was carefully created by considering only the important aspects and capability of manufacturer as well as the existing local testing laboratory. Due to the high cost of establishing a test facility, testing of the components can also be done in a more sophisticated laboratory overseas that is in cooperation with the local ones. DJ ETBKE together with Indonesian standardisation body (BSN) have been gradually adapting the relevant international standards as recommended from the review activities.
2. The installation/workmanship quality was also identified to be the main focus in the future specification. It is believed that the installation of all components and the balance of system should be performed and sized correctly.
3. It is necessary for a manufacturer to provide sufficient training on how to install and commission their products. This includes training on lightning protection design and grounding concept which must be scheduled regularly by qualified body or lightning protection manufacturer to avoid unexpected faults due to a lightning strike.
4. A detailed pre-feasibility study for each site concerning geographical situation and load data is highly suggested. This will help to fulfil the energy demand of the villagers by considering the balance between the demand, resource, and expected lifetime. The detailed geographical condition such as type of soil and the size of prospective power house may help the engineers to better design and select the suitable components.
5. The monitoring system is very important for the operational and sustainability of the entire programme. The functionality and the validity of the data must be maintained right after the commissioning to retrieve meaningful information from the system and to evaluate the performance. Monitoring database of all sites should be created to have a broad overview of all sites.
6. List of parameters and the procedure to measure have been developed to create one standard template for calculating the performance indicators. DJ EBTKE has been successfully monitoring remotely some of their systems in their monitoring platform. More parameters are expected to be introduced in the current monitoring system to have an extensive analysis on the overall performance.
7. After all, the quality assurance (QA) system is recommended to be improved. DJ EBTKE also realised the importance of establishing such a system to meet the lifetime expectancy. A good QA system should comprise of at least proof of technology reliability through a pilot test, regular operation and maintenance plan, clear warranty scheme, more detailed commissioning protocol, and guarantees for the availability of spare parts and contractor representatives nearby the site.

KM-3 | Book: Lessons Learned of Facilitation in Small Outer Islands

The publication of lessons learned document is part of GIZ's support to Directorate General Sea Space Management of KKP. The publication aims to document the activities of KKP's field facilitators in three small outer islands i.e. Larat, Kawaluso, and Matutuang, and recording the lessons gained from the programme implementation.

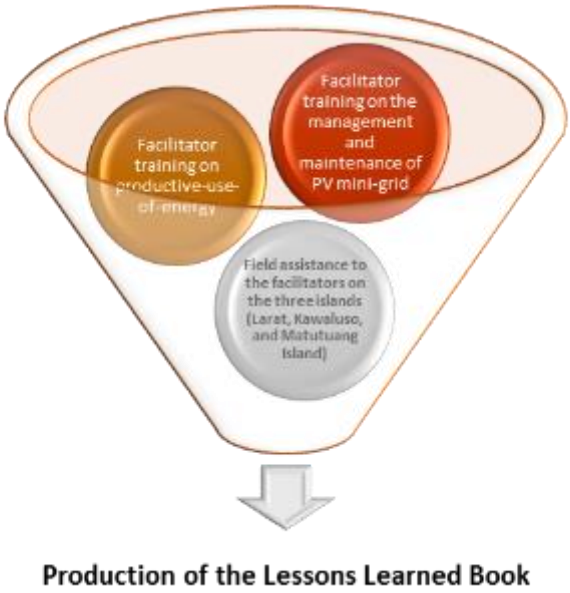

Figure 26 The book writing scheme

The book is divided into five chapters consisting of an introduction, writing methodology, an overview of the three Islands, lessons learned from facilitation activities, and recommendation. The analysis was made by comparing the output designed in PRAKARSA initiative and the output of the facilitators' field works after the training provided by EnDev Indonesia. SWOT and input-process-output analysis methods were applied to this book.

Even though the production of the book is still in progress, some lessons can be presented as follows:

1. In general, the community understands the benefit of PV mini-grid, but they are not quite enthusiastic in contributing time for the construction process. There are some issues related to such incident: (1) the mobilization time of facilitators in several islands does not fit with the commencement of PV mini-grid construction; (2) socialization was insufficient; the programme needs to design a more comprehensive socialization activity in order to have active participation from the community; and (3) personal interest within the village which might reduce the community involvement to some extent.
2. Prolonged hand-over process creates a delay in fund allocation at district and village level. Such postponement would be more significant for village fund allocation since the long-term village plan (RPJMDes) requires a lengthy process before it could be implemented. The fund is essential to ensure sustainable operation of the PV mini-grid.
3. Legality of VMT is very crucial, especially for the VMT to access external funds in order to increase the service quality or to develop a small business to increase the saving.
4. Facilitators play a significant role in assisting small business development in small islands. The knowledge and skill they gained from the training a sufficient, but they need more time, sources and market information to be able help the local community.

5. Besides the series of training for operators, local PV services provider and spare parts retailer located nearby the islands are important for maintaining the PV mini-grid operation.

In conclusion, capacity development measures provided to the field facilitators were adequate to help them carry out their tasks, however, there are many additional factors influenced the results as described above. The facilitators and the targeted community would require more comprehensive and extensive assistance before they could self-sufficiently perform their works. Sustainability of mini-grid systems is a result of effective collaboration among relevant stakeholders which could be activated facilitation measures.

Figure 27 The journey to Kep. Sangihe to capture the lessons learned of facilitation programme

KM-4 | Study on Bioenergy Power Plant Management

Feedstock management and institutional scheme are key issues in developing a bioenergy power plant. Good feedstock management underlines raw materials supply scheme to the plant, while the institutional scheme emphasises on the hand-over process from DJ EBTKE to the provincial government and the management team to operate the power plant.

In this regard, EnDev Indonesia is supporting LCORE-INDO in a study on bioenergy power plant management of sites built by DJ EBTKE. The study, which was started in October 2016 and will be completed in March 2017, aims at providing a reference for DJ EBTKE in formulating the management concept for biomass and biogas power plants, especially for the DJ EBTKE biogas-based POME[9] power plants on Sumatra and Kalimantan as well as biomass power plant on Nusa Tenggara Timur.

The study applies SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis method on three aspects namely: feedstock availability (on-site and off-site supply), grid availability (on-grid and off-grid), and existing management set-up. The analysis is divided into four scenarios as described in the following diagram:

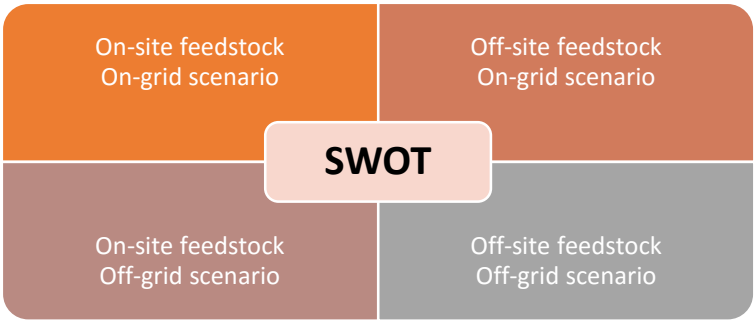

Figure 28 SWOT analysis and the feedstock versus grid availability scenarios

Four existing projects (in Sumatra Utara, Riau, and Sumba) and four upcoming projects (in Jambi, Kalimantan Tengah, and Kalimantan Timur) were selected for the study, as shown in the table below:

Table 5 SWOT analysis and the feedstock versus grid availability scenarios

No	Location of bioenergy power plant	Type of feedstock	Capacity
	Existing projects		
1.	PTPN II, Pagar Merbau, Sumatra Utara	POME	1 MW
2.	Bondohula Village, Lamboya, Sumba Barat, Nusa Tenggara Timur	Wood	1 MW
3.	Rantau Sakti Village, Rokan Hulu, Riau	POME	1 MW
4.	Lewa District, Sumba Timur, Nusa Tenggara Timur	Rice husk	50 kW
	Upcoming projects		
5.	Karang Anyar Village, Pemenang, Merangin, Jambi	POME	1 MW
6.	Nanga Mentajai Village, Nanga Bulik, Lamandau, Kalimantan Tengah	POME	1 MW
7.	Teberu Village, Batu Engau, Paser, Kalimantan Timur	POME	1 MW
8.	Jorong Village, Tanah Laut, Kalimantan Selatan	POME	1 MW

[9] Palm Oil Mill Effluent

PM | Rural Mini-grid Management Model (RUMI-Model)

Sustainable operation is a fundamental goal of a renewable-energy-based rural electrification programme. Based on experiences from the GIZ's support to MHP and PV mini-grids, there are several factors which lead to sustainable operation i.e. good installation, legality and high capacity of VMT, good and working tariff scheme, availability and accessibility of spare parts and service provider, as well as strong policy support from the government. While in MHP sector such management system is quite advance already, PV mini-grid sector is still struggling with its operation management issues. Therefore, in 2016 EnDev Indonesia initiated an effort to find or create a management model that could support the sustainable operation of PV mini-grids. The initiative is called Rural Mini-grid Management (RUMI) Model.

RUMI-Model has two-fold goal; (1) to ensure that PV mini-grid can operate for long-term and (2) to strengthen provincial government capacity to be able to manage its rural mini-grid portfolio in the region. The project was planned to be implemented for eight (8) months, starting from October 2016. Two approaches are applied in executing RUMI-Model: the bottom-up and top-down approach. These two approaches would be done in parallel in order to expedite the project.

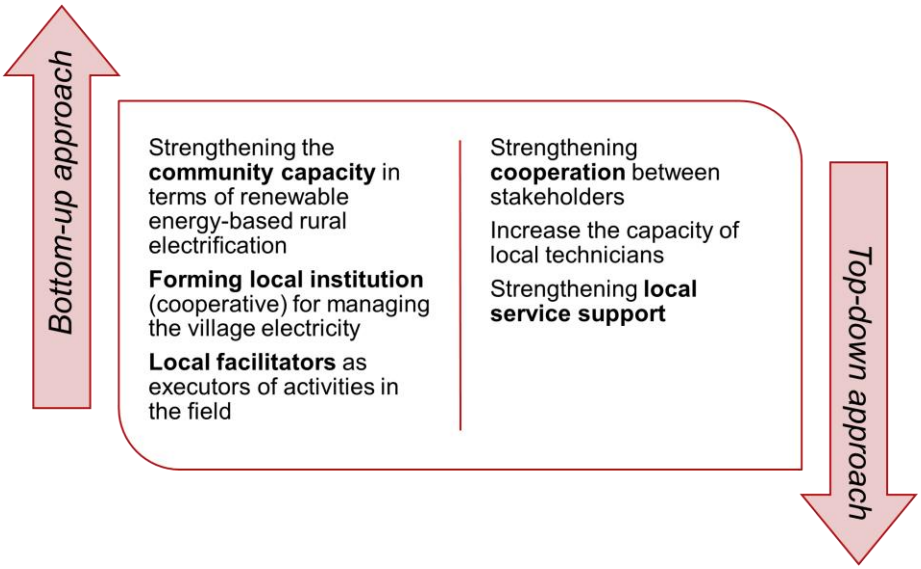

Figure 29 Approaches in executing RUMI-Model

RUMI-Model consists of three main activities:

- **Coordination**: in the form of workshop to kick-off the project and to share the lessons learned;
- **Facilitation**: which covers activities related to cooperative establishment, development of small business, and development of local technical/service support;
- Series of **training**: which includes 1) introduction to PV mini-grid for local agencies and other relevant local stakeholders; 2) PV mini-grid technology for the service provider (e.g. local technicians/electrician); 3) on-site management team training, business development and management of local commodity. A team of local consultant will be recruited to facilitate the cooperative establishment and small business development of the targeted community.

Nusa Tenggara Barat (NTB) province is selected as pilot site based on criteria, among others: the number of PV mini-grids have been and will be built (preferably above 10 systems), the interest of local government to participate in this initiative, the number of PV mini-grids with capacity above 30 kWp, the current PV mini-grid management is relatively good, and vocational school(s) or university with technical personnel associated with solar technology are available.

Based on consultation with the local government and field survey conducted in October and November 2016, three sites in two districts were selected as pilot sites.

Figure 30 Site survey for RUMI Model pilot project in Pulau Moyo, Sumbawa

Table 6 Pilot sites for RUMI-Model

Site code	Fund	District	Sub-district	Village	Capacity (kWp)	HH & SI
NTBS13	APBN[10]	Sumbawa	Labuan Badas	Labuhan Aji, Dsn. Arung Santek	15	109
-NA-	APBD[11]	Sumbawa	Labuan Badas	Labuhan Aji, Dsn. Brangkuang	30	115
-NA-	APBD	Lombok Utara	Bayan	Dusun Pegadungan	30	80

The expected outputs of RUMI-Model are:

- At least two (2) cooperatives established and/or in the process of formally established,
- At least one (1) business group on local commodity processing established,
- At least five (5) trained RE technicians available in NTB.

By the end of December 2016, GIZ has carried out series of meetings with BAPPEDA[12], Dinas ESDM, and Dinas KUKM at both provincial and district level. As from non-government institutions, GIZ pursued the NTB Development Bank (BPD[13] NTB), provincial office of AKLI[14], PEKA Sinergi (a training and certification development project for renewable energy sectors funded by MCAI[15]) and Mataram University. All stakeholders showed positive feedback and enthusiasm to cooperate.

[10] *Anggaran Pendapatan Belanja Negara* (State Budget)
[11] *Anggaran Pendapatan Belanja Daerah* (Regional Budget)
[12] *Badan Perencanaan Pembangunan Daerah* (Regional Planning Agency)
[13] *Bank Pembangunan Daerah*
[14] *Asosiasi Kontraktor Listrik dan Mekanikal Indonesia*/Electrical and Mechanical Contractor Association of Indonesia
[15] Millennium Challenge Account - Indonesia (MCA-Indonesia)

Zainal Abidin, a local craftsman,

is finishing a cupboard ordered by his neighbour. The entire equipment used by Zainal is powered by electricity from a micro hydro power.

4. External Events

a. Joint Sector Network Conference TUEWAS and SNRD, Bangkok, 31 May - 2 June 2016

GIZ held a joint conference of two Sector Networks: TUEWAS (Transport, Environment, Energy and Water in Asia) and SNRD Asia (Natural Resources and Rural Development in Asia) on 30 May until 2 June 2016 in Bangkok, Thailand. This GIZ annual meeting aims to share and build a network across projects in the region.

Figure 31 Thematic workshop on "Regional and Bilateral Cooperation on RE and EE in ASEAN"

The conference comprised general assembly, thematic workshops, and open space sessions. EnDev Indonesia contributed in the open space session by bringing out two topics, namely:

- A quest to survive: Understanding changes of rural mini-grid in Indonesia (the presented material is available in energypedia[16]);
- Productive use of energy: EnDev Indonesia shared a session with EnDev Nepal to share experiences in promoting PUE.

The conference also discussed how to make practical progress in conjunction to the Sustainable Development Goals (SDGs). SDGs will play a crucial role in development cooperation over the coming years and the key to its success is better joint implementation and linkages between local, regional, and national levels.

b. Talk show as part of the World Renewable Energy Congress (WREC) event, Jakarta, 22 September 2016

EnDev Indonesia together with LCORE-INDO organised a talk show with the theme, "Advancing the Economy of Indonesia's Small and Outermost Islands through Renewable Energy Solutions and Development". The talk show was arranged as a side event of the 15th World Renewable Energy Congress (WREC) on 22 September 2016, in Jakarta. It aimed at exploring, assessing and bridging a wide range of the current challenges and opportunities in developing the economy of small and outermost islands.

The talk show was opened by Arifin Rudiyanto, Deputy Minister of Regional Development of BAPPENAS, who affirmed that the outermost islands acquire a sovereignty function to claim for the Exclusive Economic Zone, where the core of development planning is the government's ability to fulfil the basic needs and to promote economic growth in these small outer islands. To achieve those goals, a sufficient energy supply is certainly necessary.

[16] https://energypedia.info/wiki/File:TUEWAS_Indonesian_Rural_Electrification_update_2016.pptx

Figure 32 First session of the talk show with resource persons from government

The event was divided into two sessions. The first session discussed the policy topic of which the keynote speakers coming from government institutions i.e. Ida Nuryatin Finahari (DJ EBTKE), Rido Miduk Sugandi Batubara (KKP), Victoria br. Simanungkalit (KUKM), Josaphat Rizal Primana (BAPPENAS), and Rohmad Supriyadi (BAPPENAS) as the moderator.

The second session discussed the practical implementation where the keynote speakers coming from non-governmental and local institutions i.e. Ramsyah Hamsar (BUMDes Desaku Bersinar, Kutai Kartanegara), Aditya Utama Surono (Indonesian Communities and Fisheries/MDPI[17]), Ahdar (Cooperative Puncak Ngengas, Sumbawa), Boy Nunuhitu (Regional Development Bank of Nusa Tenggara Timur), Rudolf Rauch (GIZ), and Untung Widyanto (Tempo Magazine) as moderator.

As many as 156 participants from various background attended the talk show and shared their experiences regarding the challenges on economic development and infrastructure management, including RE development in small outer islands. Breakthrough ideas and support from national and local governments for business development through RE intervention were also discussed in the event.

As a conclusion, to construct an RE power plant, a standard operating procedure (SOP) is vital. Starting from identification of RE potential, planning, construction, up to the operation phase, the SOP will guide any interested parties to follow the implementation procedures. Another critical point addressed was reference data of islands and RE facilities built around the small outer islands. Such data should be shared with all relevant institutions and stakeholders, including PLN[18] as a reference for the network development.

Furthermore, the community should be involved in the development process. The operators, who mostly are the villagers, need to be trained so they are able to carry out their duties properly. There are many success stories from the field, which show that by utilising the local wisdom the community is able to manage the RE power plants as well as able to develop productive activities for the system's sustainability. However, the community still needs assistance to improve their management quality.

Figure 33 Second session discussing utilisation of RE technologies in the field

[17] *(Yayasan) Masyarakat dan Perikanan Indonesia*
[18] *Perusahaan Listrik Negara* (State-owned utility)

c. 3rd HPNET Annual Gathering, November 2016

The Hydro Empowerment Network (HPNET) held its 3rd Annual Gathering on 22-25 November 2016 in Kathmandu, Nepal, participated by at least 40 practitioners from 14 countries. The event was hosted by the Nepal Micro Hydropower Development Association (NMHDA) and supported by WISIONS Germany, the Nepalese Alternative Energy Promotion Centre (AEPC), and the Skat Foundation Switzerland.

Figure 34 MHP practitioners in South and South East Asia get together in Kathmandu

HPNET is in its 3rd year of operation and currently has 70 members with expertise in policy, financing, technology development, watershed strengthening, and community organising processes. The network serves as a knowledge and advocacy platform for micro and mini hydropower (MHP) practitioners across South and Southeast Asia. This year, Amalia Suryani represented EnDev Indonesia in participating in the annual gathering.

The members discussed issues in five thematic panels on the following topics: MHP Research and Advocacy, Integrating MHP into National Electrification Planning, Financing Mechanism, Socio-Environment Sustainability, and Technical Capacity Development. The gathering also attempted to link HPNET members to mainstream international development agencies, among others IRENA[19], World Bank, and Winrock International, who were invited as guest speakers in the panel discussion. The presence of these mainstream actors would be an invaluable opportunity for HPNET members to directly showcase their work to powerful development agencies in the region.

Figure 35 MHP practitioners discussing the challenges in MHP development

The overall purpose of the event was to synergise the growing membership of HPNET towards finding effective ways to develop and use the HPNET platform, in order to meet shared aims of advancing the sector as a whole. Building up from the reflection of the earlier events, the gathering highlighted a more inclusive, milestone-based approach, where the Working Groups become the core players within the network. This year the gathering has successfully formed nine Working Groups.

Further information about the event: http://www.hpnet.org/2016-nepal-annual-mtg.html

[19] The International Renewable Energy Agency

Lastri, 16, wants to train to be a police officer.

In the evenings, when she has finished her school work, she enjoys watching television. Her favourite programmes are football matches and cop shows.

5. Outlook 2017

To continue addressing sustainability issues in rural electrification, EnDev Indonesia project will highlight its activities in the area of capacity development for relevant stakeholders both in central government as well as in regional level, specifically at the pilot regions selected for RUMI Model initiative. The pilot project will take off in Lombok Utara and Sumbawa districts, Nusa Tenggara Barat province, focusing on facilitation process to establish a legal organisation to manage the PV mini-grids. Additionally, RUMI-Model will also emphasize on the initiation of local service support model, most likely through a renewable energy service company (RESCO) form. Through RUMI-Model, the project will also implement capacity development activities specifically for local governments both on technical and managerial aspects.

Having analysed the performance of two PV mini-grid systems, EnDev Indonesia seeks to transfer the methodology to the government personnel so that such performance monitoring and analysis can be replicated for more PV mini-grids. This is crucial to ensure that the systems fulfil their purpose in providing reliable electricity.

From the learnings during technical inspection since 2013 to 2015 of which a wealth of photographs had been collected, the project has initiated the compilation of Good and Bad Book on PV Mini-grid since the fourth quarter of 2016. The book is foreseen to be published in 2017.

The project will also devise an activity in bioenergy sector on how to support DJ EBTKE in developing and/or improving its rural electrification programme. The internship programme of 2017 will be hosting three students who will work on three topics namely: data management of PV mini-grids inspection results of MSP 2013-2015, content management for Energi Desa and developing strategy to expand the use of the platform, and an impact study of rural electrification efforts in Indonesia.

Figure 36 More light in houses and street have made the night in the villages more lively

EnDev Indonesia has supported over 189,000 people to get access to electricity, as well as over 1,500 social institutions and 2,700 rural businesses. The electricity is provided by 614 mini-grids, amounts to approximately 12 MW, installed throughout the archipelago by various government and non-government initiatives.

Annex A: List of Training

EnDev Indonesia implemented a wide range of capacity development activities through training. The training materials formulated for these activities are available for further use. The training conducted till end of 2016 are listed in this annex.

No	TIME	#	PARTICIPANTS	TRAINING LOCATION	TECHNOLOGY
TRAINING ON WORKING MECHANISM OF VILLAGE MANAGEMENT TEAM (VMT)					
1	28 Mar-2 Apr 2016	18	KKP facilitators	Jakarta	PV
2	19-25 April 2015	35	KKP facilitators, staffs of DJ EBTKE and KKP	Jakarta	PV
3	2-6 June 2013	36	VMT members of Luwu Utara	Luwu Utara	MHP
4	13-16 May 2013	40	VMT members of Luwu Utara	Luwu Utara	MHP
5	14-18 April 2013	40	VMT members of Tana Toraja and Minahasa	Tana Toraja	MHP
6	13-17 March 2013	36	VMT members and Dinas ESDM of Luwu Utara	Luwu Utara	MHP
7	17-21 Feb 2013	28	VMT members of Majene	Mamuju	MHP
8	11-14 Feb 2013	40	VMT members and Dinas ESDM of Enrekang	Enrekang	MHP
9	10-13 January 2013	15	VMT members of Sangihe Utara and Buton	Makassar	MHP
10	17-20 Dec 2012	24	VMT members of Toraja Utara	Rantepao, Toraja Utara	MHP
11	11-15 Dec 2012	40	VMT members of Phakphak Barat, Tapanuli Selatan, and Madina	Bukittinggi	MHP
12	10-13 Dec 2012	28	VMT members of Luwu Utara	Masamba, Luwu Utara	MHP
13	4-8 December 2012	32	VMT members of Lebong, Bengkulu Utara, Bengkulu Selatan and Kaur	Bengkulu	MHP
14	8-10 October 2012	20	VMT members of Mamasa	Mamasa	MHP
		432	**People**		
TRAINING OF TRAINERS (TOT) ON VMT CONCEPT AND WORKING PROCEDURE					
1	1-4 October 2012	15	NGOs personnel from Sulawesi dan Sumatra	Makassar	MHP
		15	**People**		
ON-SITE VMT AND OPERATOR TRAINING DURING TECHNICAL INSPECTION FOR MHP AND PVVP					
1	Within four months in 2015	83	Villages inspected on MSP PVVP 2015	In 83 villages	PV
2	Within four months in 2015	23	Villages inspected on MSP MHP 2015	In 23 villages	MHP
3	Within four months in 2014	110	Villages inspected on MSP PVVP 2014	In 110 villages	PV
4	Within four months in 2014	19	Villages inspected under MSP SAM 2014	In 19 villages	MHP

5	Within four months in 2013	112	Villages inspected on MSP PVVP 2013	In 112 villages	PV
		347	**villages**		
TRAINING ON COMMISSIONING AND TECHNICAL INSPECTION					
1	18-19 August 2016	23	PPHP of DJ EBTKE	Bogor	PV
2	4-5 August 2016	22	PPHP of DJ EBTKE	Bekasi	PV
3	28-29 July 2016	27	PPHP of DJ EBTKE	Bandung	MHP
4	15 May 2013	18	PV mini-grid reviewers	Jakarta	PV
5	12-14 Dec 2013	11	Staff of Dinas ESDM from Blora, Jombang, Gunung Kidul, Banyumas, Sumenep, Banjarnegara, and PV contractors	Jakarta	PV
6	1-2 May 2012	18	Local manufacturers, university, vocational school, NGO, and PNPM-LMP facilitators	Bandung	MHP
		119	**people**		
TRAINING ON SMALL BUSINESS DEVELOPMENT					
1	27-29 May 2016	16	Cooperative members	Komba, Manggarai Timur	MHP
2	27-29 May 2016	19	Cooperative members	Batulanteh, Sumbawa	MHP
3	27-29 May 2016	14	Cooperative members	Kolaka Timur	MHP
4	27-29 May 2016	13	Cooperative members	Uesi, Kolaka Timur	MHP
5	18-20 May 2016	12	Cooperative members	Kamosope, Pasir Puti	MHP
6	18-20 May 2016	19	Cooperative members	Cantung Kanan	MHP
7	15-17 Dec 2015	22	Cooperative members	Sekadau Hulu, Sekadau	MHP
8	10-12 Nov 2015	18	Cooperative members	Gn. Komba, Manggarai Timur	MHP
9	10-12 Nov 2015	14	Cooperative members	Borong, Manggarai Timur	MHP
10	1-5 October 2015	15	KKP facilitators	Denpasar	PV
11	19-21 August 2014	11	Cooperative members	Tepal, Sumbawa	MHP
12	12-14 August 2014	15	Cooperative members	Sintang	MHP
13	29 July-4 Aug 2015	13	KKP facilitators	Makassar	PV
14	16-18 June 2014	11	Cooperative members	Parsoburan, Toba Samosir	MHP
15	16-18 June 2014	15	Cooperative members	Humbang Hasundutan	MHP
16	10-12 June 2014	13	Cooperative members	Solok Selatan	MHP
17	21-23 May 2014	24	Cooperative members	Mambi	MHP
18	21-23 May 2016	11	Cooperative members	Enrekang	MHP
19	14-16 May 2014	11	Cooperative members	Pidie	MHP
20	7-9 May 2014	8	Cooperative members	Alor	MHP
21	7-9 May 2014	27	Cooperative members	Manggarai Timur	MHP
		321	**people**		

Annex B: List of Knowledge Materials

EnDev Indonesia produced a number of knowledge materials which are intended for internal use as well as publicly distributed to various stakeholders. The knowledge materials produced till 2016 are listed in this annex.

Guidelines

Panduan Pelatihan Tim Pengelola Listrik Desa (GIZ, 2015)
Inspection Guide for Photovoltaic Micro-grids (revised) (GIZ, 2015)
VMT Training Manual - A Guide to Rural Electrification Trainers and Facilitators (GIZ, 2014)
Multimedia DVD Version 3: All About MHP (GIZ, 2013)
KPI User Manual for PVVP (GIZ, 2013)
KPI User Manual for MHP (GIZ, 2012)
Best Practice Guideline for Rural Electrification_en (GIZ, 2011)
Manual on Productive Use of Energy_en (GIZ, 2011)
Pedoman Praktik Terbaik untuk Listrik Perdesaan (GIZ, 2011)
Panduan Singkat PLTMH (GIZ, 2011)
Panduan Singkat - Mengenal Lingkungan PLTMH (Entec, 2010)
Panduan Spesifikasi Teknis (TSU, PNPM, 2010)
Panduan Teknis Konstruksi PLTMH (TSU, PNPM, 2010)
Baik & Buruk dari Mini Hidro Vol 1 (ACE, 2009)
Baik & Buruk dari Mini Hidro Vol 2 (ACE, 2009)
Good & Bad of Mini Hydro Power Vol 1 (ACE, 2009)
Good & Bad of Mini Hydro Power Vol 2 (ACE, 2009)
Hydro Scout Guide (GTZ, 2009)

Posters

Energi Desa Poster (Indonesian) (GIZ, 2015)
Troubleshooting Guide for MHP Problems Poster (Indonesian and English) (GIZ, 2013)
Troubleshooting Guide for PV-VP Problems Poster (Indonesian and English) (GIZ, 2013)
Catchment Area Management for MHPs Poster (Indonesian and English) (GIZ, 2013)
Guidelines for Village Management Teams Poster (Indonesian and English) (GIZ, 2013)

Reports

Review on Design and Specification of PV Micro-Grid System (GIZ/Fraunhofer ISE, 2016)
Report on Technical Performance Analysis of two PV Mini-grids (GIZ, 2016)
Concept Notes of Pilot Project: RUMI Model (GIZ, 2016)
Potret Kegiatan dan Pembelajaran Program Pendampingan Pengelolaan PLTS di Pulau-Pulau Kecil Terluar dan Berpenduduk (GIZ, 2016)
Skripsi: Analisis Kinerja Sistem PLTS pada Lima Desa yang Tersebar di Kalimantan Selatan, Kalimantan Timur dan Sulawesi Tengah terhadap Pemenuhan Kebutuhan Listrik Pedesaan pada Tahun 2015 (UGM, 2016)
Skripsi: Analisis Kinerja Sistem PLTS terhadap Pemenuhan Kebutuhan Listrik 5 Lokasi Desa Provinsi Papua Barat, Papua dan Maluku Utara Tahun 2015 (UGM, 2016)
Laporan Pelaksanaan Pelatihan PPHP Mengenai Inspeksi Teknis PLTMH dan PLTS (GIZ, 2016)
Laporan Pelatihan Peningkatan Kapasitas Pelaku Usaha Koperasi Pengelola PLTMH (GIZ, 2016)

Laporan Kerja Sama GIZ, KKP, dan DFW untuk Program di Pulau-Pulau Kecil Terluar (GIZ, 2016)
Report on Operational Status of Micro-grid 2015 (GIZ, 2016)
Final Executive Report on Technical Review of PV-VP 2015 (GIZ, 2016) (confidential)
Final Report MHP Technical Review for KUKM 2014 (GIZ, 2015) (confidential)
Final Report MHP Technical Review for DJ EBTKE 2014 (GIZ, 2015) (confidential)
Report Rural PNPM Institutional Strengthening for Renewable Energy (GIZ, 2015) (confidential)
Dokumentasi Pengembangan Ekonomi Produktif Berbasis PLTMH (GIZ, 2015)
Laporan Pelatihan Peningkatan Kapasitas Pelaku Usaha Koperasi Pengelola PLTMH (GIZ, 2014)
Report Business Capacity Development Training for Cooperatives in MHP Community (GIZ, 2014)
Final Executive Report on Technical Review of PV-VP 2014 (GIZ, 2014) (confidential)
Final Executive Report on Technical Review of PV-VP 2013 (GIZ, 2013) (confidential)
EnDev2 Impact on Sustainability - A Comparative Study (GIZ, 2013)
Productive Use of Energy - Findings of Pilot Project (GIZ, 2013)
Survey on Key Performance Indicators for Indonesian Micro-hydro Power Sites (GIZ, 2012)
Benefit & Cost Study: Retrofitting the Standalone MHP into Grid-connected System (GIZ, 2012)
Grid in-feeding screening tool user manual (GIZ, 2012)
Indonesia PUE database introductory manual (GIZ, 2012)
Report: Indonesia - Sustainable PV Diffusion Alternatives (GIZ, 2012)
Survey Productive Use Potential (GIZ, 2011)

Templates and Tools

PV-VP Technical Checklist templates (revised) (Indonesian and English) (GIZ, 2015)
PV-VP Technical Survey Summary template (revised) (Indonesian and English) (GIZ, 2015)
PV-VP KPI questionnaire (revised) (GIZ, 2013)
MHP KPI questionnaire (revised) (GIZ, 2013)
Spread sheet: Grid in-feeding screening tool (version 2) (GIZ, 2012)
Template: MHP Commissioning checklist and manual (GIZ, 2012)
Template: MHP Commissioning report (GIZ, 2012)
Template: MHP Pre-commissioning checklist and manual (GIZ, 2012)
Template: PUE Screening form (GIZ, 2012)
Tool: Treasurer Cash Book for MHP and PV-VP (GIZ, 2012)
Tool: Operator Log Book for MHP and PV-VP (GIZ, 2012)
Tool: Customer Book for MHP and PV-VP (GIZ, 2012)
Tool: Activity Book for MHP and PV-VP (GIZ, 2012)
Tool: Tariff Card for MHP and PV-VP (GIZ, 2012)

Training Modules

Training Module: Technical Inspection of MHP (GIZ, 2016)
Training Module: Technical Inspection of PV Mini-grids (GIZ, 2016)
Training Module: Micro-grid Service Package for PV-VP and MHP (GIZ, 2015)
Training Module: TOT on Facilitation and Village Management Team (GIZ, 2015)
Training Module: TOT on Business Capacity Development (GIZ, 2015)
Training Module: Rural Business Capacity Development (GIZ, 2014)
Training Module: Institutional Setup of Village Management Team for PV-VP (GIZ, 2013)
Training Module: Institutional Setup of Village Management Team for MHP (GIZ, 2012)

Videos

No	Full Name	Content	Year	Languages
01.	**Product Launch Indonesia-German Energy Cooperation**	On the gala dinner of Indonesia EBTKE Conference and Exhibition 2015 held on 19 August 2015, the Director General of EBTKE launched two guidelines on renewable energy and rural electrification management, with the titled: Renewable Energy Guidelines on Biomass/Biogas Power Project in Indonesia and Village Management Team Training Manual: a practical guide for rural electrification trainers and facilitators.	Dec 2015	Indonesian + English
02.	**Training: Capacity Development of Entrepreneurs and Cooperatives Managing MHP System in Sintang, Kalimantan Barat**	Capacity Development of Entrepreneurs and Cooperatives Managing MHP System is held under the cooperation between GIZ and KUKM in 9 location, one of them is in Sintang, Kalimantan Barat. Topic comprises four business management aspects namely marketing, production, human resources and organisation, and financial) using CEFE method. The output of the training is that the participants comprehend and able to create a measurable business plan. After training, it is expected that the productive activities run sustainably by utikising electricity generated from the MHP.	August 2015	Indonesian
03.	**Villagers of Napajoring Have Access to Electricity Now**	MHP Napajoring is part of power plant development for productive economy escalation programme that was built through the funding from the Indonesian Ministry of Cooperative and Small and Medium Enterprises and supported by the District Government of Tobasa.	Dec 2014	Indonesian + English
04.	**Capacity Building for Entrepreneurs of MHP Management**	The training purpose is to increase the competencies of rural entrepreneurs in relation to micro hydro power plant programme, and it is expected that there will be sustainability development in the productive use of energy through the utilization of electricity from the MHP.	Dec 2014	Indonesian + English
05.	**Technical Aspect of SMG**	SMG maintenance is important to ensure all components function well. Regular maintenance is the key factor towards sustainability.	Sep 2014	Indonesian + English subtitles
06.	**Catchment Area Management**	A natural forest provides many important services to its people. A stable and reliable water flow in rivers is ideal for micro-hydro power generation and it is directly related to the health of the forest.	Jun 2013	Indonesian + English
07.	**Global Hydro Workshop 2013**	The 5th GIZ Micro Hydro Power Workshop was held in Indonesia from April 15 -22, with the support of the GIZ Sub-Sahara Sector Network and Energising Development.	Apr 2013	Indonesian + English

08.	**Productive Use of Energy**	Rural electrification has a purpose. That purpose is the improvement of livelihoods for rural communities on a sustainable basis with maximum positive social, economic and environmental impacts.	Nov 2012	Indonesian + English
09.	**Sustainability of Centralized Photovoltaic**	Centralised solar powered micro-grids are a viable alternative for many rural villages. Unlike small solar home systems, solar micro-grids can cater for many more appliances and encourage productive use of energy.	Jun 2013	Indonesian + English
10.	**Solar Energy to provide electricity to the community**	Solar energy maintenance and sustainable operation.	Jun 2013	Indonesian
11.	**Solar Energy in Solok**	Solar energy and the application of the monthly tariff system for sustainability.	Apr 2013	Indonesian
12.	**Micro Hydro Power Plant**	Electricity is a very efficient energy form for reducing work load, making tasks easier and providing access to education and entertainment.	Jan 2013	English
13.	**Administration**	Administration is activities related to record-keeping or book-keeping which are an essential part of the MHP management.	Jan 2013	English
14.	**Financial Management**	Financial management, done by the “accountant” who regulates and controls all MHP financial aspects, including book-keeping and reporting cash flow.	Jan 2013	English
15.	**Maintenance**	MHP maintenance is important to ensure all components function well, unanticipated breakages are avoided and electricity supply remains stable. Regular maintenance is the key factor towards sustainability.	Jan 2013	English
16.	**Electricity Utilisation**	Appropriate electricity usage can improve the quality of live in rural communities. They can extend their productive or entertaining activities by using electricity.	Jan 2013	English
17.	**Commissioning**	Commissioning is the process of thoroughly testing the MHPs functioning. This consists of verifying construction is in line with the design and on the site testing of the equipment.	Jun 2012	Indonesian + English subtitles
18.	**Case-MHP Construction in Mesakada**	Progress report on construction MHP in Mesakada, April 2010. Construction work of the weir, penstock and powerhouse also planting pine trees work.	Jun 2013	Indonesian + English subtitles
19.	**Case-MHP Utilisation in Lisuan Ada**	With the right facilities and technology applied for utilization of rural energy sources, it can be expected that small scale industrial and productive activities will emerge providing a stimulus to the local economy.	Jun 2013	Indonesian + English subtitles
20.	**Current Meter**	Instructions on flow Measurement using current meter method. Current meter is a measuring instrument used to measure water flow in the river.	Feb 2013	Indonesian + English subtitles

21.	**Easy-flow**	Instruction to flow measurement using conductivity meter easy-flow. Easy-flow is measuring equipment to measure flow river.	Feb 2013	Indonesian + English subtitles
22.	**Flow Measurement by Float Method**	Flow measurement by float method. This is an indirect method to measure the flow, because it only measures the stream velocity by measuring the time needed for the floater to pass a distance that is set on a river.	Feb 2013	Indonesian + English subtitles
23.	**Head Measurement by Plastic Tube**	Head measurement by tube filled with water method. This method is better used if the other levelling tools are unavailable. Although accurate enough, this method needs more time to study and to design the MHP.	Feb 2013	Indonesian + English subtitles
24.	**Method of MHP Construction Implementation**	Construction method is one stage of work implementation in and MHP construction process. MHP implementation or construction work begins with the preparation of materials, setting the work quality standards, and method of work implementation.	Jan 2013	Indonesian + English subtitles
25	**Productive Use of Energy**	Other than being used for household purposes; lighting, TV, radio, etc., electricity can also be used for productive business such as welding machine, milling and others.	Feb 2013	Indonesian + English subtitles
26.	**MHP Operational**	Before performing the operation, check first the intake, channel, forebay, penstock, and turbine components, so that the operation can run properly.	Feb 2013	Indonesian + English subtitles
27.	**MHP Institutional Setup**	Energy supply from Micro Hydro Power or MHP may provide a lot of benefits. The community can enjoy better lighting in the evening, get information from television or utilise the energy from MHP for business.	Feb 2013	Indonesian + English subtitles
28.	**Formulation of Village Regulation and Monitoring System**	The community must establish a clear and transparent tariff system, and requires the beneficiaries to follow the system. Sanctions should also be introduced for those who violate it.	Feb 2013	Indonesian + English subtitles
29.	**MHP Financial Management**	Management organisation is formed to ensure that the MHP will work well and also based on a good financial management.	Feb 2013	Indonesian + English subtitles
30.	**Head Measurement by Pressure Gauge Method**	Head measurement by gauge pressure method. Pressure gauge or manometer is a method to measure head or height difference using a water hose mounted in a water pressure gauge.	Feb 2013	Indonesian + English subtitles
31.	**Socialisation of Institutional Setup**	Institutional socialization MHP is one of the activities in the establishment and strengthening of village-level MHP. In the PNPM-LMP, socialization activities carried out during the construction still going on.	Jan 2013	Indonesian + English subtitles
32.	**Stake Out to Determine Water Surface Elevation**	Stakeout is the detailed measurement and placing of markers to be used as a reference during construction. This activity is very important	Jun 2012	Indonesian + English subtitles

		because it determines the elevation of the water level, as a primary reference for civil structures of the MHP plant.		
33.	**Supervision and Monitoring of MHP Construction**	Technical Support Unit (TSU) as a technical team in PNPM-LMP (MHP), conducting supervision and monitoring on the MHP construction process periodically to direct or mentor the community in construction works.	Jan 2013	Indonesian + English subtitles
34.	**Tendering Process**	Tendering is one element of the Green PNPM project implementation procedure. The tender procedure adopts the same mechanism developed and applied under Rural PNPM.	Jan 2013	Indonesian + English subtitles
35.	**The Role of TSU within Green PNPM**	As an integral component of Green PNPM TSU works together with the Directorate General of Rural Community Empowerment, Dept. of Home Affairs as the project executing agency.	Jan 2013	Indonesian + English subtitles
36.	**Verification and MHP Potential Survey**	Verification of a proposal aims to examine and assess the feasibility of an activity proposed by a village to be funded under Green PNPM.	Jan 2013	Indonesian + English subtitles

Energising Development

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