SOCIAL IMPACT

ADVANCING DEVELOPMENT EFFECTIVENESS

Evaluation Design Report

MCC Indonesia Green Prosperity Project

Grant Facility Community-Based Off Grid Renewable Energy Grant Portfolio

January 2019

This report was prepared independently by Social Impact, Inc. at the request of MCC.

EVALUATION DESIGN REPORT

MCC Indonesia Green Prosperity Project

Grant Facility Community-Based Off Grid Renewable Energy Grant Portfolio

v.2

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ACRONYMS

ADB	Asian Development Bank
AEI	Akuo Energy Indonesia
APDS	Asosiasi Periau Danau Sentarum
ARI	Acute respiratory infection
BA-SBT	Bentang Alam Sumba Bagian Tengah
BPS	Badan Pusat Statistik
BUMD	Badan Usaha Milik Daerah
BUMDes	Badan Usaha Milik Desa
BUMK	Kampung-owned enterprise
CBA	Cost benefit analysis
CBNRM	Community-Based Natural Resource Management
CBOG	Community-Based Off Grid
CEM	Coarsened exact matching
CEO	Chief Executive Officer
CIA	Conditional Independence Assumption
CoK	Center of Knowledge
CPI	Charta Putra Indonesia
CUKK	Koperasi Kredit Keling Kuman
DFS	Detailed Feasibility Study
DiD	Difference in differences
DRB	Disclosure Review Board
EDR	Evaluation Design Report
EPC	Engineering, Procurement and Construction
EQ	Evaluation Question
ERR	Economic Rate of Return
ESMP (1)	Environmental and Social Management Plan

ESMP (2)	Environmental and social performance
EVI	Electric Vine Industries
FEED	Front End Engineering Design
FGD	Focus Group Discussion
GEF	Global Environment Facility
GHG	Greenhouse gas
GIS	Geographic Information System
GPS	Geographic Positioning System
GOI	Government of Indonesia
GP	Green Prosperity
GSK	Green Sumba Consortium
GW	Gigawatt
Ha	Hectare
HH	Household
IBEKA	Inisiatif Bisnis dan Ekonomi Kerakyatan
ICC	Intra-Cluster Correlation
IDR	Indonesian Rupiah
IE	Impact Evaluation
IEA	International Energy Agency
IIEE	Indonesian Institute for Energy Economics
IRB	**I**nstitutional Review Board
ITT	Indicator Tracking Table
JRI	PT. Jasa Layanan Risetindo
KEN	Kebijakan Energi Nasional/ National Energy Policy
KII	Key Informant Interview
KKI Warsi	Komunitas Konservasi Indonesia WARSI
KSM	Kelompok Swakelola Masyarakat

KW	Kilowatt
kWp	Kilowatt peak value
LAKPESDAM-PBNU	Lembaga Kajian dan Pengembangan Sumber Daya Manusia – Pengurus Besar Nahdlatul Ulama
LATIN	Yayasan Lembaga Alam Tropika Indonesia
LED	Light Emitting Diode
M&E	Monitoring and Evaluation
MCC	Millennium Challenge Corporation
MCA-I	Millennium Challenge Account- Indonesia
MDES	Minimum detectable effect size
MHP	Micro Hydro Power
MKS	PT Mikro Kisi Sumba
MW	Megawatt
NRE	New and Renewable Energy
NRM	Natural Resource Management
O&M	Operations and Maintenance
PE	Performance Evaluation
PEKA	Yayasan Peduli Konservasi Alam
PLTMH	Micro Hydro Power Plants
PLN	Perusahaan Listrik Negara
PLTS	*penerangan lampu tenaga surya rumah tangga*
PLUP	Participatory Land Use Planning
PMAP 1	Participatory Mapping and Planning
PODES	Village Potential Statistics
PSGIP	Project Social and Gender Integration Plan
PSM	Propensity Score Matching
PV	Photovoltaic

RE	Renewable Energy
REDD	Reducing Emissions from Deforestation and Forest Degradation
RESCO	Renewable Energy Service Center
RT	Sub-village administrative unit, also known as kampungs
RUPTL	Rencana Usaha Penyediaan Tenaga Listrik
SI	Social Impact
SI-HQ	Social Impact Headquarters
SHS	Solar Home System
SPV	Special Purpose Vehicle
SWP	Solar Water Pump
TA	Technical Assistance
TAPP	Technical Assistance and Preparation Project
TV	Television
UN	United Nations
UNEP	United Nations Environment Program
VBS	Village Boundary Setting
WtP	Willingness to Pay
WWF	World Wildlife Fund
YLBHL	Yayasan Lembaga Bantuan Hukum Lingkungan Jambi

1 INTRODUCTION & BACKGROUND

1.1 Country context

Indonesia, which has the largest economy in Southeast Asia, has experienced steady growth averaging between 5-6 percent since the Asian financial crisis of 1997-1999.[1] Nonetheless, as an archipelago nation stretching over 5,000 kilometers across Oceania, Indonesia is vulnerable to the increased occurrence of extreme weather events, flooding due to sea-level rise, and water-borne illnesses that are likely to accompany the climate change that is already being observed across the country.[2] For this reason, it is a stated objective of the Government of Indonesia (GOI) to achieve a reduction of greenhouse gas (GHG) emissions "in a way that is consistent with pro-growth, pro-poor, and pro-job development objectives."[3] As one way of achieving these parallel objectives, Indonesia's National Energy Policy (Kebijakan Energi Nasional, or KEN) set a target of increasing the country's usage of new and renewable energy (NRE) from 4 percent of all energy usage in 2011 to 23 percent by 2025 and 31 percent by 2050.[4] Indeed, the Asian Development Bank (ADB) indicates that renewable sources of electricity offer many "positive cobenefits" in addition to reduced GHG emissions including rural revitalization, jobs and employment, economic development, and avoided environmental costs of fuel extraction and transport.[5]

Although Indonesia has rapidly electrified a large proportion of its population, 16 percent of households still lacked access to electricity as of 2014.[6] Compared to the 84 percent with access to electricity, these households are more frequently found in remote islands or rural villages where the feasibility and cost of electrification through traditional means is prohibitive. As a result, households in these villages typically resort to "costly and polluting"[7] diesel-fired power generation for intermittent electricity throughout the day.[8] For some of these communities, off-grid, renewable resources (such as solar, biomass, or micro-hydro systems) represent a more feasible path to electrification than traditional, fossil-fuel based power grids.

1.2 Objectives of this report

This report has four primary objectives. The first is to identify the two focal projects within the portfolio of community-based off grid (CBOG) renewable energy (RE) grants of the Millennium Challenge Account-Indonesia (MCA-I) Green Prosperity (GP) Project's Grant Facility for impact and pre/post performance evaluation, along with four additional projects selected for *ex post* case studies and provide background information on these grants. The second is to communicate the purpose and guiding research questions

[1] Tharakan, Pradeep. "Summary of Indonesia's Energy Sector Assessment." Www.adb.org, Asian Development Bank, 10 Nov. 2017, www.adb.org/publications/summary-indonesias-energy-sector-assessment. pg. 6.

[2] Fujii, Tomoki. "Climate Change and Vulnerability to Poverty: An Empirical Investigation in Rural Indonesia." Www.adb.org, Asian Development Bank, 17 Nov. 2017, www.adb.org/publications/climate-change-vulnerability-poverty-indonesia.pg. 2

[3] Ministry of Finance, Republic of Indonesia. "Economic and Fiscal Policy Strategies for Climate Change Mitigation in Indonesia ." *Https://Www.illegal-Logging.info/*, Ministry of Finance, Republic of Indonesia Australia Indonesia Partnership, 2009, www.illegal-logging.info/sites/files/chlogging/uploads/IndonesiasiaranpdfGreenPaperFinal.pdf. pg. 20

[4] ESDM. "ESDM - Kementerian Energi Dan Sumber Daya Mineral Republik Indonesia." *ESDM*, ESDM, www.esdm.go.id/.

[5] Sovacool, Benjamin K. "Cobenefits and Trade-Offs of Green and Clean Energy: Evidence from the Academic Literature and Asian Case Studies." Www.adb.org, Asian Development Bank, 29 Nov. 2017, www.adb.org/publications/cobenefits-and-trade-offs-green-and-clean-energy.. 7-8

[6] W3A Anekatek Solar, East Sumba DFS pg. 1-3.

[7] In addition to the increased household-level cost of this energy source relative to renewable sources, the Asian Development Bank estimates that about $0.50 of every $1.00 expended on conventional electricity leaves the local economy, whereas every dollar invested in renewable electricity can produce $1.40 in gross economic gain due to the local and labor-intensive nature of the capital required.

[8] W3A-80 DFS pg. 1-2.

behind the evaluation of those six projects. The third is to define the quantitative and qualitative methods Social Impact (SI) has chosen to respond to these evaluation questions, along with the limitations of these methods. The final objective is to outline SI's administrative approach to executing the evaluation, including the evaluation team structure and schedule.

The guiding research questions and methods for the four *ex post* case study grants will differ from those selected for the grants evaluated using an impact or pre/post performance evaluation methodology, although all of these will serve the larger purpose of characterizing the grant portfolio's approach to and achievement of increasing renewable energy capacity, use, and related outcomes in the regencies of Berau, East Kalimantan and East Sumba, East Nusa Tenggara.

2 OVERVIEW OF COMPACT & INTERVENTIONS

2.1 Overview of the Project and Implementation Plan

To combat environmental degradation and alleviate rural poverty, The Millennium Challenge Corporation (MCC) entered a five-year, $600 million Compact with the GOI in April 2013, establishing MCA-I, which aimed to reduce poverty through economic growth. The GP Project, the flagship project of the Indonesia MCC Compact with a budget of $332 million, was designed to support the GOI's commitment to a more sustainable, less carbon-intensive future by promoting environmentally sustainable, low carbon economic growth. The main objective of the project was to work with local communities to create economic opportunities that alleviate poverty and improve management of Indonesia's natural capital. The project provided a combination of technical assistance and grants to help communities improve land management practices and design and implement economic activities that enhanced livelihoods and protected critical ecosystem services that people rely on for income and wellbeing. It was anticipated that activities under the GP project would complement the GOI's efforts to reduce emissions from deforestation and environmental degradation. More broadly, the project was also expected to help foster greater, greener, and smarter outside investment in Indonesia by improving the basis by which land use decisions are made and by creating incentives for increased deployment of cleaner technologies.

The Green Prosperity project as a whole was comprised of four discrete activities, detailed below:

1. The **Participatory Land Use Planning (PLUP)** activity was meant 1) to ensure that projects funded by the GP Finance Facility were designed based on accurate and appropriate spatial and land use data, and adhered to and reinforced existing national laws, regulations and plans; and 2) to strengthen the capacity of local communities and district-level institutions to manage their own land and resources. This was intended to be accomplished through participatory village boundary setting (VBS), updating and integrating land and other natural resource use plans, and enhancing district and provincial spatial plans. The first PLUP contract, called Participatory Mapping and Planning 1 (PMAP 1), was awarded to Abt Associates to implement PLUP Tasks 1 through 4 in the four starter districts. Seven additional PMAPs with varying levels of implementation of the four PMAP 1 tasks were also originally planned, although one of these—PMAP 5—was cancelled. As of December 2018, all PMAP contracts were completed. Overall, PMAP contracts were intended to be implemented in up to 45 districts throughout Indonesia.

2. The **GP Facility** provided grant financing to mobilize greater private sector investment and community participation in RE and sustainable land use practices. The GP Facility investments were intended to enhance sustainable economic growth and social conditions while also reducing Indonesia's carbon footprint. The GP Facility targeted investments in commercial and community-based renewable energy projects less than 10 megawatts (MW) in size, sustainable natural resource management, and community-based projects to promote improved forest and land use practices. These investments were meant to support a number of objectives that promoted productive use of energy and protected renewable resources from which energy can be derived. Grants were funded through three schemes, or "funding windows": Partnership Grants (Window 1), Community-based Natural Resource Management Grants (CBNRM) (Window 2), and RE Grants (Window 3). The funded grants fit into seven different "portfolios" defined by the thematic area which they covered, including Sustainable Agriculture, Peatland, Social Forestry, Women's Economic Empowerment, CBOG RE, On-Grid RE, and other CBNRM grants such as ecotourism, fisheries, etc.

3. The **Technical Assistance and Oversight** activity was designed to provide assistance and oversight for eligible districts, project sponsors and community groups to identify and develop potential investments in sustainable low-carbon economic growth. This activity also instituted a comprehensive set of procedures to track and evaluate the progress of the projects it funded and the effectiveness of the GP Project activities implemented to facilitate the success of those projects. Technical Assistance included performing or reviewing detailed feasibility studies, engineering designs, as well as requirements on environmental, social and economic benefits, and monitoring and evaluation to meet GOI permitting and international performance standards.

4. The **Green Knowledge** activity supported and enhanced the results of GP projects by facilitating the collection, application and dissemination of knowledge relevant to low carbon development within and beyond GP districts. The activity provided capacity building for local and provincial stakeholders, developed and improved centers of excellence in science and technology related to low carbon, and established broad networks for information exchange, knowledge generation, and sharing.

2.1.1 Original Project Description

At the outset of the GP Facility, grants were meant to be issued through three separate funding windows, each with different mechanisms for selecting grantees. At the time of this report, MCC prefers to consider aggregations of GP Facility grants by thematic area (e.g. CBOG RE, palm oil, cocoa, etc.) rather than by the funding window through which they were granted. We will introduce the CBOG RE portfolio in the context of how each grant was funded before proceeding to characterize each grant by the method through which it aims to promote the usage of CBOG RE in Indonesia. By introducing the grants in this way, we also hope to facilitate referencing them throughout the report.

Window 1 of the GP Facility aimed to co-fund grants leveraging private resources to accomplish an array of larger GP objectives including "improving land governance, resource management, and renewable

development to improve people's access to clean energy."[9] Ultimately two grants co-financed through this window included renewable energy components, although only one (implemented by a Hivos-led consortium) maintained this component.

Window 2 of the Facility sought to issue grants for small-scale, community-based natural resource management projects that "promote community-based initiatives in forestry, agriculture and off-grid renewable energy, enhanced management of watersheds and forests to improve the sustainability of renewable energy and/or agriculture investments and support rural livelihoods and economic development."[10] Although it is uncommon that these grants focus entirely on CBOG RE components, many (18 of 49) include some kind of CBOG RE component in their programming.

Finally, Window 3 of the GP Facility funded grants focused almost entirely on the promotion of RE. These grants were divided into two funding schemes: Community-based RE grants (Window 3A, or W3A) and Commercial-scale RE Grants (Window 3B).[11] The former funding scheme provides grants for "project preparation, construction, initial Operations & Maintenance (O&M), and training for suitable small RE projects that will benefit local communities. These grants will help communities receive reliable and adequate supplies of electricity and benefit from revenue streams derived from energy production."[12] The projects financed by these grants are defined by new or expanded electricity generation from a community-based facility utilizing off-grid micro-hydro, solar, biomass, and/or wind energy systems.

By July of 2015, 21 Technical Assistance & Project Preparation (TAPP) Grant Agreements had been issued to organizations working with various communities across Indonesia to implement the Window 3A projects described above. Seven of these were granted TAPP extensions. The stated purpose of these TAPP grants was to strengthen "Implementer project preparation on par with MCA-Indonesia standards in order to support high quality, evidenced-based project preparation." Under each grant, implementers were to produce four key deliverables[13]:

1. A Detailed Feasibility Study (DFS) and Front-End Engineering Design (FEED);
2. Specific studies to bridge design gaps identified in any existing feasibility study;
3. Capacity-building, staff training, and supervision services necessary for successful project preparation for implementation; and
4. Incremental work related to complying with MCC Environmental Guidelines and MCC Gender Policy and landscape-lifescape analysis.

On the basis of the deliverables produced under these seven extended TAPP grant agreements, MCA-I funded the implementation of six additional implementation grant agreements.

Table 16**Error! Reference source not found.**, presented in Annex 6.4, includes a high-level summary of all 26 grants that comprised the CBOG RE Portfolio. Although grant numbers and project titles are included in

[9]Millennium Challenge Account- Indonesia. "Millennium Challenge Account - Indonesia Green Prosperity Partnership Grant Home." Www.mca-Indonesia.go.id, Millennium Challenge Account - Indonesia, 2017, www.mca-indonesia.go.id/en/project/green-prosperity/grant/green-prosperity-partnership-grant.
[10]Millennium Challenge Account- Indonesia. "Millennium Challenge Account - Indonesia Community-Based NRM (BCNRM) Grants Home." Www.mca-Indonesia.go.id, Millennium Challenge Account - Indonesia, 2017, www.mca-indonesia.go.id/en/project/green-prosperity/grant/community-based-nrm-cbnrm-grants.

[11] As none of the Window 3B grants include CBOG RE components, they are outside the scope of this evaluation and will not be included in this report.
[12] Millennium Challenge Account- Indonesia. "Millennium Challenge Account - Indonesia Green Prosperity Facility Home." *Http://Www.mca-Indonesia.go.id*, Millennium Challenge Account - Indonesia, 2017, www.mca-indonesia.go.id/en/project/green-prosperity/green-prosperity-facility.
[13] W3A-80 TAPP Agreement pg. 7

this table, these numbers and titles are not referred to consistently across project documentation. Henceforth in this report, to avoid confusion, we will refer to grants using the following convention: "[W(indow)#] [Grantee] [Technology], [Location]." For example, the first grant in the solar category in Table 16 would be referred to as "W2 Javlec Solar, Berau" and the first grant in the biomass category would be referred to as "W3A Charta Putra Biomass, Siberut Island."

It was not possible to review documentation for all the grants in the CBOG RE portfolio prior to writing this report; nor will it be possible to include all of them in the scope of an evaluation meant to characterize the portfolio's achievements and lessons learned. In the sections that follow, we give a more detailed overview of the two grants selected from Window 3A for impact and pre/post performance evaluation and the four selected from the other Windows for ex post case studies. Overviews of grants that were considered, but not selected, for the evaluation are available in Annex 4: Project Descriptions of Non-Selected Grants.

2.1.2 Project Participants, Geographic Coverage, and Outputs

The evaluation is designed to assess the program logic underlying the portfolio of CBOG RE grants in the GP Grant Facility and investigate the different approaches grants use to render their outcomes sustainable over time. It will do so through a focused investigation of six specific grants, two selected for impact and pre/post performance evaluation looking at changes at multiple points in time, and four selected for detailed case studies with data collection at one time point. Below we provide a summary of these projects' coverage and approach in this section, followed by a summary of their theories of change in the next section.

The two grants included in our portfolio evaluation as impact and pre/post performance evaluations, which will be introduced first in this section, were both funded through Window 3A. Each of the Window 3A grants has six general categories of outputs in common (as enumerated in their grant agreements): (i) an Engineering, Procurement and Construction (EPC) contract with an MCA-I approved contractor; (ii) physical infrastructure including off-grid Power Plants, electricity distribution lines, house installation lines, protection devices, and meters; (iii) Mandatory operational permits and licenses for electricity generation and distribution; (iv) fully implemented and monitored environmental and social performance (ESMP) and project social and gender integration plans (PSGIP); (v) community members with adequate technical, managerial, and entrepreneurial capacity to sustainably operate a Special Purpose Vehicle (SPV) responsible for overseeing the off-grid system and supporting productive activities for the electricity's use; and (vi) project management, monitoring, and reporting. Although the grants have similar outputs in the abstract, they differ in the nature and amount of physical infrastructure in each grant, the timeline for the infrastructure's activation, and the capacity building requirements for the establishment of an SPV in each community. To avoid repetition, we will focus on these particular variations in describing their outputs.

In turn, the four grants selected for case studies were funded through other windows whose outputs were not as consistent. These grants were selected for case studies by MCC because they employed different RE technologies and/or different approaches to achieving sustainability in similar geographic and socioeconomic contexts to the two Window 3A grants. The documentation available as of November 2018 for these grants—W1 Hivos Solar/Biogas, Sumba/Sulawesi; W2 IBEKA Micro-Hydro, East Sumba; W2 Javlec Solar, Berau; and W2 PEKA Solar, Berau—varies in terms of its ability to accurately convey the "planned" project participants, community ownership model, and anticipated outcomes pursued by each grant. Thus, although we endeavor to describe each grant to the extent possible in the following sections, this description may lack some details

until further data and documentation are received from grantees over the course of the evaluation. Indeed, we consider uncovering the “planned” theory of change, model for sustainability, and anticipated outcomes of each grant to be within the scope of the evaluation itself, rather than a given input for the evaluation design.

2.1.2.1 Window 3A Grants

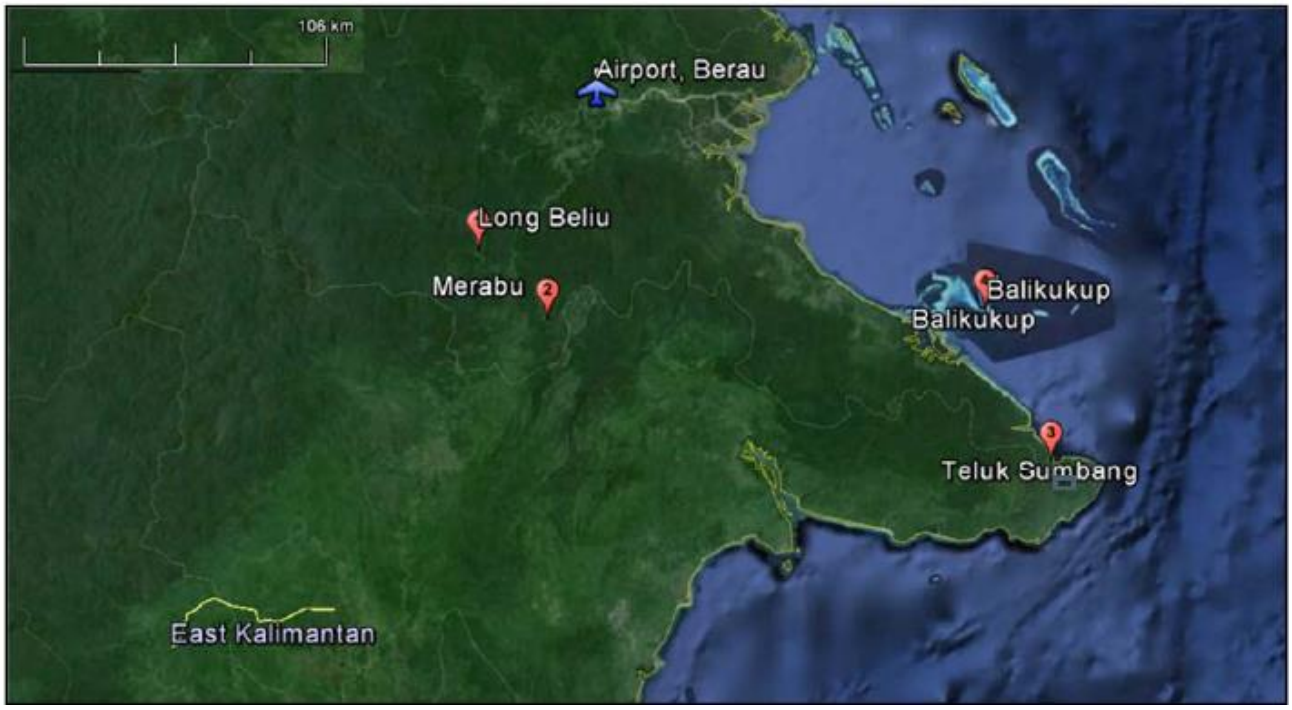
2.1.2.1.1 W3A Akuo Energy Solar/Micro-Hydro, Berau

The Off-Grid Power Plants for three Villages in Berau Regency-East Kalimantan Project (W3A Akuo Energy Solar/Micro-Hydro, Berau) targeted three villages in the Berau Regency of the East Kalimantan Province: Teluk Sumbang, Long Beliu, and Merabu. All the households in Teluk Sumbang and Merabu (comprising 167 and 73 households, respectively) were connected to the new and/or upgraded power systems. In Long Beliu, 223 out of 251 total households were connected to the new power system. In all cases, the grantee planned to attempt to connect all households where a connection would be practical and feasible based on distance from the grid and socioeconomic conditions. In the case of the non-connected households in Long Beliu, all these pertained to a sub-village administrative unit (or “RT”) that is wealthier than other parts of the village, located directly along the main village road. The targeted households pertain to a different RT seven kilometers away from the road.

At the village level, site selection occurred on the basis of government priority lists of villages with low or no rates of electrification. The Mining and Energy Agency in Berau (Dinas Pertambangan dan Energi (Distamben)) collected applications from villages to receive grant assistance and presented a list of ten suitable villages to PT. Akuo Energy for potential inclusion in the project. PT Akuo Energy initially selected four of these villages in which they conducted DFS, and ultimately dropped one (Balikukup) when the DFS found that the most suitable location for a solar PV micro-grid was prone to erosion and potentially unsustainable.

Figure 1 displays the final three villages selected for grant assistance, along with the originally considered fourth village.

Figure 1: Map of Target Villages for W3A Akuo Energy Solar/Micro-Hydro, Berau



W3A Akuo Energy Indonesia (AEI) Solar/Micro-Hydro, Berau started construction of all facilities and necessary complementary outputs for all three villages in July of 2017. The facility in Merabu was scheduled for commissioning in December of 2017, while the remaining facilities were scheduled to be commissioned in March of 2018. A summary of the main physical outputs from this project and their corresponding power capacities can be found in Table 16.

Table 1: W3A Akuo Energy Solar/Micro-Hydro, Berau Summary of Physical Outputs

Location	Technology	Number of facilities	Capacity (kWp)	Household connections
Teluk Sumbang	Solar PV, Micro-hydro	2	414 (solar), 30 (hydro)	138
Long Beliu	Solar PV	1	518	165
Merabu	Solar PV	1	311	97
TOTAL		**4**	**1,273 kWp**	**400**

While the facilities were under construction, AEI worked with the local communities to form SPVs that will be responsible for the facilities' long-term operation. According to the grant's SPV Business Plan (revised May 8, 2017), these village-level SPVs will be dually owned by the implementer and a village-owned enterprise (Badan Usaha Milik Desa, or BUMDes). During construction, AEI will have a majority share in the SPV,

whereas after construction shares will be split 75% to 25% in favor of the BUMDes. Each SPV will be shaped according to the organigram in Figure 2.

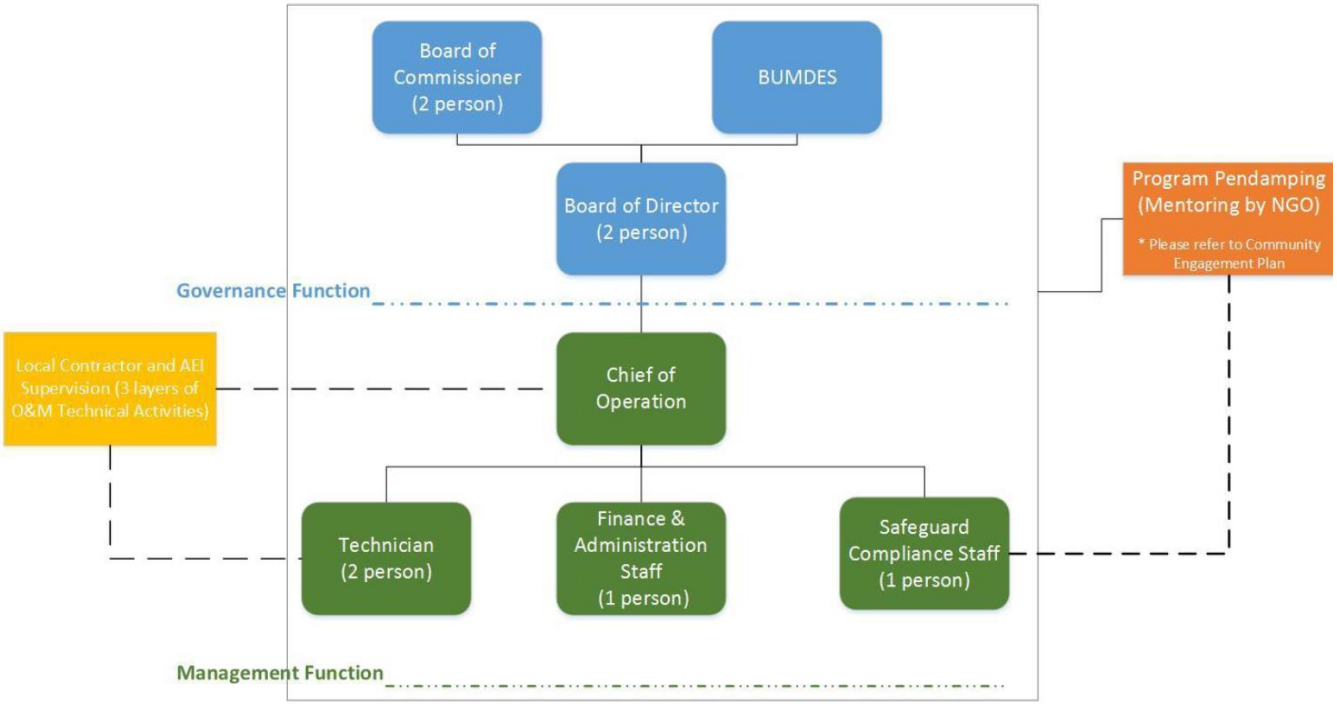


Figure 2: W3A Akuo Energy Solar/Micro-Hydro, Berau SPV Organigram

Operationally, the technician is responsible for day-to-day O&M of the plant. The finance and administration staff is responsible for book-keeping and documentation as well as managing the SPV's voucher-based sales system and financial reporting. The safeguard compliance staff is responsible for coordinating community development and compliance with environmental, social, and gender safeguard procedures. Routine preventative maintenance and intermediate troubleshooting will be contracted out to a local O&M company, while system control and advanced and inverter troubleshooting will be handled by AEI.

Although AEI will have a 25% share in the SPV, all SPV dividends will belong to the BUMDes. These dividends will be utilized according to the procedure outlined in Figure 3. Specifically, the 10% of gross profits reserved for community benefits each year will target awareness of how to use electricity efficiently and support economic activities by women's groups.

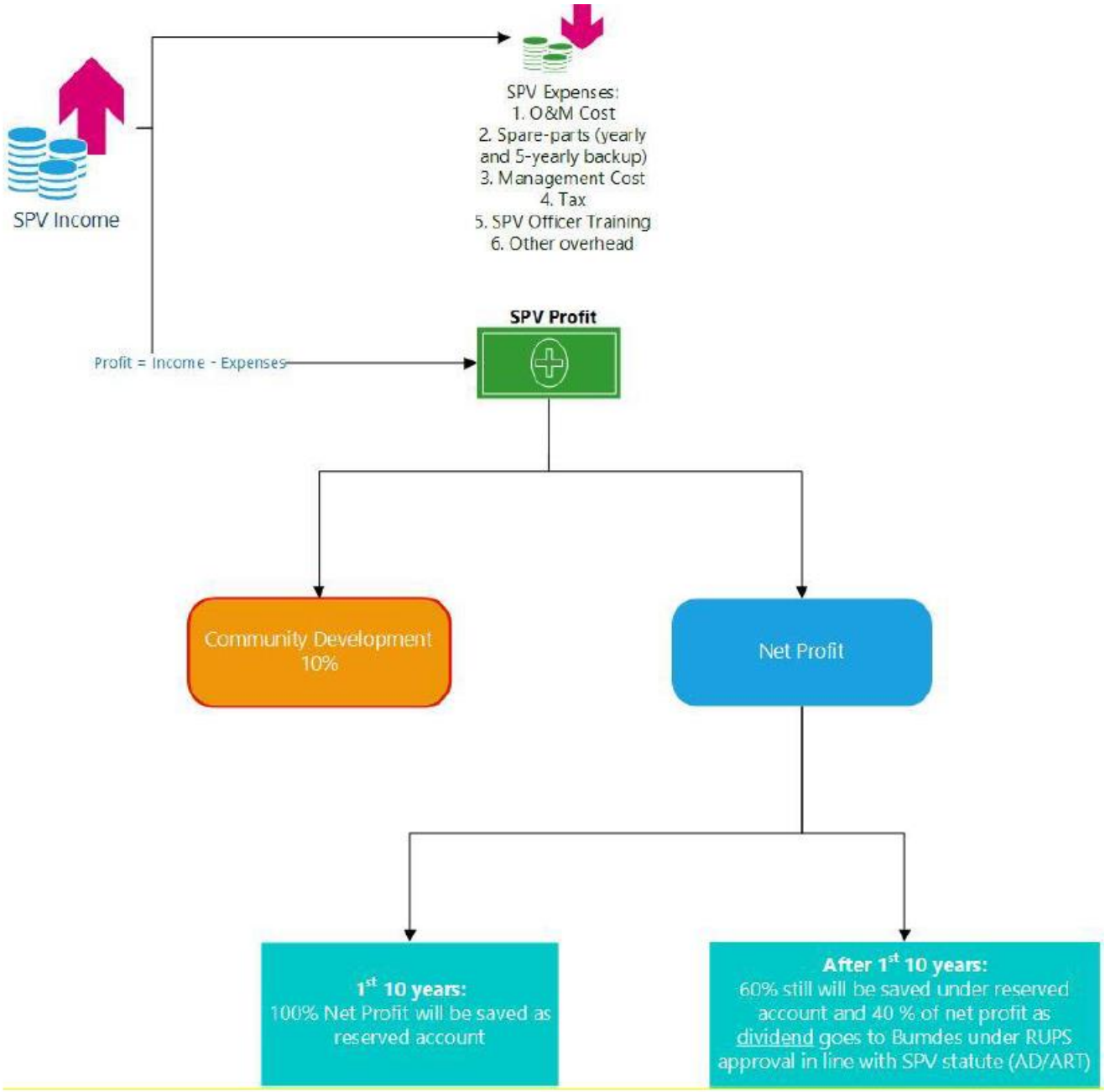


Figure 3: W3A Akuo Energy Solar/Micro-Hydro, Berau SPV Profit Utilization

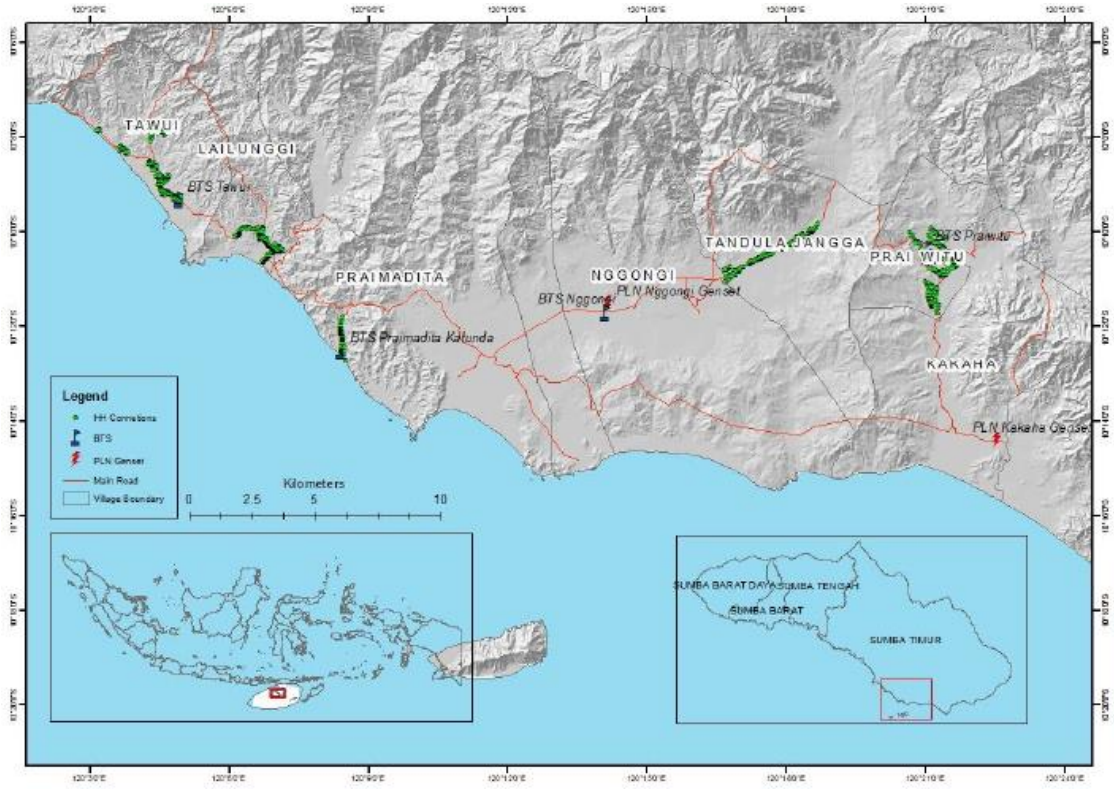
2.1.2.1.2 W3A Anekatek Solar, East Sumba

The Solar PV Distributed System in East Sumba Project (W3A Anekatek Solar, East Sumba) targeted 909 households in the East Sumba Regency for electrification via connection to eleven, sub-village (or kampung)

level solar PV micro-grid systems. These eleven systems are distributed across five villages: Tawui, Lailunggi, Praimadita, Tandula Jangga, and Praiwitu. The 909 households targeted include all the households in the eleven kampungs targeted across the five villages.

The East Sumba regency was targeted by this project based on previous studies executed under an ADB Technical Assistance grant (TA 8287) held by Castlerock Consulting, a service provider on cross-cutting deliverables on the W3A grant.[14] Within this regency, the implementer selected villages (desa) based on criteria that included mobile network access and proximity to a Perusahaan Listrik Negara (PLN)[15] station. Finally, targeted kampungs were selected within these villages based largely on population density, as measured by a Geographic Positioning System (GPS) roof-tagging exercise. Aside from population density, it is the implementer's belief that there are no categorical differences between selected and non-selected kampungs. Figure 4, below, displays the kampung targeted by the project in the larger context of East Sumba.

Figure 4: Map of Target Sub-Villages for W3A Anekatek Solar, East Sumba



The Solar PV facilities and complementary infrastructure in Tawui Riyang, Tawui Northeast, Tawui North, and Tawui West were due to be commissioned by November 10, 2017. The remaining facilities were to be

14 The purpose of this TA was to "support the GoI's Sumba Iconic Island Initiative," which aims to electrify 95% of households on the island of Sumba via 100% renewable means by 2025. The referenced Network Planner exercise was part of a "comprehensive least-cost electrification planning exercise" for Sumba, wherein the most cost-effective and technically appropriate means for achieving a 100% electrification ratio were laid out (ADB 2014).

15 Indonesian state-owned company tasked with supplying the electricity needs of the Indonesian people.

completed between November 28, 2017 and January 31, 2018. **Error! Reference source not found.** Table 2 summarizes the capacity and expected household connections of each of these facilities.

Table 2: W3A Anekatek Solar, East Sumba Summary of Physical Outputs

Location	Technology	Number of facilities	Capacity (kW)	Household connections
Tawui Riyang	Solar PV	1	9	18
Tawui West	Solar PV	1	12	28
Tawui Northeast	Solar PV	1	7.5	17
Tawui North	Solar PV	1	12	27
Tawui South	Solar PV	1	99	209
Lailunggi	Solar PV	1	103.5	216
Rehi Jara	Solar PV	1	16.5	32
Tanah Rong	Solar PV	1	24	44
Tandula Jangga	Solar PV	1	75	136
Praiwitu North	Solar PV	1	103.5	136
Praiwitu South	Solar PV	1	30	46
TOTAL		**11**	**492 kW**	**909**

Compared to the W3A grant in Berau, which set up an SPV in each village in which it operated, W3A Anekatek Solar, East Sumba established one SPV, "PT Mikro Kisi Sumba (MKS)," to cover all eleven treatment areas spread across five villages.[16] The implementer's sister company, Electric Vine Industries (EVI), had 100% ownership of the SPV during the construction phase, after which ownership will be split 51% to 49% in favor of the communities. The communities will be represented by a secondary cooperative comprised of members of five primary cooperatives representing each village in which the project will operate. [17]

Operationally, the SPV will issue a contract to "PT LVI" for O&M of the facilities and management of administration and finance. Where other grant's SPVs typically aim to complete finance and administration in-house, PT MKS is paying for these to be completed externally since the contractor has key experience and software to implement a mobile phone-based, pre-paid "smart metering" system that aims to increase project sustainability by matching payment cycles with end-user's income cycles. Users of the micro-grids will lose access to power once they have used their pre-paid credit. Custodians employed by the SPV will be responsible solely for O&M tasks related to cleaning arrays and clearing vegetation and debris from the roots and distribution. Besides the custodians, the only other operational SPV staff will be community, social, and environmental officers responsible for overseeing the implementation of ESMP and PSGIP along with liaising

[16] The information presented in this section is based off of the grant's SPV Business Plan, dated July 5, 2017 which was the most updated plan available to SI as of July 2017. SI acknowledges based on MCA-I comments that this approach may have been updated since this time.

[17] In all villages but Praiwitu, these cooperatives will be established from scratch. Since Praiwitu is the only village with an existing cooperative, this cooperative will be assessed for suitability as an SPV before a cooperative is established from scratch.

between cooperative members and technical and managerial SPV staff—including registering customer complaints. See Figure 5 for an overview of the SPV's structure following the end of the construction phase.

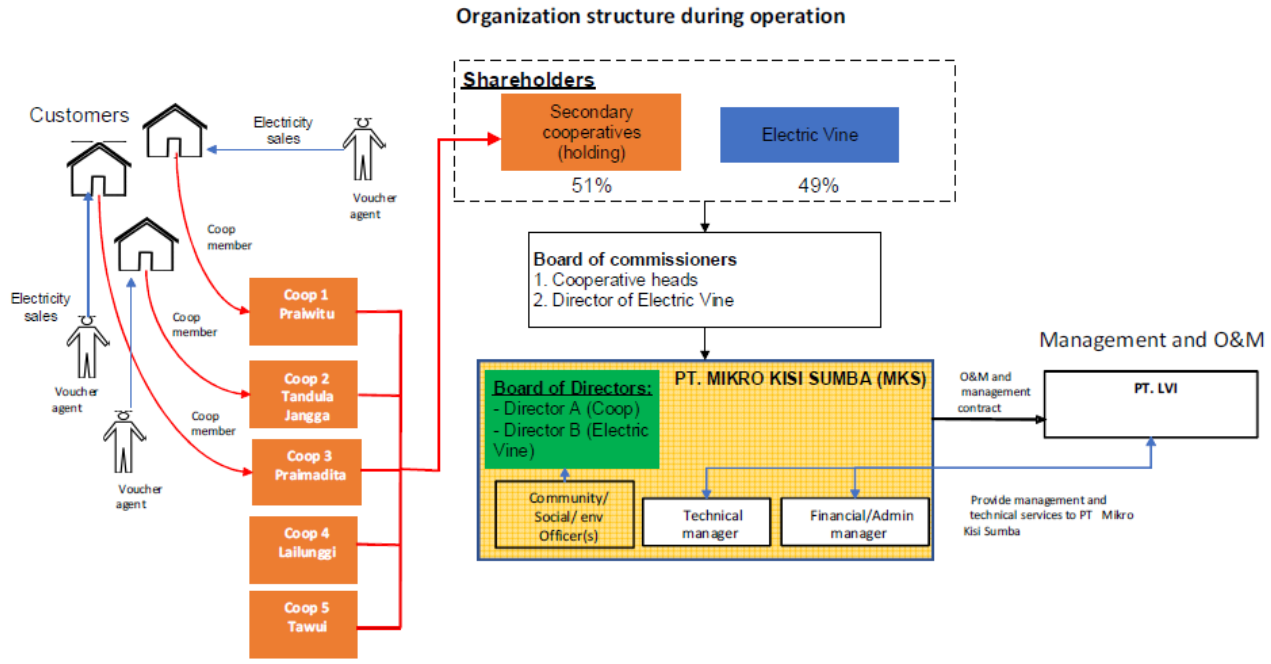


Figure 5: W3A Anekatek Solar, East Sumba SPV Organigram[18]

In order to increase sustainability of the micro-grids, members of the primary cooperatives (households in each village) received capacity building over the course of construction on various themes, including: community development, social inclusion, and gender awareness; SPV management and sustainability; operation and maintenance, and renewable energy. These trainings were meant to increase community members' awareness of and engagement with the benefits of the RE technology as well as their ability to successfully manage it after the project has ended.

Once the SPV is generating revenue and funds have been set aside for a maintenance reserve, dividends remaining after O&M and contractor costs will be allocated for community activities. These may include capital for new businesses in the villages, incentives for members that do not have sufficient income to pay electricity tariffs, or capital for cooperative members.

2.1.2.2 Other Grants

2.1.2.2.1 W2 Javlec Solar, Berau

The "Building a Local Potential Environmentally Friendly Business in the Eastern Region of Berau Regency" Project aimed to improve coastal livelihoods in the Berau regency through the promotion of ecotourism and responsibly managed local businesses using local resources such as fish and coconut. The grant targeted

[18] W3A Anekatek Solar, East Sumba SPV Business Plan (dated July 5, 2017); Exhibit 2

four villages across the Derawan Islands and Maratua sub-districts, but only utilized CBOG RE in one village on Maratua Island. Specifically, the project constructed a 56 kWp peak capacity solar power plant to power a miniature ice factory, which in turn was expected to benefit 222 fishermen in the village who could preserve their catch for sale without needing to rely on expensive ice imported from other islands. Aside from the fishermen, the project also aimed to capacitate 21 people to manage the Solar power plant and ice factory.

To render the Solar power plant and ice factory sustainable, two management groups were formalized in a Village Chief Decree and integrated into a kampung-owned enterprise (BUMK) framework. The Solar PV management group will be responsible for basic maintenance, installation checks, and monitoring the energy supply. The ice factory management group, in turn, will be responsible for ensuring adequate raw water supply, optimizing production at the factory, and marketing the ice to consumers. In time, they will become responsible for a scheme that differentiates ice factory "members" from "non-members," roughly equating to individual fishermen purchasing ice for their own consumption compared to larger collectors or distributors. By integrating these groups into the BUMK, the village-level government can provide the required capital for the Solar power plant and ice factory's continuous operation and ensure that revenue accrues for the community rather than any single individual.

2.1.2.2.2 W2 PEKA Solar, Berau

The "Utilization of Natural Resources and Renewable Energy for Enhancing Community Welfare Throughout the Karst Landscape in Batu Putih District and Biduk Biduk District, Berau Regency" Project, implemented by Yayasan Peduli Konservasi Alam (PEKA) Indonesia, aimed to construct solar power plants to power natural resource processing facilities in the Sumber Agung and Giring Giring villages. The final report estimates that 222 individuals will have benefitted from training given during the project in addition to 24 small business groups, which were developed and/or capacitated to use the electricity from the micro-grids for productive purposes. Aside from the electricity users, twenty people were trained to be managers of the solar power plants.

The processing facilities powered by the solar power plants are used to create fiber, peat, and briquettes from coconut husks in Giring Giring or paste, cakes, and other products from shrimp and seaweed in Sumber Agung. Each of the units has a capacity of 8 kWp. The villages made in-kind contributions to the project, including land for the project outputs. The project facilitated the establishment of BUMK in each of the villages to oversee the solar PV management unit and production house and capacitated these groups in management and maintenance of solar plants, operation and maintenance of production machinery, and general BUMK management. Although these units will be expected to manage project outputs autonomously using their training, the grant facilitated access to market networks for the final goods produced in the processing facilities—such as facilitating a relationship with the Berau Coal Company to buy byproducts of the coconut husks—and established processes for collective consultation between he BUMK, solar PV management units, processing facility management units, and business groups such that a portion of the profit from the businesses can be set aside for maintenance and sustainability of the solar power plants.

2.1.2.2.3 W2 IBEKA Micro-Hydro, East Sumba

This Window 2 grant was implemented by Inisiatif Bisnis dan Ekonomi Kerakyatan (IBEKA) Foundation (as the lead institution) together with consortium partners.[19] The project constructed a 65 kWp micro-hydro power (MHP) mini-grid in the Kambata Bundung village, Kahaungu Eti sub-district and a 95 kWp MHP mini-grid in the Maubokul village, Pandawai sub-district. The first, known as "Kalilang," entailed 26.6 kilometers of transmission and distribution lines to serve 228 households and 35 public facilities. The second, known as "Kamajara," entailed 12.0 kilometers of transmission and distribution lines to provide electricity for 69 households and 6 public facilities. Aside from promoting the use of renewable energy from the MHP mini-grids for domestic, productive, and educational use, the grant also aimed to increase agricultural productivity using irrigation pumping systems, agricultural processing facilities, and community training and capacity-building.[20]

The project trained twenty local individuals to be operators of the mini-grids. At the end of the Compact, the Kalilang mini-grid had four full-time operators and the Kamanjara mini-grid had two full-time operators. An additional 162 people were trained on themes related to O&M of the irrigation pumping systems, O&M of the agricultural processing facilities, development of small business, and operation of local "Knowledge Centers." In seeking to provide for the sustainable operation of the MHP mini-grids, community cooperatives were developed with the purpose of operating and maintaining the MHP facilities. The project additionally involved the community through orientations and regular meetings, facility location selection, and construction. IBEKA committed to providing continued technical assistance to the community cooperatives following the grant period of performance, as needed. MHP mini-grid maintenance and management costs were to be funded through a combination of tariffs (IDR 30,000, or about $2.30 per household per month) and village funds allocated by the Village Consultative Body.

2.1.2.2.4 W1 Hivos Solar/Biogas, Sumba/Sulawesi

This grant operated in nine districts spread across three provinces: East Nusa Tenggara, West Nusa Tenggara, and South Sulawesi. The specific districts targeted include East Sumba, West Sumba, Central Sumba, Southwest Sumba, North Lombok, East Lombok, Central Lombok, North Luwu, and East Luwu. Although most of the grant's physical outputs (such as solar lanterns or solar PV units) targeted schools, kiosks, and agro-processing mills on the island of Sumba, the grant also aimed to install household biogas digesters across all three provinces. Besides physical RE outputs, the grant targeted government, private sector, and civil society stakeholders with community engagement programming. In total, the grant estimates that it will have 61,500 direct beneficiaries. These direct beneficiaries are mostly comprised of rural households with school-aged children, with emphasis placed on households where program outputs might promote livelihood security, reduce economic constraints, or promote economic opportunities. [21]

Hivos' grant aimed to improve rural livelihoods through utilization of renewable energy across two dimensions: increased access to and application of RE technology and improved human capacity and social cohesion with respect to RE technology. It aimed to accomplish the first dimension by installing 50 solar-powered agro-

[19] The Consortium, in addition to IBEKA, includes Koperasi Serba Usaha (KSU) Kamanggih, Koperasi Jasa Peduli Kasih Kamanggih, PT.RENERCONSYS, PT. Caruban Inti Technology, and CV Insan Bangun Utama.
20 Note that, at the time of this report, it is not clear if the irrigation pumping systems or agricultural processing facilities are powered by the MHP

[21] Grant agreement, Attachment B

processing mills, 25 school-based solar PV systems, and 20 solar remote charging stations in Sumba, while installing 3,200 household biogas digesters across the East Nusa Tenggara, West Nusa Tenggara, and South Sulawesi provinces. The grant will also rent 6,000 solar lanterns in the same areas where school-level solar PV units are installed. In total, these technologies will have a combined capacity of 9,152 kW spread across an estimated 61,500 direct beneficiaries.[22] Although these outputs and beneficiaries are identified in aggregate, it is not clear based on available documentation where key outputs are specifically located within East Sumba.

To complement these physical installations and accompanying rental technologies (including solar lanterns accompanying the school-based solar PV systems and charging kiosks), the Hivos consortium conducted capacity building on business-, technical-, and gender-related themes to prepare communities for the utilization of the new technology.

In order to sustain these outputs, the consortium endeavored to simultaneously create a market for the off-grid technologies using a renewable energy service center (RESCO) approach coupled with stakeholder engagement and community outreach to maintain a commitment to participatory and gender-sensitive development of RE systems in government, civil society, and the private sector. The Waingapu- and Waitabula-based RESCOs constitute a different approach to community engagement and ownership than the SPV approaches utilized by the Window 3A grants. Specifically, they will collect monthly fees from customers (mostly local cooperatives or user groups and kiosk owners) to fund maintenance fees, repayment of equipment funded by the grant, and an operating margin. The repaid equipment portion of these fees will fund replacement of RE system components when they fail, and the operating margin will cover operating expenses such as salaries and rent. In turn, the RESCOs will ensure delivery of the RE service and provide monthly maintenance and system repairs. All program activities were scheduled to be completed by March of 2018.

2.2 Theories of Change

2.2.1 Window 3A Grant Theories of Change

All of the Window 3A grants operate on a nearly identical theory of change, which can be summarized as: if communities with low access to electrification in remote areas of Indonesia are provided with renewable-energy based micro-grids and capacity building in the proper operation and management of these micro-grids, then (i) the communities will have an increased awareness of RE and sustainable natural resource management; (ii) households in these communities will have reliable and sustainable access to electricity; and (iii) community cooperatives will have the capacity to operate and manage the micro-grids. Supposing these outcomes are realized, and the communities derive sustainable benefits as SPVs continue to provide adequate O&M services, household income will be increased and GHG emissions decreased due to the improved access to and utilization of electricity generated from RE sources. In addition to the three outcomes mentioned above, most of the W3A grants additionally posit that increased economic opportunities will result from productive uses of the increased supply of electricity. By way of example, the log frame for W3A Anekatek

[22] Grant agreement, Attachment B

Solar, East Sumba depicts the logical progression of this theory of change from the status quo through to final impacts in Figure 6.[23]

Although the DFS or M&E (Monitoring and Evaluation) Plans for the Window 3A grants typically include some characterization of the theory of change above, they rarely include the underlying assumptions or detailed intermediate steps required for the ultimate goals to be realized. We provide a bit more detail from the literature here to highlight key measurement areas for the evaluation.

In theory, electrification is expected to positively affect households and service provision. First, it improves incomes via a decrease in energy expenditures, an extension of working hours, the use of productive motive power, and eventually better income opportunities and new and more efficient businesses. Second, it yields better education via extended study hours, improved access to knowledge and information, and improved school services. Third, it leads to improved health from a decrease in polluting lighting sources (kerosene) and improved health services by electrified health facilities. Lastly, it yields positive effects via electrification on security, community participation and (gender) attitudes via improved connectivity and media access (see Lenz et al., 2017).

These theorized impacts are contingent upon a handful of key assumptions:

1. Households are open to using the new technology. While this is generally not a problematic assumption, it could be violated if there is mistrust between the community and the implementer or a lack of optimism in the community that the new technology will be sustainable.
2. Beneficiary communities will have adequate access to regional and national markets to allow village enterprises to count on more than local demand. Without this, there may be little incentive to expand or create new businesses. This assumption is likely to be tested more often in agricultural communities that cannot count on the same export base as enterprises in communities that rely on fishing or eco-tourism.
3. For education outcomes to materialize, schools must be up and running and students must have access to study materials in order to allow households to use electricity in a beneficial way with regards to education.
4. The capacity building provided for operation and maintenance of the RE infrastructure is given in a sufficient quantity and quality such that selected community members are capable of properly maintaining the infrastructure and willing to do so for the long-term. There are no external constraints that would prevent them doing so, such as a dearth of locally available replacement parts or poor quality O&M contractors.
5. Finally, this theory of change assumes that all program components are fit for purpose. The physical infrastructure and training of community members must be suitable for achieving the purposes set out below. If it is not, the construction of solar arrays may not result in a sustainable source of usable electricity that meets the energy demands of uses that contribute to the above stated goals. For example, if energy supply in practice is only sufficient to power small household appliances or lights, then new economic opportunities may not be available.

[23] Our presentation of program logic in this section is representative of the benefit streams outlined in project M&E plans. There are frequently additional outcomes associated with increased electricity access, including improved gender equality through changes in time use due to time-saving appliances and improved security due to lighting. Our evaluation will aim to capture such outcomes of similar programming, even if they are not included in project M&E documents.

SI will work to monitor the veracity of these assumptions, where appropriate, using our existing instruments. As an example, we may monitor the assumption about access to markets by asking enterprises where their customers generally come from alongside questions about their revenue and future prospects. Additionally, we may ask community members about their interactions with grantees and their past direct or indirect experiences with similar programming to monitor their openness to the new technology.

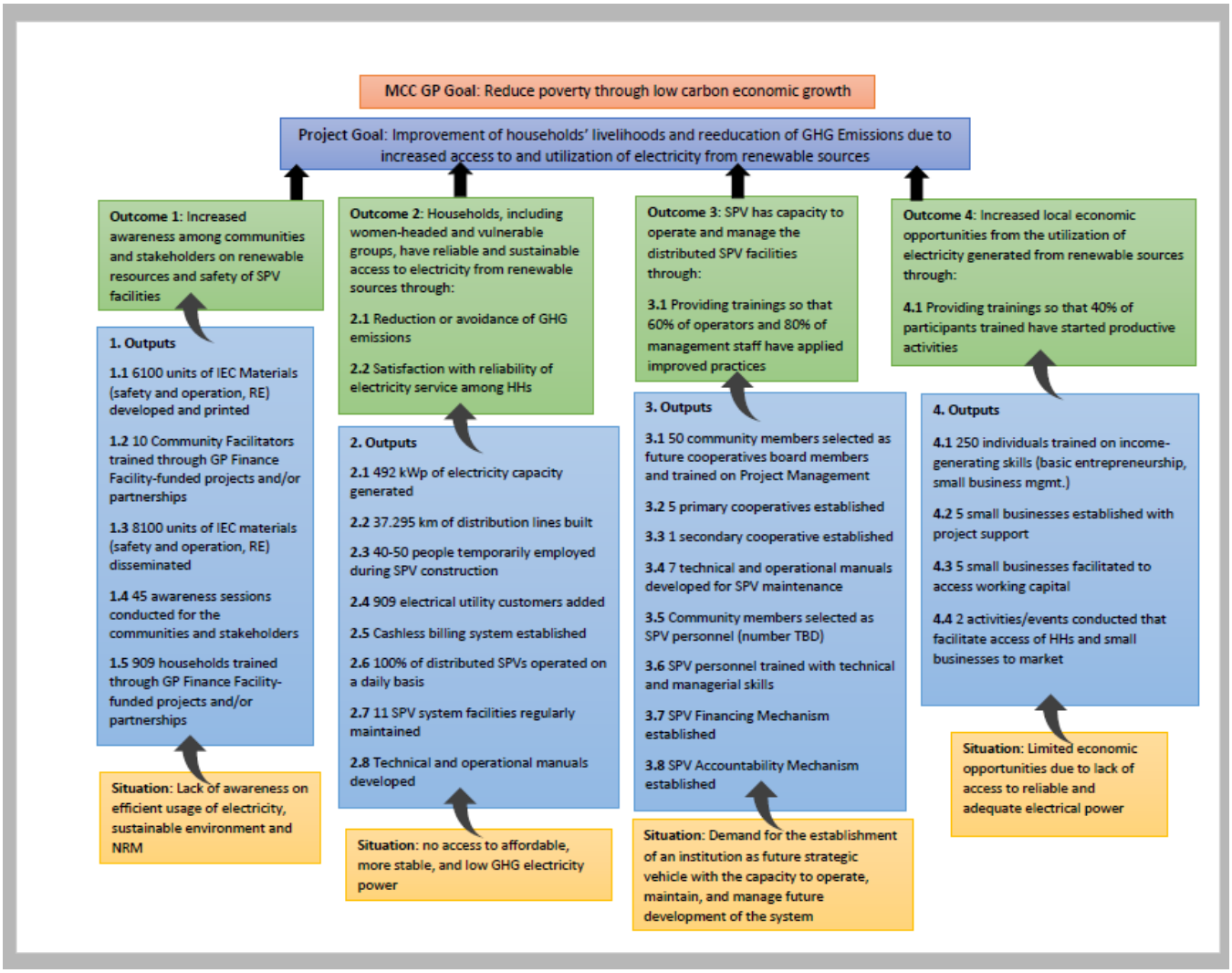


Figure 6: Log Frame for W3A Anekatek Solar, East Sumba

2.2.2 Other Grant Theories of Change

The theories of change underlying the grants included as case studies, although similar, are more heterogeneous. Additionally, with the exception of W1 Hivos Solar/Biogas, Sumba/Sulawesi, the program logic of these grants can only be constructed implicitly based on the available program documentation. These theories of change vary at times according to different grant objectives and operational contexts but can also vary due to different strategies to achieve sustainability in outcomes. For brevity, we will only elaborate on the

theory of change of components of these grants that fit within the scope of our case studies. This includes only components of the grants that include renewable energy themes and components that occur within the regencies of East Sumba and Berau.

2.2.2.1 W2 Javlec Solar, Berau

The RE component of this grant, a solar-powered mini-ice factory, responds to a situation in which local fishermen on Maratua island reportedly paid up to a 20% premium to obtain ice from other islands and still lost up to 40% of their catch to decay prior to sale.[24] The theory of change implied by grant outputs, then, is that if a solar PV facility and miniature ice factory is constructed on Maratua island and local individuals are capacitated in the management and operation of the solar PV plant and factory, local fishermen will decrease their expenditure on ice and sell a higher proportion of their catch, leading to higher incomes. This theory of change assumes, if operators and managers of the facilities are adequately capacitated for their tasks, that the revenue from the ice factory will be sufficient to fund the continuous operation of both facilities. For this revenue to be sufficient, there must be an adequate demand for ice from local and regional consumers and/or a willingness on behalf of village government to cover the difference in operating costs from village funds.

2.2.2.2 W2 PEKA Solar, Berau

Similarly to the RE component of the Javlec grant, the PEKA grant appears to focus nearly exclusively on productive use of renewable energy as a desired outcome. It thus implies that if (i) solar-powered processing facilities and corresponding plants are constructed, (ii) small business groups are formed to use these facilities to process locally available natural resources, (iii) management units are formed and trained to specialize in the operation and maintenance of the solar power plants and production machinery, and (iv) access to markets for final goods is facilitated by the grantee; then community members will sustainably produce and sell by-products of locally available natural resources in such a fashion that their income will increase and greenhouse gas emissions and time spent on existing manual and mechanical processing machinery will decrease.

The assumptions underlying this theory of change are similar to those underlying the productive use component of the W3A grants. Namely, that an accessible regional or national market exists for these goods that will allow local businesses to grow. However, in a departure from the W3A grants, this grant appears to assume that the training given to local communities to operate and manage the plant and machinery is sufficient for these to operate sustainably in the long-term, or that the villages will have the means to seek further training on their own. The theory of change appears to also assume that local enterprises will use the processing facilities instead of fossil-fuel based or manual machinery for processing. They may not be motivated to do so if the capacity of the solar PV plants powering the facilities is insufficient or the price of using the processing facilities is too high.

2.2.2.3 W2 IBEKA Micro-Hydro, East Sumba

The theory of change for this grant cannot be completed, even implicitly, based on the available documentation for this grant. Key components of this theory of change include (i) the construction and installation of the MHP mini-grids, irrigation pumps, and agricultural processing facilities; (ii) community engagement in the siting, construction, and management of the mini-grids through cooperatives; (iii) connection of households and public facilities in each of the target villages to the mini-grids; and (iv) training community members on themes

[24] Final grant report, pg. 13

related to mini-grid management, operation and maintenance, and agricultural productivity. However, aside from increasing agricultural productivity and presumably increasing household incomes, it is not clear what the desired outcomes of the grant are. Documentation alludes to education outcomes, but this could imply that children in connected households can study later into the night due to the mini-grid, that schools can use electric assets for education due to the mini-grids, or something else. It is also unclear which public facilities aside from schools may be connected and in what ways these facilities stand to benefit from a connection to electricity.

It is similarly unclear if all of the grant's outputs are RE-related or if some are exclusively related to increasing agricultural productivity or sustainable natural resource-management. For example, although we presume that the irrigation pumps and agricultural processing facilities are powered by the MHP mini-grids, this is not confirmed in available documentation. Also, it is not clear if all of the training is focused on operating the MHP mini-grids or if some is general training on natural resource management or other themes. Defining this theory of change will be an objective of this evaluation.

We can assert based on preliminary discussions with MCC that a key component of this grant's approach to sustaining outcomes is the project proponent's ability to manufacture their own hydropower equipment that is easier and cheaper to maintain than commercially available equipment. If this holds true, this grant may be more able to sustain O&M challenges to the MHP's long-term operation and, so long as the decreased expense of operation is filtered down to end-users in the form of lower tariffs, encourage better uptake of the technology from community members.

2.2.2.4 W1 Hivos Solar/Biogas, Sumba/Sulawesi

Hivos' CBOG RE grant was the only one to explicitly identify its logic model, as pictured in Figure 7 below. Its theory of change most significantly departs from the other grants covered by this evaluation in the extent to which it asserts that the establishment of a robust market for off-grid RE technology is a necessary condition for its RE outputs and corresponding outcomes to be sustained. It aims to establish this market by (i) engaging with public and private stakeholders at the local and national level and (ii) establishing renewable energy service centers (RESCOs) with the capacity to service all of the technology deployed in their respective regions and the objective of expanding the market for renewable energy following grant completion. Otherwise, the theory of change resembles the ones employed by the other grants, where funding off-grid technology and training communities in its use and operation leads to outcomes of interest.

Relative to strategies employed by other grants in encouraging small-scale RE usage in similar contexts, another differentiating factor of the Hivos grant is the aggregation of RE sources and charging stations in centralized locations where there are educated personnel and built-in habitual users, such as schools and health centers. By dispersing individual- or home-level technologies around these hubs, the grant aims to reduce the risk of equipment falling into disrepair or falling out of use.

At the impact level, the "rural livelihood improvement" sought with the technology includes increased agricultural productivity from the solar-powered agro-processing mills and increased study time enabled by the school-based solar PV systems and rental solar lanterns. Although the logic model includes reductions in GHG emissions as a desired impact of the grant, the agreement makes clear that the most significant contribution to this outcome (99.7% of the total 18,780 metric tons of CO2e2 that will be reduced due to the grant) will come from the biogas digesters which are outside the scope of our case study. As such, although

we will seek to highlight cases where the solar-powered RE technology is being substituted for fossil fuel-powered alternatives, the majority of the outcomes and impacts we will seek to verify are those related to increased productivity and studying time.

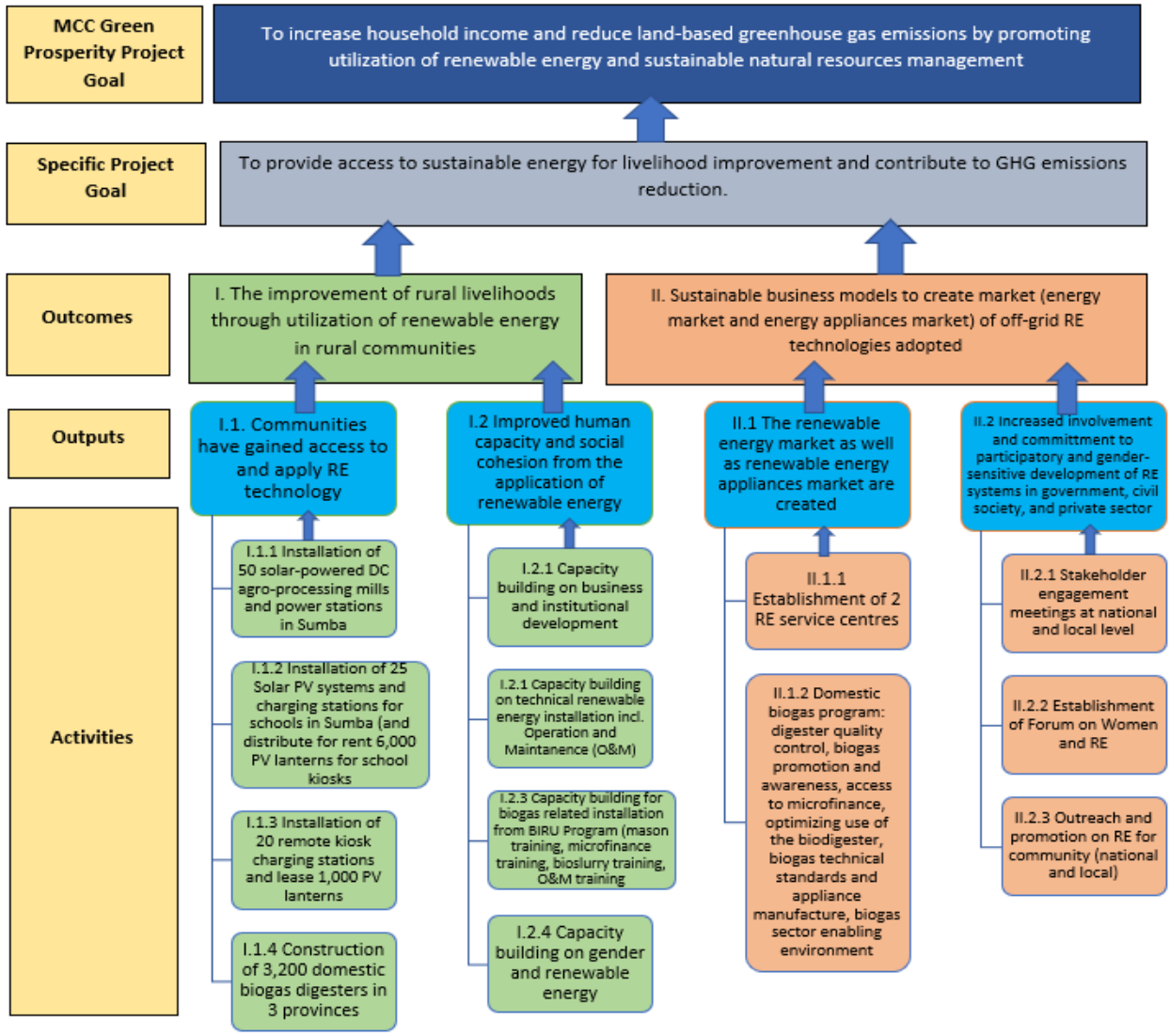


Figure 7: W1 Hivos Solar/Biogas Logic Model[25]

[25] Grant Agreement Attachment B, pg. 9

Quarterly Reports for this grant monitor risks to the grant in a similarly detailed fashion, which roughly correspond to implicit assumptions in the logic model. The most significant of these in the most recent quarterly report available to SI[26] include:

1.) Following grant-funded training, there will be sufficient implementation capacity in human resources and technical expertise to operate and maintain the technology
2.) The market developed by the grant will be robust enough to permit an adequate supply of replacement parts for selected technology
3.) Targeted communities will have adequate demand and take up the RE technology despite potential negative history with past RE programming or norms of non-payment for RE technology
4.) Pricing models will be sufficient for small RE entrepreneurs to profit, and they will have adequate skills and financial literacy to do so
5.) Central, provincial, and district government RE-policy will be coordinated enough for market to flourish

2.3 Cost Benefit Analysis & Beneficiary Analysis[27]

The largest and most consistent economic benefit considered by MCC cost benefit analyses (CBAs) for the Window 3A grants is derived from the increased access to electricity from the newly established power systems. This benefit mirrors outcome 2 in the grants' logical frameworks. The economic benefit of this outcome is quantified as the increased consumer surplus of the increased access to electricity (as measured through a Willingness to Pay (WtP) methodology). Another benefit stream that appears consistently in all the economic rate of return (ERR) calculations is a resource cost savings benefit, measured by the decrease in consumer expenditure on electricity from the new RE sources compared to status quo sources like kerosene or diesel generators. This substitution is not explicitly linked to any of the four grant outcomes, although it is an implicit mechanism for the increased household income and decreased GHG emissions cited as the overall objective and impact of the grants.

In the case of W3A Akuo Energy Solar/Micro-Hydro, Berau, there are additional benefit streams in the CBA to reflect increased income for honey and boat production and additional resource cost savings on ice for storage of caught fish. These benefits are linked to outcome 4 of the grant logic, which involves productive uses of the increased electricity supply. Although these benefits are between ten and fifty times the magnitude of the standard resource cost saving benefit from substitution of the source of electricity, they still pale in comparison to the increased consumer surplus benefit. After adding these to the WtP benefit, the overall 20-year ERR only increases from 24.5 percent to 25.0 percent.

Table 3: ERR for each of the Window 3A Grants

Grant	20-year ERR (standard benefits)	20-year ERR (total)
W3A Akuo Energy Solar, Berau	24.50 percent	25.03 percent
W3A Anekatek Solar, East Sumba	19.45 percent	19.45 percent

[26] Q5 Technical Report (January-March 2017), pgs. 48-49
[27] This section only describes the ERRs to which SI had access as of November 30, 2018.

As of November 2018, SI does not have access to ERR calculations for the case study grants.

2.4 Literature Review

As the majority of the scope of this portfolio evaluation will be devoted to evaluating the two Window 3A grants using an impact and pre/post performance evaluation methodology, this literature review mostly reflects existing literature that is related to those grants' theories of change. Some of this literature is broadly applicable, however, such as the general overview of the impacts of rural electrification on rural development.

2.4.1 Summary of Existing Evidence

Micro-grids play a crucial role in efforts to provide universal access to electricity by 2030 around the world, as proclaimed by the United Nations (UN) initiative Sustainable Energy for All (SE4All) and the Sustainable Development Goal 7. The International Energy Agency (IEA) estimates that 42 percent of the additional electricity generation capacity to reach universal access can most economically be achieved through micro-grids (IEA 2010[28]).

The academic literature is inconclusive about the impacts of rural electrification on rural development, and there are only few rigorous studies to provide compelling evidence. For example, in India, Bangladesh, and Vietnam respectively, Van de Walle et al. (2015)[29], Khandker, Barnes, and Samad (2012)[30], and Khandker, Barnes, and Samad (2013)[31] find evidence for positive effects on job market indicators, household income, and educational performance as a result of electrification. Parikh et al. (2015)[32] find positive effects in particular for women from infrastructure provision, including electricity, in Indian slums on literacy, income and health. Grimm, Sparrow and Tasciotti (2015)[33] and Peters and Vance (2011)[34] show that electrification contributes substantially to the fertility decline in Indonesia and Côte d'Ivoire respectively. In addition, some positive evidence on firm productivity comes from India, Kenya, Nicaragua, and South Africa (Rud, 2012[35]; Gibson and Olivia, 2010[36]; Kirubi et al., 2009[37]; Grogan and Sadanand, 2013[38]).

There is, however, a set of more sobering findings. While research indicates that lighting is a high priority for people and is in fact used also for purposes considered to be beneficial from a development perspective, impacts on productive activities, however, are often much less pronounced than expected (Bernard, 201[39];

[28] Birol, F. (2010). World energy outlook 2010. International Energy Agency, 1(3).
[29] van de Walle, D., Ravallion, M., Mendiratta, V., & and Koolwal, G. (2015). Long-term impacts of household electrification in rural India. World Bank Economic Review, forthcoming.
[30] Khandker, S. R., Barnes, D.F. & Samad, H.A. (2012). The Welfare Impacts of Rural Electrification in Bangladesh. The Energy Journal, 33(1), 187.
[31] Khandker, S. R., Barnes, D.F. & Samad, H.A. (2012). The Welfare Impacts of Rural Electrification in Bangladesh. The Energy Journal, 33(1), 187.
[32] Parikh, P., Fu, K., Parikh, H., McRobie, A., & George, G. (2015). Infrastructure Provision, Gender, and Poverty in Indian Slums. World Development, 66, 468-486.
[33] Grimm, M., Sparrow, R., & Tasciotti, L. (2015). Does electrification spur the fertility transition? Evidence from Indonesia. Demography, forthcoming.
[34] Peters, J., & Vance, C. (2011). Rural Electrification and Fertility – Evidence from Côte d'Ivoire. Journal of Development Studies, 47 (5), 753-766.
[35] Rud, J.P. (2012). Electricity provision and industrial development: Evidence from India. Journal of Development Economics, 97(2), 352–67.
[36] Gibson, J., & Olivia, S. (2010). The effect of infrastructure access and quality on non-farm enterprises in rural Indonesia. World Development, 38(5), 717-726
[37] Kirubi, C., Jacobson, A., Kammen, D. M., & Mills, A. (2009). Community-based electric micro-grids can contribute to rural development: evidence from Kenya. World Development, 37(7), 1208-1221.
[38] Grogan, L. & Sadanand, A. (2013). Rural Electrification and Employment in Poor Countries: Evidence from Nicaragua. World Development, 43(0), 252–265.
[39] Bernard, T. (2012). Impact Analysis of Rural Electrification Projects in Sub-Saharan Africa. World Bank Research Observer, 27(1), 33–51.

Peters, Vance and Harsdorff, 2011[40]; Neelsen and Peters, 2011[41]; Grimm, Hartwig and Lay, 2013[42]; Banerjee et al., 2011[43]; Lenz et al., 2017[44]; Peters et al., 2013[45]; Peters and Sievert 2015[46]; Oakley et al., 2007[47]; Obeng and Every, 2010[48]). A recent large-scale evaluation of a rural electrification program in Tanzania[49], for example, finds reductions in some traditional energy source uses and positive effects on land prices and lighting usage as proxies for well-being. However, there are no impacts on non-agricultural employment or firm creation. The reason is often that in most rural areas electricity is not the only bottleneck that impedes business development. In the absence of roads and market access, electricity can only be used for productive purposes that serve the local demand, which is often small. Moreover, households and enterprises in rural areas typically have a very low ability to pay. As a result, typical household electricity demand is very low (see for example D'Agostino et al. 2016[50]; Grimm and Peters 2016[51]; Bensch et al. 2016[52]). Electricity in rural areas is often only used for lighting, charging mobile phones and operating radios and sometimes TV (television)-sets (see for example IEG 2008[53], Lenz et al., 2017[54]).

The impacts of electrification on GHG emissions and the environment depends on the source of electricity that is supplied and the initial energy sources that are being replaced. Currently, RE sources make up between 15 percent and 20 percent of the world's total energy demand. In the case of solar PV and micro-hydro plant installation, the energy provided is from non-depletable fuels solely and consumption does not emit GHG (Akella et al., 2009)[55]. The more these new systems replace initial reliance on oil, coal, and natural gas, the better the environmental impacts of the intervention. One example is dry-cell batteries and light emitting diode (LED) lamps, which have replaced kerosene in many parts of the developing world (see Bensch, Peters and Sievert 2017[56]). Electrification can hence help to reduce e-waste in rural areas. Furthermore, high emission reductions can in particular be expected when rural households replace diesel-driven machinery use or

[40] Peters, Jörg, Colin Vance, and Marek Harsdorff. 2011. "Grid Extension in Rural Benin: Micro-Manufacturers and the Electrification Trap." World Development, 39(5): 773–83.
[41] Neelsen, Sven and Jörg Peters. 2011. "Electricity usage in micro-enterprises — Evidence from Lake Victoria, Uganda." Energy for Sustainable Development, 15(1): 21–31.
[42] Grimm, M., Hartwig, R. & Lay, J. (2013). Electricity Access and the Performance of Micro and Small Enterprises: Evidence from West Africa. European Journal of Development Research, 25, 815-829.
[43] Banerjee, S. G., A. Singh, and Samad, H. (2011). Power and people : the benefits of renewable energy in Nepal. Washington D.C., World Bank.
[44] Lenz, L., A. Munyehirwe, J. Peters und M. Sievert. 2017. Does Large Scale Infrastructure Investment Alleviate Poverty? Impacts of Rwanda's Electricity Access Roll-Out Program. World Development 89 (17): 88-110.
[45] Peters, J., M. Sievert and C. Vance (2013), Firm Performance and Electricity Usage in Small Manufacturing and Service Firms in Ghana. In: Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH (ed.), Productive Use of Energy – PRODUSE - Measuring Impacts of Electrification on Small and Micro-Enterprises in Sub-Saharan Africa. Eschborn: Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH. 75-94
[46] Peters, J., & Sievert, M. (2015). The provision of electricity to rural communities through Micro-Hydro Power in rural Indonesia: Micro Hydro Power pilot programme within the national programme for community development (PNPM) supported by the Netherlands through energising development (No. 88). RWI Materialien
[47] Oakley, D., P. Harris, et al. (2007). Modern energy - Impact on micro-enterprise. A report produced by the Department for International Development. R8145. DFID. AEA Energy and Environment. March 2007.
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[49] Chaplin, D., Mamun, A., Protik, A., Schurrer, J., Vohra, D., Bos, K., ... & Cook, T. Grid Electricity Expansion in Tanzania by MCC: Findings from a Rigorous Impact Evaluation, Final Report (No. 144768f69008442e96369195ed29da85). Mathematica Policy Research.
[50] D'Agostino, A.L., Lund, P.D. and Urpelainen, J., 2016. The business of distributed solar power: a comparative case study of centralized charging stations and solar microgrids. Wiley Interdisciplinary Reviews: Energy and Environment.
[51] Grimm, M., & Peters, J. (2016). Solar off-grid markets in Africa. Recent dynamics and the role of branded products. Field Actions Science Reports. The journal of field actions, (Special Issue 15), 160-163.
[52] Bensch, G., Grimm, M., Huppertz, M., Langbein, J., & Peters, J. (2016). Are promotion programs needed to establish off-grid solar energy markets? Evidence from rural Burkina Faso (No. 653). Ruhr Economic Papers.
[53] Independent Evaluation Group (IEG). 2008. The Welfare Impacts of Rural Electrification – An IEG Impact Evaluation. Independent Evaluation Group, World Bank.
[54] Lenz, L., A. Munyehirwe, J. Peters und M. Sievert. 2017. Does Large Scale Infrastructure Investment Alleviate Poverty? Impacts of Rwanda's Electricity Access Roll-Out Program. World Development 89 (17): 88-110.
[55] Akella, A.K. 2009. Social, economical and environmental impacts of renewable energy systems. Renewable Energy 34: 390–396
[56] Bensch, G., J. Peters und M. Sievert (2017), The lighting transition in rural Africa — From kerosene to battery-powered LED and the emerging disposal problem. Energy for Sustainable Development 39 : 13-20.

biomass-based cooking and heating by electric appliances. Biomass use for cooking and heating is a major cause of climate-relevant emissions (for example Shindell et al., 2012[57]; Ramanathan & Carmichael 2008[58]; Bailis et al. 201[59]). While typically electricity is rarely used for cooking in developing countries, in Asia the use of electric rice cookers is very common.

There are very few rigorous studies on the sustainability of micro-grid programs, partly because only few examples of sustainably working micro-grid programs exist that have matured beyond the installation of just a model micro-grid. There are a few potential reasons for low sustainability. First, institutional and political challenges often impede cost-covering electricity consumption tariffs that would make investments into micro-grids attractive. In most countries, rural electricity tariffs - even for the national grid - are not cost recovering (see Trimble et al. 2016[60]), but highly subsidized by governments or in the best-case cross-subsidized by urban consumers. Accordingly, typically regulatory bodies or the incumbent utility will not readily approve higher tariffs that are needed to make micro-grids cost covering (Peters and Sievert, 2015[61]). In addition, payment enforcement may be hampered by low ability to pay (D'Agostino et al. 2016[62]) and irregular, seasonal income flows that are typical among agriculture-reliant populations. Furthermore, there may be a low willingness-to-pay, as the costs of renewable energies (solar, hydro, wind) are not directly visible for the population given its local generation (as compared to, for example, the case of generators).

Mini-grids can be operated by public-private partnerships or by communities. For micro-grids operated by the community, the two key challenges are tariff setting and payment enforcement (Peters and Sievert 2015[63]). Incentives and obstacles to enforce payment rigorously are different for a community member than for outsiders working for a commercial operator. Most importantly, social entanglements may complicate rigorous enforcement. In theory, the same mechanism can also work the other way around, where social cohesion might lead people to feel more obliged to pay their contributions. Lastly, payment for operational staff may seem dispensable in rural subsistence communities where paid labor is rather an exception than the rule. This, again, may lead to too low tariffs and bad payment discipline.

2.4.2 Gaps in Literature

This evaluation can provide evidence on three gaps in the literature. In particular, three design features of the Window 3A projects are highly interesting from a global learning point of view.

First, as outlined above, despite high costs attached to electrification, there is generally no consensus on the impacts of electrification on rural development, and less so for the case of micro-grids. Given that micro-grids play an important role in the SE4ALL goal of universal electricity access, evidence is highly required.

[57] Shindell, D., Kuylenstierna, J. C., Vignati, E., van Dingenen, R., Amann, M., Klimont, Z., ... & Schwartz, J. (2012). Simultaneously mitigating near-term climate change and improving human health and food security. Science, 335(6065), 183-189.
[58] Ramanathan, V., & Carmichael, G. (2008). Global and regional climate changes due to black carbon. Nature geoscience, 1(4), 221.
[59] Bailis R., Drigo R., Ghilardi A. and O. Masera (2015). The carbon footprint of traditional woodfuels. National Climate Change 5:266–72
[60] Trimble, Christopher Philip; Kojima, Masami; Perez Arroyo, Ines; Mohammadzadeh, Farah. 2016. "Financial viability of electricity sectors in Sub-Saharan Africa : quasi-fiscal deficits and hidden costs". World Bank Policy Research Working Paper.
[61] Peters, J., & Sievert, M. (2015). The provision of electricity to rural communities through Micro-Hydro Power in rural Indonesia: Micro Hydro Power pilot programme within the national programme for community development (PNPM) supported by the Netherlands through energising development (No. 88). RWI Materialien
[62] D'Agostino, A.L., Lund, P.D. and Urpelainen, J., 2016. The business of distributed solar power: a comparative case study of centralized charging stations and solar microgrids. Wiley Interdisciplinary Reviews: Energy and Environment.
[63] Peters, J., & Sievert, M. (2015). The provision of electricity to rural communities through Micro-Hydro Power in rural Indonesia: Micro Hydro Power pilot programme within the national programme for community development (PNPM) supported by the Netherlands through energising development (No. 88). RWI Materialien

Second, a comparison of different micro-grid management or financing systems does not exist in the literature. The only examination has been done in Indonesia for non-private micro-grids run by the community and fully subsidized by the government (see Peters and Sievert 2015[64]). Evidence on the impacts of the management system on the sustainability of micro-hydro plants is not available and, more concretely, there is no understanding of the dynamics that may hamper or foster payment enforcement among local customers and O&M practices among the local community operators.

Third, there is no study that assesses the impact of providing electricity access paired with productive use promotion. The exception is one study on microfinance and electricity (Khandker and Koolwal (2010[65]). Given high impact expectations from electrification and productive use aspirations, but often limited income effects in practice, learning on combined interventions is highly relevant. The trainings on productive use, as provided by the Window 3A projects, in conjunction with electricity provision therefore serve as a unique opportunity to fill this gap.

2.4.3 Policy Relevance of the Evaluation

The electrification rate in Indonesia has been increasing at a steady pace, expanding from approximately 43 percent in 1995 to 84 percent in 2015[66]. There are, however, great disparities in electricity access across regions, ranging between 36.4 percent in Papua and 100 percent in Jakarta. Generally, electrification is disproportionately provided in the centers of Java and Bali, while the eastern provinces are characterized by the lowest electrification rates. In 2012, the provinces East Kalimantan (W3A Akuo Energy Solar/Micro-Hydro, Berau) and East Nusa Tenggara (W3A Anekatek Solar, East Sumba) had electrification rates of 64 and 44 percent respectively, lagging behind the average electrification rate of 75 percent of that year.

The country has an installed electricity generating capacity of 51.92 GW (gigawatts), of which the vast majority is generated from fossil fuels (83.2 percent), with coal being the predominant type of fossil fuel. 11 percent of the capacity is generated by hydroelectric plants. The remaining 5.8 percent comes from other renewable sources.[67] The country produces high levels of GHG emissions. The use of fossil fuels, in particular in the power sector and transportation, is expected to more than double the country's energy-related CO_2 emissions in the coming 25 years, rising to more than 800 million tons by 2035.[68]

The GoI political agenda pursues as major objectives the increase in electricity access, an expansion of RE use and green growth. The country was one of the first to ratify the United Nations Framework Convention on Climate Change and to adopt the Kyoto Protocol[69]. The *National Energy policy* (KEN) aims at increasing the country's usage of new and RE from 4 percent of all energy usage in 2011 to 23 percent by 2025 and 31 percent by 2050[70]. Simultaneously, the *2015-2019 National Medium Development Plan* sets the goal of

[64] Peters, J., & Sievert, M. (2015). The provision of electricity to rural communities through Micro-Hydro Power in rural Indonesia: Micro Hydro Power pilot programme within the national programme for community development (PNPM) supported by the Netherlands through energising development (No. 88). RWI Materialien
[65] Khandker, S.R., Koolwal, G.B. (2010) How Infrastructure and Financial Institutions Affect Rural Income and Poverty: Evidence from Bangladesh. Journal of Development Studies, Vol. 46 (6), p.1109–1137
[66] https://www.cia.gov/library/publications/the-world-factbook/geos/id.html
[67] Tharakan, Pradeep. "Summary of Indonesia's Energy Sector Assessment." Www.adb.org, Asian Development Bank, 10 Nov. 2017, www.adb.org/publications/summary-indonesias-energy-sector-assessment. pg.8
[68] Tharakan, Pradeep. "Summary of Indonesia's Energy Sector Assessment." Www.adb.org, Asian Development Bank, 10 Nov. 2017, www.adb.org/publications/summary-indonesias-energy-sector-assessment..9
[69] ESDM. "ESDM - Kementerian Energi Dan Sumber Daya Mineral Republik Indonesia." *ESDM*, ESDM, www.esdm.go.id/.
[70] Tharakan, Pradeep. "Summary of Indonesia's Energy Sector Assessment." Www.adb.org, Asian Development Bank, 10 Nov. 2017, www.adb.org/publications/summary-indonesias-energy-sector-assessment.pg.31

reaching an electrification rate of 96.6 percent by the end of 2019 with a particular focus on disadvantaged communities and remote, undeveloped regions.[71] In an attempt of bringing together these multiple goals, the GOI and the state electricity company PLN have launched several rural electrification plans. Among them stands out the longer-term solar development plan *Thousand Islands Program,* which aims at expanding the solar installed capacity to 620 MW (megawatts) by 2020[72].

However, the government faces several challenges in reaching the remaining 16 percent of its population that lacks electricity access. This population group is the most costly and timely and technically more difficult to serve, given the lower population density and ability to pay. Moreover, the mountainous topography of the archipelagic nation represents a challenge for the expansion of electricity access. Electricity supply in the provinces East Kalimantan (W3A Akuo Energy Solar/Micro-Hydro, Berau) and East Nusa Tenggara (W3A Anekatek Solar, East Sumba) is particularly costly[73].

Concerning off-grid electrification programs, the ADB[74] summarizes the experience made by PLN and several governmental agencies to be "mixed at best". Private sector efforts are small in number and are described as ad hoc. In addition, they seem to be hindered by project-specific regulatory requirements. Off-grid efforts by line ministries and regional governments (Pemerintah Daerah) often only fund initial installation of plants, but do not ensure financial and technical sustainability, resulting in high failure rates. PLN would be better placed to assure sustainability, but has little experience with renewable technologies, is in a bad financial situation and has a high workload in conventional grid extension.

As a result, many initial attempts of the *Thousand Islands Programs* have been delayed due to financing or technical difficulties. The following problems have been encountered in the implementation of off-grid electrification projects:

- Failure to assess full present and future electricity needs of the target population
- Poor design, materials and workmanship, compromising technical performance and sustainability
- Lack of financing mechanisms to trigger payment discipline among customers to finance O&M
- Lacking human resources to operate and maintain the plants
- Pricing that is inconsistent with ability to pay of the target population
- Limited scale-up opportunities due centralized focus on PLN and too little mobilization of local governments, NGOs, the private sector, and community.

The Window 3A project approaches coincide largely with current and future (governmental) efforts of providing electricity to the remaining unconnected 16 percent of the Indonesian population, which are characterized by residence remoteness, low ability to pay, and limited productive activities. Thereby, the projects and the evidence that Window 3A project create on sustainability and worthwhileness are relevant and timely. In addition, the project design incorporates several features to tackle past challenges in sustainable off-grid

[71] Current policies in the RE sector include the Ministerial Decree No.38/2016, which aims at expediting electricity access in remote Indonesia. However, the Ministerial Decree No. 12/2017 by the Ministry of Energy and Mineral Resources regulates tariffs of electricity generated from RE, and Decree No. 4 and 5/2017 by the Ministry of Industry set quality requirements for the content of solar PV modules. Both may hamper investments into RE (see https://d2oc0ihd6a5bt.cloudfront.net/wp-content/uploads/sites/837/2017/06/ACEF-2017-Session-18-Info-sheet-02-06-2017.pdf)

[72] Asian Development Bank. "Achieving Universal Electricity Access in Indonesia." *Www.adb.org*, Asian Development Bank, 2016, www.adb.org/sites/default/files/publication/182314/achieving-electricity-access-ino.pdf. pg.35

[73] Asian Development Bank. "Achieving Universal Electricity Access in Indonesia." *Www.adb.org*, Asian Development Bank, 2016, www.adb.org/sites/default/files/publication/182314/achieving-electricity-access-ino.pdf. pg.46

[74] Asian Development Bank. "Achieving Universal Electricity Access in Indonesia." *Www.adb.org*, Asian Development Bank, 2016, www.adb.org/sites/default/files/publication/182314/achieving-electricity-access-ino.pdf. pg.46

electricity provision outlined above. First, the community-based operation approaches (Evaluation Question [EQ] 4: Special Purpose Vehicles and the primary-secondary cooperative scheme) may serve as examples of how to trigger payment discipline, thereby financing O&M and assuring sustainability of the plants. Second, the implementation of income generating trainings (EQ 2) might represent a positive example of complementary activities to unlock growth potentials of electrification interventions. Based on these experiences, learnings from this evaluation may inform the design of a (still lacking) coordinated, sound policy instrument to foster sustainable off-grid provision in rural areas. Third, this evaluation will provide evidence on electricity consumption patterns in the typical unconnected areas (EQ 1), which can improve assessment of present and future electricity needs of the unconnected 16 percent of the population. Lastly, an assessment of off-grid electrification impacts on households, GHG emissions (EQ 3) and the local economy can confirm or adjust theoretical impact expectations, and provide evidence on potential bottlenecks to unlock them in practice.

3 EVALUATION DESIGN

3.1 Evaluation Questions

Taken as a whole, this evaluation aims, to the extent possible, to validate the program logic underlying the portfolio of CBOG RE grants in the GP Grant Facility and investigate the different approaches grants use to render their outcomes sustainable over time. It will do so through a focused investigation of six specific grants spanning two regencies: W3A Anekatek Solar, W1 Hivos Biogas/Solar, and W2 IBEKA micro-hydro in East Sumba and W3A Akuo Energy Solar/Micro-Hydro, W2 IBEKA Solar, and W2 PEKA Solar in Berau.

3.1.1 Window 3A Evaluation Questions

The component of this portfolio evaluation dedicated to the Window 3A grants will simultaneously aim to measure impacts and compare and contrast how the W3A Anekatek Solar, East Sumba and W3A Akuo Solar/Micro-Hydro, Berau grants operate. At baseline, conducted in October and November 2017, the evaluation sought to characterize baseline conditions of outcomes of interest and important contextual factors for program success through quantitative and qualitative means that ultimately allow for a rigorous validation of program logic and comparative study of approaches. The evaluation is guided by four primary questions:

1.) How have energy consumption patterns changed among beneficiary households and businesses in response to the provision of a renewable source of electricity?
    a. What are the implications of these changes for household expenditures?
2.) Has the electricity provided through the RE infrastructure been used for economic purposes at the community or household level?
    a. Has the productive uses/profit-generating component of the grant been effective; and has it helped the SPV be sustained?
3.) To what extent do any changes in energy consumption patterns favor reduced GHG emissions?
    a. Are there any other ways in which the grants contribute to the objective of reducing or avoiding GHG emissions?
4.) Has the Special Purpose Vehicle been an effective intervention to improve community buy-in and sustainability of the infrastructure?

Our baseline contributed to this effort by validating the logic that is underlying two typical Window 3A grants' approaches to increasing household income and reducing GHG emissions via the increased utilization of electricity generated from renewable sources. Two follow-up data collection periods will allow us to monitor these conditions and report on program outcomes and impacts in the near- and long-term. As the program documentation for these grants permits a detailed understanding of their theories of change and community ownership models, we can monitor the veracity of their assumptions as challenges emerge over time.

We will analyze and present results both within and across the grants included in the evaluation to identify patterns or differences. However, since the evaluation design and contextual factors will also vary across grants, we will note where attribution of evaluation findings may be more heavily confounded (in a simple, treatment-only pre/post comparison vs. a quasi-experimental, counterfactual-based comparison, for example).

3.1.2 Case Study Evaluation Questions

In contrast with the Window 3A evaluation questions, which take "planned" theories of change, models for sustainability, and outcomes as a given input, the case study evaluation questions essentially seek to understand the planned and actual versions of these concepts in the near-term following program implementation:

1) **Theory of Change:** How did each grant intend to deploy renewable energy resources in target communities? How did each intend for target communities, households, and enterprises to use the new renewable energy source(s)?
    a. Were these intents achieved or not? Why, or why not? If not, does it appear that the original theory of change could be plausible in other circumstances? (e.g. with what we know post-implementation, do these ToCs seem valid or are there important missing elements?)
    b. How, if at all, did the grants' theories of change diverge in their hypothesized mechanisms to reach shared outcomes? (e.g. if grants had the same outcomes in mind, did they have the same strategy for achieving these outcomes or did they use different approaches?)

2) **Sustainability:** How did the grants approach achieving sustainability of the RE infrastructure in each community? What are the relative advantages and disadvantages of these approaches (SPV, RESCO, village-owned enterprise, etc.), given the geographic and social settings in which they were deployed? What lessons can be learned from these approaches for future off-grid RE programming?
    a. Were there any ways that productive uses of renewable energy were intrinsically linked with the model for achieving sustainability?

3) **Outcomes:** What changes do households, enterprises, and leaders in target communities perceive to be caused by grant outputs? Do these changes map onto planned outcomes for the grants? Do perceived outcomes appear to be consistent with quantitative changes observed in the Akuo and Anekatek grants? Do perceived outcomes vary across different RE technologies, different management arrangements, or different geographic settings?
    a. What are the different ways that RE outputs are being used for productive purposes?
    b. Are there any other ways that RE outputs are being used aside from domestic or commercial/productive use (e.g. use in public facilities)?
    c. Were there any perceived outcomes from grant outputs that targeted improvements in RE-related knowledge, market demand, or other social themes?

3.2 Evaluation Design Overview

It is not possible due to financial, logistical, and technical constraints to include all 26 CBOG RE grants in the scope of an evaluation meant to characterize the portfolio's achievements and lessons learned. We begin this overview by briefly justifying the selection of the six grants included in this portfolio evaluation (section 3.2.1). Then, since the Window 3A and case study components of this portfolio evaluation will have separate methodologies to reflect their separate guiding questions, we will provide an overview of their respective designs in sections 3.2.2 (Window 3A) and 3.2.3 (case study).

3.2.1 Justification for Selected Grants

In choosing which grants to include at minimum in this portfolio evaluation, we placed the highest emphasis on which grant would lend itself the most to an impact evaluation design, since such a design is essential to providing valid quantitative evidence of attribution of program outcomes and impacts. On this question W3A Anekatek Solar, East Sumba was the only suitable candidate. All of the Window 3A grants, as described above and in Annex 4: Project Descriptions of Non-Selected Grants, targeted whole villages in a way that made a household-level comparison group impractical. As such, any grant that could be evaluated with a comparison group design needed to provide adequate treatment clusters with similar control clusters nearby. Since W3A Anekatek Solar, East Sumba is operating in eleven sub-village units with comparable analogs in geographic proximity, we selected it as the subject of our impact evaluation. The other Window 3A grants were either providing treatment to all villages on an island, to fewer communities, and/or to relatively unique communities with few options for similar comparisons nearby.

The utilization of an SPV approach for community engagement and sustainability of program outputs is a fundamental aspect of the design of the Window 3A grants. Any evaluation of the GP Facility's approach to community-scale RE programming must evaluate the extent to which the SPV approach contributes to the achievement (or lack thereof) of program outcomes. This approach differs in specific details and contextual factors from grant to grant, so we selected the remaining grant with the most compelling potential narratives in terms of community engagement for a pre/post performance evaluation to combine with the impact evaluation of W3A Anekatek Solar, East Sumba.

On this count, all of the other grants have merits. However, W3A Akuo Energy Solar/Micro-Hydro, Berau has a variety of factors that will make for interesting qualitative comparison. First, it has a diverse set of villages for implementation that have varying degrees of history with community cooperatives and distinct socio-economic backgrounds. Second, the grant includes a micro-hydro component—albeit quite small in the context of the capacity provided by the Solar PV facilities—that may provide for interesting comparisons with community management of Solar PV components alone. Finally, it is in a different geographic area from W3A Anekatek Solar, East Sumba, allowing for a comparative study of how similar program logic applies in different geographic contexts. By investigating process, outcomes, and sustainability across these two grants, we can qualitatively explore a variety of factors that mediate results and sustainability.

The four grants selected for *ex post* case studies were selected by MCC due to the potential to assess the theories of change, models for sustainability, and perceived outcomes of grants that employed different RE technologies and/or different approaches to achieving sustainability in similar geographic and socioeconomic contexts to the two pre/post grants. Thus, two of the grants selected for case studies were implemented in Berau and two were implemented in East Sumba.

3.2.2 Window 3A Evaluation Design

The portion of our portfolio evaluation targeting Window 3A grants incorporates two major components seeking to validate key quantitative and qualitative tenets of the Window 3A program logic. The first component is an impact evaluation of grant W3A Anekatek Solar, East Sumba, which will include a pre/post, large-scale quantitative exercise designed to respond to evaluation questions 1-3 and a qualitative exercise to provide depth on evaluation questions 1-3 and respond fully to evaluation question 4. The quantitative exercise will be

a rigorous, quasi-experimental evaluation that collects primary data on outcomes of interest and important contextual factors in treatment as well as comparison areas of East Sumba. The impact evaluation will use a matching methodology and difference-in-differences analysis to construct a valid counterfactual. The qualitative exercise will cover both treatment and control areas, focusing mainly on actors involved in or affected by the SPV approach to community engagement and ownership. It will utilize key informant interviews and focus group discussions, analyzed through rigorous coding and triangulated by the quantitative data.

The second component is a pre/post performance evaluation of W3A Akuo Energy Solar/Micro-Hydro, Berau including a duplicate of the household survey utilized in East Sumba to provide non-experimental, quantitative information in response to evaluation questions 1-3 and qualitative data collection to provide depth on these and respond fully to evaluation question 4. The scope of this performance evaluation will focus on treatment areas alone. As with the qualitative component of the W3A Anekatek Solar, East Sumba component, the performance evaluation will utilize key informant interviews and focus group discussions, analyzed through rigorous coding and triangulated by the quantitative data.

We propose to conduct two follow up data collection periods for each of these components—one occurring twelve to sixteen months after the mini-grids were commissioned[75] and another occurring two and a half to three years after they were commissioned. The justification for the first follow up is that it will allow for measurement of outcomes expected to manifest in the short- and medium-term (such as increased energy consumption and decreased expenditure) without risking contamination of the control group by electrification efforts conducted by other actors in East Sumba. Meanwhile, the second follow up will capture longer-term outcomes and allow more time for challenges to arise to project sustainability that may not be captured after only one year. At MCC's request, the following new components will be added to interim and endline data collection:

1. We will assess and report on the risk of PLN grid extension into treatment or comparison communities during or following interim and endline data collection. If there are any villages to which PLN has extended its grid prior to our interim and endline data collection, we will administer a new household survey module that allows for a comparison of outcomes between households supplied with PLN grid electricity and households supplied with off-grid electricity from the grants.[76]
2. We will assess the post-compact financial sustainability of the new off-grid RE plants by:
    a. Analyzing PLN's fuel mix in the intervention areas to determine whether there has been a change to the fuel mix.
    b. Comparing PLN's cost of service to the grid to the cost of service of the off-grid RE plants to determine whether the utility's cost of service or production is higher than that of the off-grid RE plants.[77]

[75] The original plan for interim data collection was for it to occur eight to twelve months after the mini-grids had been commissioned (depending on the kampung). The justification for the revision to sixteen months following baseline data collection will be discussed in the Challenges & Limitations section (3.5)

[76] See updated questions 31-67 of the household questionnaire. These will be applied regardless of treatment status.

[77] MCC notes that "the tariffs for the low voltage connections used by almost all rural households are extremely low. Given this PLN tariff structure, if the cost of solar power exceeds $0.05/kWh, then a cost reflective tariff for solar power will most likely not be attractive to household end users. This suggests that the compact-funded investment will not be commercially viable unless PLN agrees to purchase power from the SPV at a sustainable tariff level. The fact that the cost of service to the PLN grid might be higher than the cost of solar power is not sufficient evidence that PLN will purchase solar power at a sustainable tariff level."

Table 4 demonstrates how the evaluation's two initial major components will collectively serve as the foundation for responding to the four Window 3A evaluation questions.

Table 4: Window 3A Evaluation Design Overview

EQ	Key Outcomes	Data source, location	Data type
1	Household and enterprise energy consumption (by source), energy expenditures	Household survey, Quant. Community KII/FGD, Qual. Enterprise Survey, Quant. Enterprise KII, Qual.	Quantitative, Qualitative
2	Productive uses of electricity, occupational and transformed agricultural income, employment	Household survey, Quant. SPV KII protocols, Qual. Community KII/FGD, Qual. Enterprise Survey, Quant. Enterprise KII, Qual.	Quantitative, Qualitative
3	Greenhouse gas emissions	Household survey, Quant. Gov. official KII, Qual. Grantee KII, Qual.	Quantitative, Qualitative
4	Capabilities of SPV members, sustainable operation of facilities	All qualitative instruments	Qualitative
4	Risk/effects of PLN extension, sustainability of respective tariffs	PLN/Mini-grid Manager Form[78]	Qualitative, Quantitative

We note that while the qualitative instruments for the Window 3A grants studied at baseline primarily served to help inform quantitative instruments and provide perspective on the likelihood for outcomes and sustainability to be realized, their purpose will shift at interim and endline data collection to provide explanatory depth and qualitative color to quantitative findings. So, although the targets of these instruments remain the same, the questions for interim and endline data collection will be modified. Some of these qualitative modifications must necessarily wait until quantitative data collection has been completed and trends have been analyzed.

3.2.3 Case Study Evaluation Design

Our case studies will entail one-shot, *ex post* data collection efforts coinciding with interim qualitative data collection for the Window 3A grants. Although our case studies will focus on the same three themes—theory of change, outcomes, and sustainability—instruments will be tailored to capture these themes as they apply within the framework of each grant. In each case, we will discuss the grants with grantees, program beneficiaries, and any local, regional, or national public or private entities with a stake in these themes. A specific list of targeted entities is included in Table 5, although these are subject to change as we learn more about grants from grantees.

[78] This is a new instrument for interim and endline data collection, see Annex 6.3.8

We will begin each case study by using the grantee protocol in Annex 6.3.9 to iteratively build an understanding of the planned state of each of these themes using program documentation and/or remote interviews with grantee staff. The purpose of field data collection will be to understand the "actual" or lived theory of change and outcomes based on interviews with a variety of stakeholders. Where this differs from the plan, we will probe to understand how and why this divergence took place. Generally, program beneficiaries (mostly households and enterprises/entrepreneurs) will be targeted for primary data collection through focus group discussions to discuss perceived program outcomes and the outlook for sustainability while the other stakeholders will be targeted through key informant interviews. The information from these FGDs and KIIs, where feasible, will be corroborated and/or contextualized through secondary documentation such as program records and strategic planning documents from PLN and/or government ministries. Detailed themes for each of these "types" of respondents are outlined in section 3.5.4.1.[79] The relative effort applied to investigating each of these themes will vary for each grant according to the core tenets of their theories of change—the case studies in Berau will focus more intensively on productive use as an anticipated outcome of renewable energy, while the case studies in East Sumba will focus more on the varying strategies for community ownership and management of RE assets in pursuit of sustainability.

In summary, we will use the grantee protocol to round out our understanding of the "planned" theory of change, anticipated outcomes, and sustainability approach for each grant. To the extent possible, we will try and obtain design, installation, and O&M documents for all RE assets in the grant. A draft protocol, which will be customized for each grant, is included in general form as Annex 6.3.9. The set of tools that will be used for fleshing out the actual state and outlook for each of these themes is in Table 5. For any of these that are held with entities responsible for the management of the assets funded by the grants, we will ask to include a tour of project facilities and assets in use to take photographs that can aid in the communication of their current use.

Table 5: Case Study Design Overview

Grant	EQ/Theme	Tool(s)
W2 Javlec Solar, Berau	1/Theory of Change	Fishermen FGD Plant Management Unit KII Factory Management Unit KII
	2/Sustainability	Plant Management Unit KII Factory Management Unit KII BUMK KII
	3/Outcomes	Fishermen/women FGD
W2 PEKA Solar, Berau	1/Theory of Change	Small Business Group FGD Trainee FGD BUMK KII
	2/Sustainability	BUMK KII
	3/Outcomes	Small Business Group FGD

[79] Full instruments will not be developed until "planned" theories of change, outcomes, and sustainability approaches can be confirmed with grantees to ensure that the instruments and content are mapped appropriately to key beneficiaries and stakeholders.

Grant	EQ/Theme	Tool(s)
		Trainee FGD
W2 IBEKA Micro-Hydro, East Sumba	1/Theory of Change	Household FGD Farmer FGD Public Facility FGD Community co-op KII
	2/Sustainability	Community co-op KII
	3/Outcomes	Household FGD Farmer FGD Public Facility FGD
W1 Hivos Solar/Biogas, Sumba/Sulawesi[80]	1/Theory of Change	Households FGD School Administrator KII Kiosk operator FGD RESCO KII
	2/Sustainability	RESCO KII
	3/Outcomes	Households FGD School Administrator KII Kiosk operator FGD
Overall	2/Sustainability	Provincial/Regional PLN KII National Ministry of Energy and Mineral Resources (ESDM) KII Provincial/Regional ESDM KII

3.3 Window 3A Quantitative Approach

3.3.1 Methodology

To answer evaluation questions 1-3 which seek to identify the impact of the RE installations, we compare the outcomes of individuals who have received increased access to electricity through RE sources against the counterfactual: the outcomes for these same individuals, if they had not received increased access to RE sources. Since it is not possible to directly observe the counterfactual, we need a mechanism to estimate it with as little bias as possible. The ideal method is to randomly assign participation among a sample of potential participants, creating a treatment and control group. Through random assignment, the treatment and control groups, on average, are expected to be similar along the characteristics affecting the outcome of interest. Hence, in the absence of the project, both groups would have the same expected outcome and any differences between the two groups after project implementation can be attributed to the project.[81]

For the grants we are evaluating, including Grant W3A Anekatek Solar, East Sumba, participation is not randomly assigned. Rather, sites were purposefully selected for installation of RE, as described above. One means of randomization would have been to randomly assign connections (or randomly offer discounted

[80] Due to feasibility constraints and at the suggestion of MCC, we will focus this case study component only on the school-based components of this grant, with particular focus on the solar lanterns. So, we will not discuss the grant with operators or beneficiaries of the biogas digester or solar agro-processing mill components.

[81] Assuming a well-run experiment without spillovers, differential attrition, Hawthorne effects, etc.

connection fees to generate random variation in connection status) to the micro-grids within selected villages. However, for political, logistical, and ethical reasons, nearly all households in selected communities will receive free connections to the micro-grid, with only very remote households not being offered a connection. Thus, SI will utilize a quasi-experimental approach which incorporates elements of statistical matching techniques and difference in differences (DiD) to estimate counterfactual outcomes and program impact for the W3A Anekatek Solar, East Sumba grant.

We propose to collect panel data from a sample of treatment and comparison households, with the evaluation sample identified using the following approach:

1.) **Identification of comparison kampungs:** Given that nearly all households in the 11 treatment kampungs will be electrified and the few that do not are systematically different, we must identify comparison households from other kampungs in the same desas or in nearby desas. To do this, we developed a sample frame of nearby kampungs that (1) had, like the treatment kampungs, been classified as suitable for a micro-grid according to a recent network planning activity conducted by the ADB (described below) and (2) based on discussions with key stakeholders, were not slated to receive electrification in the following year through other planned initiatives, including through Window 2 grants. From this sample frame, we used data on population size and geographic distance to identify a sample of 17 comparison kampungs. Comparison kampungs (relative to treatment kampungs) were oversampled in order to increase power (given the fixed and limited number of treatment kampungs), to generate a buffer in case a small number of comparison kampungs are electrified during the evaluation period, and to provide a larger pool of potential comparison units from which to draw matches.

2.) **Baseline data collection:** Within each treatment and comparison kampung we sampled, on average, 30 households, as described below in Section 3.3.3.

3.) **Match similar treatment and comparison households**: To generate the final sample of households for the evaluation, we will use statistical matching techniques to identify similar treatment and comparison groups. We will conduct two types of matching at the household level, Coarsened Exact Matching (CEM) and Propensity Score Matching (PSM), and select the matching technique which maximizes the comparability of the groups, statistical power of the comparison, and external validity. Given the potential for electrification in comparison areas, which would exclude the electrified community from the evaluation comparison sample frame, we recommend that final matching is conducted prior to follow-up data collection. However, we did present the results of a tentative matching exercise at baseline to illustrate how the groups can be made more comparable.

Follow up data collection with the final matched sample will be conducted once approximately sixteen months after the micro-grids are commissioned and then again thirty-six months after commissioning. As described below, we will then analyze the results using a DiD regression approach.

The initial selection of similar kampungs and matching of treatment and comparison households helps to reduce selection bias by minimizing differences along observed household and community characteristics measured at baseline. However, all matching methods rest on the Conditional Independence Assumption (CIA). That is, we assume that conditional on the vector of baseline characteristics used in matching, the

expected outcomes of the treatment and comparison groups are independent of the assignment, and selection bias is removed. However, the potential exists that unobserved variables will differ across the treatment and comparison group, thus violating the CIA. The DiD approach to analysis will serve to reduce the threats posed by unobservable differences between the households that do not vary over time.

Also, there is a tradeoff in CEM between the level of coarsening and power that is similar to the common support condition or assumption other matching approaches. With very fine coarsening of variables (separating them into higher numbers of strata), we increase the number of strata and reduce the likelihood of matches. This leads to pruning higher numbers of observations which reduces sample size and power and limits our ability to generalize to the full evaluation sample (or to those pruned observations). However, if we use only very loose coarsening of variables (separating them into fewer strata), we increase the likelihood of matches, preserving a larger proportion of the evaluation sample, but we risk retaining a greater degree of imbalance between treatment and comparison units. We propose a systematic approach to variable selection and degree of coarsening, as described below in the baseline analysis section, which optimizes the tradeoff between imbalance and power.

3.3.2 Timeframe of Exposure

Since the methodology employed to evaluate W3A Anekatek Solar, East Sumba will rely most critically on an appropriate timeframe of exposure to treatment, SI will select the timeframe of exposure on the basis of this grant. Commissioning of the Solar PV mini-grids funded by this grant was due to take place between November 3, 2017 and January 17, 2018, although we understand from baseline data collection that this schedule may have been delayed somewhat. In practice, commissioning likely occurred no later than the commissioning of the mini-grids for the W3A Akuo Energy Solar/Micro-Hydro, Berau grant in March of 2018.[82]

Based on discussions of historical implementation of similar programming in East Sumba, SI expects that beneficiaries will switch from baseline consumption sources (e.g. kerosene, diesel generators) soon after the commissioning of the new solar micro-grid facilities. In the past, it has taken longer for communities to innovate productive uses of new RE technology, but stakeholder interviews suggest initial manifestations of this (e.g. producing new goods/services, extending operating hours, etc.) should occur starting within three to six months of exposure to the program. More significant productive uses requiring capital investment (e.g. new equipment, workshops, etc.) may take years to manifest. Besides the exposure to treatment required for positive outcomes to manifest, it is additionally necessary to consider how long it would take for O&M or administrative challenges to occur that would put the sustainability of grant outputs at risk. The final consideration is the potential for contamination or electrification of comparison villages, which increases over time.

With these aspects in mind, SI originally suggested waiting one year to collect follow up data for the evaluation, allowing for 8-12 months exposure to the new electricity source (depending on the kampung). This would allow sufficient time for initial productive uses and/or operational challenges for the micro-grids to develop and be considered in the measurement of program outcomes. Additionally, this would allow for follow up data

[82] While SI received a final report to confirm the state of W3A Akuo Energy Solar/Micro-Hydro, Berau implementation as of March 2018, no such report was available for W3A Anekatek Solar, East Sumba. The commissioning dates cited are from an email with Castlerock Asia dated August 3, 2017.

collection events to occur during the same season, cancelling out any unobserved bias from seasonal effects on energy consumption and income. However, due to administrative delays, SI was unable to mobilize for interim data collection by November 2018. Instead, we will conduct interim data collection in March of 2019, which according to local sources is the nearest feasible time to collect data while avoiding peak weather disruptions that would make it incompatible to November. This interim data collection timing is equivalent to 12-16 months of exposure the new electricity source. We consider waiting longer than this for interim data collection to be inadvisable given the increasing risk of contamination of comparison kampungs over time. The rationale behind this decision and a discussion of alternatives can be found in section 3.3.4.2.

Given that sustainability and O&M concerns and opportunities for productive use become more pronounced over time, we will conduct endline data collection 2.5-3 years after commissioning (November 2020) to further investigate evaluation question 4 and observe longer-term outcomes of interest in the other evaluation questions. We anticipate that there will be significantly more wear on equipment over this timeframe, potential for competition with PLN or service provision, and time for communities to adapt and potentially make capital investments to take advantage of the new electricity source that will not be observable after only 12-16 months of exposure.

3.3.3 Study Sample

3.3.3.1 Sample unit

The quantitative portion of the evaluation will take a clustered approach, where individual sample units include households that are clustered into either “settlement aggregations” in East Sumba or villages/desa in Berau. For the most part, the settlement aggregations in East Sumba are sub-village units sometimes referred to as kampungs or RT. Occasionally, a settlement aggregation will encompass a whole village.

3.3.3.2 Sample size

The sample in East Sumba includes approximately 840 households (330 treatment and 510 comparison) clustered into 11 treatment settlement aggregations and up to 17 comparison settlement aggregations. The sample in Berau includes approximately 150 households clustered into 3 treatment villages.

3.3.3.2.1 Power Calculation and Assumptions

Given the clustered nature of the intervention and sample, data is collected from all 11 treatment settlement aggregations and 17 comparison settlement aggregations in East Sumba. To determine the number of households to sample in each settlement aggregation, we estimated the intra-cluster correlation (ICC) for key outcomes and then looked at the relationship between minimum detectable effect size (MDES) and cluster size at the estimated values of ICC. To estimate ICC, we used data from Castlerock’s baseline survey in the W3A Anekatek Solar, East Sumba target villages and calculate values ranging from 0.00 to 010 (see Table 6).

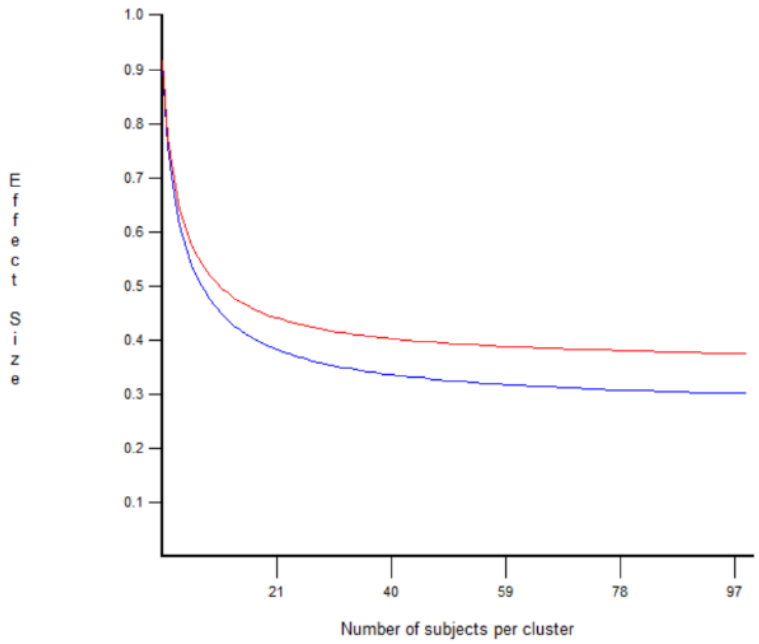

Figure 8: Relationship between cluster size and MDES

The graph in Figure 8 displays the relationship between cluster size and MDES using the highest estimated ICC values (0.06 and 0.10) as well as assuming 22 total cluster, power of 80 percent, Alpha (α)=0.05, and R-squared=0.2. Unsurprisingly, we find an inflection point around approximately 15 households with diminishing returns to power for additional households per cluster beyond that. Given this relationship and the fact that five of the eleven treatment kampungs have between 27 and 41 households, we recommended a sample size of approximately 25 households per cluster[83], which corresponds to an MDES of 0.37 and 0.43 for ICC values of 0.06 and 0.10, respectively. Based on the baseline data, this corresponds to an ability to confidently measure a change in monthly electricity expenditure of at least approximately 60,000 to 70,000 IDR or a change in electricity access of 1.52 to 1.77 hours per day.[84]

Table 6: Power Calculation Summary Statistics percent

Outcome	Mean	SD	ICC	MDES=0.35 (ICC=0.06)	MDES=0.41 (ICC=0.10)
Monthly electricity expenditure (IDR)	82,660.93	161,915.2	0.06	59,909	69.623
Monthly kerosene usage (liters)	1.73	32.93	0.00	12.18	14.16
Monthly kerosene usage for lighting only (liters)	0.43	2.06	0.02	0.76	0.88
Electricity access per day (hours)	3.23	4.12	0.10	1.52	1.77

To account for attrition and pruning during the CEM process, we proposed to inflate this sample by 20 percent at baseline, yielding a total baseline sample size of approximately 840 households in Sumba.

[83] Only 2 treatment kampungs have fewer than 25 households.
[84] The grant's CBA indicates that expected benefits include a 19,583 IDR per month reduction in energy expenditures and an increase in energy consumption of 39.19 kwh/month. We would be adequately powered to detect such a change in consumption, although we may not be adequately powered to detect changes in expenditure unless they exceed those predicted in the CBA.

Since our evaluation design in Berau does not include a counterfactual approach (e.g. we will not be making comparisons between a treatment and control group), there is no need to do a power calculation. The sample size of 150 households has been selected because this number would be adequate to pull representative samples from each village.

3.3.3.3 Sample frame

Since treatment units have already been selected by the grantee in East Sumba, the sample frame for W3A Anekatek Solar, East Sumba includes all 909 total households among the 11 treatment kampungs. To construct this sample frame, we requested a list of these households from the implementer.

For the comparison group, the sample frame includes all settlement aggregations in East Sumba that satisfy the following conditions:

1.) The Network Planner Activity of ADB TA 8287 indicates that the settlement aggregation was best suited for electrification via micro-grid or off-grid technology;
2.) The settlement aggregation does not include households that are currently connected to the PLN grid; and
3.) The settlement aggregation is not targeted by PLN for electrification until after September of 2018.

After selecting settlement aggregations from this sample frame, the household sample frame was constructed by requesting a list of all the households in each settlement aggregation.

The sample frame for household data collection in Berau includes all households that will be connected to the solar or micro-hydro micro grid. This includes 463 households among three villages. We requested a list of these households from the grantee.

In both kabupatens, the sample frame for enterprises was constructed by asking local officials upon arrival about the location of enterprises in each kampung.

3.3.3.4 Sampling strategy

For the evaluation of W3A Anekatek Solar, East Sumba, we use a **random sampling** strategy from the sample frame in treatment areas where settlement aggregations include over 25 households. Where settlement aggregations include fewer than 25 households, replacement households are selected randomly from other treatment settlement aggregations.

Since the objective of selecting comparison settlement aggregations is to match the treatment aggregations as closely as possible (and not to represent the entire sample frame of potential comparisons), settlement aggregations are selected using a **non-random method**. Specifically, we calculate the distance between each of the settlement aggregations that meets the conditions from the list in the previous section and each of our eleven treatment settlement aggregations and select the seventeen which are geographically closest to a treatment settlement aggregation, under the assumption that these would be the most similar on important characteristics in the absence of any other data.[85] For the selection of comparison households within

[85] The only data in our possession on these settlement aggregations prior to the baseline survey were GIS coordinates and population figures. After selecting the most geographically proximal settlement aggregations we verified that the distribution of populations in comparison kampungs resembled the distribution of treatment kampungs prior to data collection. In our baseline report, we compared these groups using our own baseline data and found that the groups were generally comparable pre-intervention in terms of their energy access and consumption but significantly different in terms of their wealth and remoteness.

comparison aggregations, we use the same **random sampling** technique used for treatment households from lists of households obtained by local officials in selected settlement aggregations. The final list of settlement aggregations selected for sampling in East Sumba is presented in Table 7.

Table 7: Sampled settlement aggregations and households, Baseline

No.	Kampung, Kecamatan - Treatment	Kampung, Kecamatan - Control
1	Tawui Northeast, Pinu Pahar	Kalimbu Maramba, Mahu
2	Tawui Riyang, Pinu Pahar	Tara Amah, Mahu
3	Tawui West, Pinu Pahar	Mauhani, Paberiwai
4	Tawui North, Pinu Pahar	Pahulu Bandil, Matawai La Pawu
5	Rehi Jara, Karera	Lumbuwudi, Pinu Pahar
6	Praiwitu North, Ngadu Ngala	Pingi Ailun, Matawai La Pawu
7	Tanah Rong, Karera	Linggi Tana, Paberiwai
8	Praiwitu South, Ngadu Ngala	Prai Kalu, Paberiwai
9	Tandula Jangga, Karera	Laipabundu, Pinu Pahar
10	Lailunggi, Pinu Pahar	Undut Maringging, Pinu Pahar
11	Tawui South, Pinu Pahar	Rakamau, Pinu Pahar
12		Winumuru, Paberiwai
13		Matawailuri, Pinu Pahar
14		Pada Djara, Ngadu Ngala
15		Prai Maninggat, Paberiwai
16		Laironja, Matawai La Pawu
17		Dusun 2, Matawai La Pawu
	Total	**Total**

For W3A Akuo Energy Solar/Micro-Hydro, Berau, households are sampled using a simple **stratified random sampling** technique. The strata included the three treatment villages, from each of which fifty households are randomly selected.

In both kabupatens, up to eight enterprises are sampled for the enterprise survey per treatment unit. If fewer than eight enterprises exist, all of them are surveyed. If more than eight exist, enterprises are selected for the survey purposively to cover a broad cross-section of industries.

3.3.4 Primary Data Collection

3.3.4.1 Instruments

The quantitative approach described above relies on both household surveys and semi-structured interviews with enterprises, community leaders, SPV members, and other key stakeholders. The household survey is described here while the principal semi-structured interviews for the quantitative component are introduced here and described in more detail below in the qualitative section. The same household survey is deployed for both grants (W3A Akuo Energy Solar/Micro-Hydro, Berau and W3A Anekatek Solar, East Sumba).

The household survey covers all relevant dimensions of the household that might be affected by the new access to electricity or that might affect the adoption and usage of electricity. The socio-economic living conditions will be elicited ranging from background variables like age, household size, and educational status of adult members to variables that potentially change after electrification, for example employment status, educational investments of children and expenditures. A particular focus is on energy consumption and usage, i.e. different energy services, fuels, expenditures, and appliances. Moreover, the questionnaire probes into the activities related to energy usage, for example activities after nightfall, TV usage and appliances. Attention is dedicated to income generating activities. More specifically, the household questionnaire includes the following sections and can be found in Annex 3:

Table 8: Window 3A Quantitative Instrument Summary

Instrument	Outcome Area	Specific Topics	Description/Use
Household Survey	Household Information	- Housing conditions and size - Household roster with education - Transportation assets	Covariates for energy spending and consumption as well as potential outcomes in household assets
	Migration	- Migration roster	Covariates for energy spending and potential outcomes in economic migration rates
	Energy Sources and Use	- Source of energy - Household energy use - Energy use and spending by source	Verification of increases in access to RE; key outcomes in energy usage and spending. Includes new questions from baseline to capture metered electricity use and satisfaction with electricity source for treatment households and any comparison households who may have connected to PLN (see questions 37-52).
	Agriculture and Livestock	- Agricultural income by product - Livestock assets and income	Outcomes related to increases in agricultural income
	Financial Situation and Expenditures	- Banking and savings status - Remittances - Household expenditures	Outcomes related to decreases in poverty measured through increased expenditures
	Activity Profile	- Time spent on productive, leisure, and household	Outcomes related to time use, including productive, leisure, studying, and household chores disaggregated by men, women, and children

Instrument	Outcome Area	Specific Topics	Description/Use
		activities (and studying, for children)	
	Health	- Experience of key health issues including ARI (acute respiratory infection)	Outcomes related to improved health status due to cleaner energy use
	Security	- Mobility and safety at home in night	Outcomes related to increased safety due to access to lighting at night
	Green knowledge	- Attitudes related to environmental practices	Outcomes of community awareness activities
Enterprise	Electricity access	- Type of electricity available	Verify increased access to RE
	Services	- Key services offered - Customer base	Covariate and important outcomes related to increased services offered and expansion of customer base
	Energy Use	- Appliance use by energy source - Lighting by energy source	Outcome related to productive use of RE
	Employment	- Employment by type	Outcomes related to business expansion
	Production and Expansion	- Production, expansion, and bottlenecks	Qualitative discussion to explore role of energy access in business constraints, investments and expansion
Community Leader	Demographics	- Population size and number of households	Covariates of household outcomes
	Infrastructure and services	- Transportation - TV, radio, mobile networks - Social infrastructure	Covariates of household outcomes
	Energy sources	- Energy sources and prices in the community	Covariates of household outcomes and verification of treatment
	Income generating activities	- Enterprises operating in the community - Market access	Outcome related to increase productive use of energy
PLN/Mini-Grid Form	Sustainability	- Fuel mix (both) - Cost of service (both) - Plans for extension (PLN only)	To be filled by/with assistance of PLN or mini-grid representative to characterize important dynamics for sustainability of mini-grid service

Semi-structured protocols will be held with the chief of the respective sub-villages or a sub-village member with good knowledge on the population and village dynamics. The protocol comprises modules on basic sub-village information, availability and quality of infrastructure and services, energy access and use patterns, and detailed sections on income generation in the sub-village. Lastly, it includes information on community engagement, development programs and subjective community well-being. Given the semi-structure, the protocol allows for flexibly gathering village-specific information in-depth and for learning about unexpected circumstances or developments.

Similarly, semi-structured interviews will be held with all microenterprises of the sub-village. In case of large enterprise numbers, a non-random sample was chosen, which includes all different types of enterprises, for example welders, bakers, shop owners, or carpenters. The protocol includes modules on basic enterprise and customer information, energy use and production processes, and employment patterns. It is designed to capture growth potentials of the enterprise, which might be unlocked by electricity access. Particular attention is given to understanding growth hindering bottlenecks and potential net effects of electrification for the local economy.

The present version of the questionnaires were pretested, revised, and finalized as part of baseline data collection in October and November 2017. The only new questionnaire will be the form presented to regional PLN staff and mini-grid operators to characterize their fuel mix, cost of service, and plans for expansion in response to the new evaluation components for interim and endline data collection.

3.3.4.2 Rounds and timing

The baseline was implemented in October and November 2017. Interim data collection will occur in March 2019 to track adoption behavior and investigate initial changes on key outcomes in the short-term. However, many impacts may evolve over time and technical-economic sustainability issues of the micro-grid materialize rather in the mid/long-term. Accordingly, endline data collection will track these themes in November 2020.

Administrative delays prevented us from conducting interim data collection in November 2018, which would have been ideal to avoid seasonal distortions in outcomes of interest and covariates. While we could delay interim data collection until November 2019 to avoid these distortions, doing so would increase the risk of contamination in our comparison group (electrification from an outside source) that would confound our counterfactual construction. In weighing these risks to our experimental validity, we have chosen to pursue interim data collection at the nearest possible date that is reasonably similar to November in terms of weather and other seasonal conditions such as festivals. Pt. Jasa Layanan Risetindo (JRI), SI's data collection partner from baseline, spoke with village heads in Berau and East Sumba and were made aware of a number of factors that informed the decision to pursue interim data collection sooner rather than later:

1.) Weather constraints
    - January and February are peak rainy season months in Berau and East Sumba, and will thus be incomparable to November. Inversely, September and October are the peak dry season months.
2.) Political events
    - Indonesia's national election will occur on April 17, 2019, and it is inadvisable to collect data for several weeks on either end of election day.
3.) Special occasion occurrences
    - The Idul Fitri holiday, which takes place in May and June, renders many households inaccessible for participation in survey activities.
    - Additional regional festivals take place in Berau during the month of July.

3.3.4.3 Respondents within the sample unit

A priori, the desired respondent is the person most responsible for decisions related to energy use and expenditures, likely the household head. If this person is unavailable at the time of survey administration, we

would permit the survey to be conducted with another adult household member who is involved in and informed of decisions related to energy use. We envisioned maintaining the same respondent for the entire questionnaire but based on pretesting, target respondents were allowed to refer questions to household members that were better informed based on the specifics of the question. Households frequently preferred to respond to surveys as a group, which we allowed at baseline. This same protocol will be followed during interim data collection in March 2019.

3.3.4.4 Staff

Our Program Manager, Mike Duthie, will lead the quantitative data collection effort, including participating in instrument piloting and enumerator training. He will be supported by Junior Analyst, Miguel Albornoz (SI-HQ) and a local research assistant, Upik Sabainingrum, who will provide field monitoring of data collection in both locations under the direct guidance of Mr. Duthie and Mr. Albornoz. Dr. Jörg Peters will advise on quantitative instruments and analysis remotely. Mr. Albornoz will participate on both the quantitative and qualitative field team at interim data collection and work with Mr. Duthie to ensure there are synergies between the quantitative and qualitative efforts.

SI will competitively procure a local data collection company to conduct the field work. SI will provide expert guidance in a comprehensive training, at least five days in duration and including field practice, to all field staff employed by the data collection company.

3.3.4.5 Data processing

Since we intend to conduct electronic data collection, we expect to receive data regularly throughout field work[86], which we will import into Stata and using the SI-developed errout Stata command will check for a variety of common logic, range, missing value, skip, and outlier errors. This can be conducted in near real time and generates a log of errors for discussion and verification with the data collection partner, as well as for further training of staff on common errors. Once SI receives the final dataset, we will conduct data cleaning, again checking for missing data; logic, range, and skip errors; and outliers, using Stata .do and log files. Identified issues will be discussed with the data collection partner for verification and any changes will be entered into .do files with notes explaining the change. Relevant variables will be transformed for analysis. All data cleaning, management, and analysis will be conducted through Stata .do files to ensure transparency and reproducibility of results.

3.3.4.6 Data quality

While the specific data quality assurance protocols will be agreed with the data collection partners, the following represents SI's standard approach and can be considered representative of the approach we will take. We expect to conduct electronic data collection which permits regular, timely verification of data quality, logic and range checks in data entry, and additional quality assurance checks related to automatic time stamps and geocoding.

Data Quality Assurance processes will occur in the field, in real-time, during data collection and during data entry and in delivery of datasets. The data collection company will provide significant oversight of enumerators

[86] Given that we do not expect data collection field work for the survey to last more than two or three weeks, it may not be logistically practical to get interim data sets, conduct quality checks and feedback information prior to completion of field work, but this will be discussed with the data collection firm as a priority.

in the field. Specifically, they will provide on-site management of enumerators that is sufficient to observe the activities of the interviewers, identify problems in their administration of the questionnaires, and correct those problems. The data collection partner will ensure that all administered surveys are checked at the conclusion of each day by field supervisors to ensure that they are complete and devoid of inconsistencies. The partner will be responsible for implementing quality monitoring processes and will identify key personnel ultimately responsible for data quality. Specific activities include:

- A supervisor will accompany 5 percent of survey interviews to ensure completeness and to monitor and record any discrepancies or abnormal responses.
- A supervisor will monitor the sampling process and location of completed surveys and should immediately notify SI upon discovery of any irregularity;
- Supervisors will review nightly their interviewers' instruments to ensure appropriate skips are accurately followed and answers are properly recorded;
- The partner will conduct spot-check interviews of 5 percent of surveys, by re-visiting or re-calling respondents and verifying responses to a subset of 10-20 survey questions;
- Full re-interviews will be conducted by supervisors in the event that any interviewer is suspected of fraudulent behavior;
- Weekly summaries of data quality control activities shall be submitted to SI, in addition to a final tally of interview observations, re-visit spot checks, and complete re-interviews at the completion of data collection.
- SI staff or designates will also conduct independent quality assurance.

At the conclusion of data collection, the partner will deliver a data quality summary with the final dataset. This will include information about challenges in data collection, any modifications to the data collection protocols, data quality process, identification of any data quality issues, as well as metadata about the final dataset (sample replacement, response rate, attrition, average duration of survey, etc.) SI may provide an outline with additional detail as needed, but data quality reports will include at least the following information:

- Data source
- Sample size
- Samper size of pilot(s)
- Dates of pilot(s)
- Dates of data collection
- Number of enumerators
- Number of supervisors
- Number and percent of randomly selected survey responses audited by field supervisor
- Number and percent of randomly selected survey responses audited by the firm
- Average number of surveys conducted per enumerator per day
- Summary of quality checks performed during fieldwork

3.3.4.7 Summary Table

See the summary table included above in Section 3.3.4.1.

3.3.5 Secondary Data

This evaluation will primarily use secondary data in support of our sampling strategy, specifically to select comparison sub-villages for our impact evaluation of the W3A Anekatek Solar, East Sumba grant. Due to the sub-village nature of treatment in East Sumba, most secondary data is not representative at an adequate level to serve as a covariate in analysis. SI will utilize the following data in support of our sampling approach:

1.) GIS (Geographic Information System) shapefiles of settlement aggregations in East Sumba generated by ADB TA 8287
2.) Network Planner data generated from the Midline Report of ADB TA 8287
3.) List of desas where PLN is implementing micro-grids in 2017 and 2018
4.) Variables from blocks 4 (Population and Employment) and 12 (Economy) of the 2014 PODES (Village Potential Statistics) Survey

The first two of these datasets are critical to the development of our sampling frame. They identify treatment and potential comparison clusters and characterize key conditions of the clusters, namely their population and their suitability for electrification via micro-grid technology. The third dataset provides critical information for our sampling approach by identifying potential future contamination sites. The final dataset may be helpful in providing covariates for sampling or balancing at baseline.

All of this secondary data has been transferred to SI by its owner using appropriate and secure channels. Prior to using the data from ADB TA 8287, SI assessed its quality by reviewing the methodological section of TA deliverables and asking follow up questions of staff who collected the data based on any inconsistencies found. There was no need to independently verify the quality of PLN or PODES data, since these were generated by qualified actors (PLN and BPS (Badan Pusat Statistik in Indonesia)).

3.3.6 Analysis Plan

3.3.6.1 General Approach

To analyze the project's impact on key outcomes of interest, we must first verify that the project achieved its intended *outputs*. Prior to conducting econometric analyses, we will use a combination of project monitoring data, SPV records (as available), information gathered from key informant interviews, and household survey data to determine whether the micro-grids have been successfully installed and that households have been connected. This will help establish whether the project has indeed increased access the RE. At baseline, verification of outputs is not applicable.

Following this, we will analyze the impact of the project on our key indicators, including energy consumption, energy spending, and household economic and time use outcomes, using statistical and econometric models. Note that baseline statistical analysis focused on associations of factors with outcomes rather than analyzing impacts

This study is powered to report impacts for all treatment households. We may also explore outcomes for critical sub-groups, such as poorer households or female-headed households to test the heterogeneity of impact. In some cases, for example, with female-headed households, estimates of sub-group differential impact will be made with reduced precision and power due to the smaller sample size available for that sub-group.

3.3.6.2 Baseline

The focus of baseline analysis was to both identify the matched sample of treatment and control households and to investigate the current status of, and factors associated with, energy consumption and expenditures in the target area.

Identification of matched treatment and control households

We used multiple matching approaches, as described above with baseline data to match treatment and control households, thereby identifying the final sample for the evaluation. Specifically, we:

1. **Identified secondary and baseline variables that correlate with treatment and key outcomes, with a specific focus on energy consumption and expenditures.** To look at variables associated with treatment, we estimated a logistic regression, whereas we used a linear regression model to look at factors associated with energy consumption and expenditures. Variables included:
    - household variables such as sex, education, and employment of the household head; household and home size; and household asset index

    We selected each variable that was statistically significant in either model Note that this analysis is also a critical input for the second key focus on the baseline analysis described below.
2. **Developed bin sizes for CEM**. As a starting point, we thought critically, and based on the literature, about appropriate bin sizes for each variable. However, given that there are not natural bin sizes for most of the variables we included in the matching (with the exception of sex of household head, for example),we developed a few sets of bin sizes that ranged from fine to loose coarsening.
3. **Conducted CEM based on each set of bin sizes**. Using the Stata CEM command, we matched units under each bin size scenario, pruning observations that fall into treatment-only or control-only strata.
4. **Determined the most appropriate bin size scenario.** Given the tradeoff between level of imbalance and power in matching approaches, we investigated each bin size scenario according to the following criteria:
    - Imbalance: We measured the average absolute standardized difference in means for variables included in the CEM and other variables associated with the outcomes of interest.
    - Power: We recalculated the MDES and power based on the number of households pruned.
    - External validity: To investigate the representativeness of the sample to the target population, we conducted t-tests to look for differences in means between the pruned sample and full treatment sample and then calculated an average t-statistic for each bin size scenario.

    We documented the results of each of these tests and based on these criteria, the evaluation team decided which bin scenario offers the optimal tradeoff.
5. **Identified final sample**. Based on the selected bin size scenario, the final evaluation sample included all non-pruned households. This represents the sample of households for which follow up data collection and analysis should be conducted. Int he baseline report, we presented the similarity of the matched treatment and comparison group, alongside balance in the unmatched groups for reference. We also conducted PSM to assess the most appropriate matching approach prior to follow up data collection.

Investigate the current status of energy consumption and expenditures in the target area

The baseline analysis was also useful in documenting the pre-intervention status in the target area. This included:

1. Descriptive statistics of outcome variables and covariates, by socioeconomic status and in some cases by age or gender2. Econometric analysis of factors associated with key outcomes*:* Regression analysis is used to explore the relationship between outcome variables and covariates, and test posited relationships from the project logic.

3.3.6.3 Follow-up

Follow up analysis will focus on estimating the interim and endline impacts of the grant using a DiD regression approach with controls. We will also provide a review of outputs to ensure that the project did indeed increase access to RE. Specifically, this will include:

1. Descriptive statistics of outcome variables and covariates, by socioeconomic status and in some cases by age or gender.
2. Analysis of determinants of outcomes: Regression analyses built on baseline models by examining changes in the marginal effects of household and individual demographic and economic variables on select outcomes of interest, such as energy consumption and energy expenditures. This builds on the baseline analysis, looking further at which variables (and how changes in those variables) are related to the outcomes of interest. While the relationships cannot be confidently considered causal, they may be instructive in identifying additional questions and research in household energy consumption and expenditure dynamics.
3. Analysis of output data*:* Through analysis of project monitoring data, household survey data on electricity availability, SPV documents, and key informant interviews, we hope to establish whether the grant was effective in increasing access to RE. If we find, for example, that the RE systems are non-operational or systems suffer from significant shortage in supply or that comparison areas have also gained access to RE, then we might expect null or limited results on key outcomes.
4. Statistical analysis of interim and endline impacts[87]: Using the matched sample, we will estimate program impacts using the following fixed effects panel regression framework:

$$Y_{ijt} = \alpha + \gamma T_{jt} + \delta d_{jt} + \kappa T_{jt} \cdot d_{jt} + \beta X_{ijt} + \delta_{ijt},$$

where Y_{ijt} is the outcome of interest for household or other unit *i* in kampung *j* at time *t*; *d* represents treatment assignment and is equal to 1 if kampung *j* is assigned to treatment, and 0 otherwise; T_{jt} represents time and is equal to 0 at baseline and 1 at follow-up; X_{ijt} is a vector of time-varying variables that affect the outcome for unit *i* in kampung *j* at time *t*, and δ_{ijt} is a time-varying error term. The coefficient κ will measure the "treatment effect," or the change in outcome *Y* for treatment households

[87] Note that these impact estimates will serve as quantitative answers to evaluation questions 1 and 2 on their own, and will subsequently feed into a model developed by ICF International to produce estimated reductions in GHG emissions in response to evaluation question 3. These results will be presented alongside ICF's original estimations for context. In the event that primary data calls into question assumptions used as inputs in the ICF model, SI will note this and calculate the resulting change in GHG emissions if these assumptions were altered.

or enterprises relative to that for controls. This estimate is unbiased so long as the error term δ_{ijt} is not correlated with treatment.

3.4 Window 3A Qualitative Approach

3.4.1 Methodology

To provide additional data to answer evaluation questions 1-3 (which seek to identify the impact of the RE installations) and to answer evaluation question 4 (which seeks to identify the level of effectiveness of SPVs at managing the Solar PV facilities), SI will collect baseline, interim, and endline qualitative data in treatment sites representing W3A Anekatek Solar, East Sumba and W3A Akuo Energy Solar/Micro-Hydro, Berau grants as well as conduct a mini-survey in W3A Akuo Energy Solar/Micro-Hydro, Berau areas (described in the quantitative section above). We will also conduct less intensive qualitative data collection in control areas to help investigate differences identified in the survey as well as develop a qualitative assessment of the similarity of the treatment and comparison areas. The pre/post PE approach relies on primary qualitative data from key informants and focus group participants at the regency and village levels. Observation of SPVs and facilities will be included at interim and endline data collection, but were not applicable at the baseline as these were not yet established/constructed.

The purpose of collecting interim and endline qualitative data is to further explore the factors that contribute to micro-grid success, particularly looking at evaluation question 4. A follow-up PE allows more time for failure to potentially identify additional factors of success and failure of the uptake of micro-grids. It also allows a more comprehensive review of sustainability and investigation of factors across the different solar grants that affect sustainability. Based on the time it takes to install grids, transfer management to the community, and allow for challenges/problems to arise that require SPV response, re-visiting sites two or three years after baseline data collection (as opposed to only one-year post-baseline, as proposed below for interim data collection) will also prove informative.

As noted in the Literature Review section above, the Window 3A grants innovatively utilize a community engagement (SPV) approach or scheme to attempt to address challenges identified in the transition of communities to micro-grids. The SPV approach seeks to transfer ownership to the communities in a way that will promote sustainability and use of Solar PV facilities by strategically engaging communities from project inception, establishing (or re-vitalizing existing) community engagement groups, and training SPV members in the areas of O&M, finance and administration, and sales.

In order to holistically answer evaluation question 4 related to the SPVs' ability to generate community buy-in and sustainability of critical infrastructure, baseline qualitative data collection is useful to document what the community is like pre-intervention. Areas or themes of interest include the current status of existing community engagement mechanisms/groups; levels of engagement in existing groups by various community members (men, women, and youth); community past experiences with RE sources or donor/government energy projects/initiatives; key community needs/challenges in terms of economic growth (or access to income generating activities); and perceptions (optimism) of the Solar PV facility plan. Interim and endline data collection, in addition to collecting data along similar lines of inquiry as the baseline, will include themes related to the SPV intervention in a given site. These could relate to relationship to the implementer/grantee/contractors; experience with intervention roll-out; preparedness; and productive uses.

Qualitative data at this stage is expected to provide depth to quantitative findings related to key variables that were found to relate to outcomes of interest.

Therefore, collecting pre/post qualitative data in both East Sumba and Berau will provide an opportunity to a) document baseline community engagement conditions and investigate the current status of energy consumption; and b) explore how each SPV approach/scheme ultimately impacted the achievement of outcomes of interest (measured via indicators collected in quantitative data in both locations) at interim and endline data collection. Specifically, qualitative data collected in East Sumba and Berau will: at baseline, provide baseline context for indicators of interest related to evaluation questions 1 – 4; and, at endline, provide depth on evaluation question 1-3 and answer evaluation question 4.

Data will be collected from both treatment and comparison sites in Sumba and in treatment sites only in Berau, with the exception of grantee and SPV interviews which are only relevant in treatment areas. SI will conduct semi-structured interviews with approximately 250 enterprises and 50 other stakeholders along with approximately 12 FGDs in six selected villages in East Sumba and Berau at baseline, further described below. This will allow for discussions with village/regency government officials, community members (both beneficiaries and SPV members), enterprises, contractors and grant implementers/managers.

3.4.2 Timeframe of Exposure

As described in section 3.3.2 above, SI will conduct interim quantitative data collection after twelve-sixteen months of exposure to the mini-grids with endline data collection to occur after 2.5 - 3 years of exposure. SI suggests collecting qualitative interim and endline data *after* collection and preliminary analysis of quantitative data. Qualitative data was collected first at baseline since the objective of qualitative data collection at baseline was mostly to refine quantitative instruments and define the outlook for program outcomes and sustainability. At interim and endline data collection, with the instruments mostly refined from baseline data collection, we prefer to use qualitative data collection to provide qualitative details about program implementation or operating context that may explain observed trends in quantitative outcomes. By analyzing quantitative data first, we can be sure that the qualitative tools include targeted lines of inquiry to explain or contextualize key findings in the final report. Given the logistical challenges of fielding a data collection effort in the presence of the political events and special occasions occurring in these sites from April – June (see section 3.3.4.2), we propose to collect interim qualitative data between August and September of 2019, corresponding to 21 – 22 months exposure to the mini-grids. We will conduct endline qualitative data collection in March 2021, four months after endline quantitative data collection, corresponding to 3 - 3.5 years of exposure to the mini-grids.

At interim data collection we expect for near-term outcomes in energy consumption and productive use to have been realized, such as changes in energy sources or extended operating hours for businesses. By endline data collection we expect for significant O&M or financial challenges to have emerged for the SPM which will allow us to understand how they confronted risks to their sustainability. Also, we may observe long-term changes in energy consumption or productive use, such as households purchasing assets that use more energy than had previously been available or entrepreneurs opening a new business using the RE supply.

3.4.3 Study Sample

3.4.3.1 Sample unit

SI's qualitative approach includes a variety of sample units with each type of stakeholder being interviewed using a distinct protocol (see Annex 3). For all KII protocols, the sample unit is individuals selected to represent SPVs[88], government entities[89], grant implementers/managers[90], and private firms contracted to provide support to the facilities[91]. For the community beneficiary FGD guide, the sample unit is households. For the enterprise beneficiary KII guide, the sample unit is firms and/or informal community enterprises. These enterprises are those, in addition to the SPV, that may use energy for productive uses and may include individuals earning income above a subsistence level by selling a good or service (or producing a good or service for more than auto consumption).

3.4.3.2 Sample size

The SPV Leadership KII protocol is issued to three to four individuals in each treatment unit sampled. Grantee or contractor KII protocols is issued to one individual each per treatment unit sampled. At times, these individuals may repeat across treatment units (e.g. one O&M contractor is interviewed in reference to several desas). One to three grantee staff (including MCA-I Window 3 managers) are interviewed per grant. Kampung official and enterprise semi-structured interviews are conducted in all treatment and control areas.

There are two FGDs of community beneficiaries per treatment unit (one for male beneficiaries and one for female beneficiaries), and we aspire to include eight to ten beneficiaries in each focus group. We expect a total sample size of 50 - 78 key informants, approximately 250 enterprises and around 120 focus group participants.

3.4.3.3 Sample frame

In the case of W3A Akuo Energy Solar/Micro-Hydro, Berau, the three villages selected for qualitative study include all three treatment units involved in the grant. In the case of W3A Anekatek Solar, East Sumba, time and feasibility constraints preclude the qualitative team from visiting any more than three villages. The sample frame for these villages include all five of the treatment villages targeted by the grant. The sample frame of comparison villages for the W3A Anekatek Solar, East Sumba grant includes all seventeen kampungs selected for the comparison group.

The sample frame of stakeholders to serve as key informants in each village was constructed by soliciting contact lists from each of the grantees. The sample frame of beneficiaries to serve as focus group participants was constructed from beneficiary lists from each grantee. The sample frame of enterprises in each village was constructed by communicating with village officials in advance about how many and which types of enterprises were present in the village.

[88] In W3A Akuo Energy Solar/Micro-Hydro, Berau, this could include the director, secretary, treasurer, O&M division head, sales and collection division head, or the finance and administration division head. In W3A Anekatek Solar, East Sumba, this could include the head, Finance Manager, Secretary, or other members of the community appointed to the cooperative.
[89] Primarily including the Head of the Village (Kepala Desa)
[90] Primarily including grantee staff (both local and HQ based), MCA-I Window 3 grant managers, and MCC RE Advisors.
[91] Primarily including O&M and EFC contractor staff, as relevant for each treatment unit.

3.4.3.4 Sampling strategy

At the village level, the three villages selected for additional qualitative study in East Sumba are selected **purposively** to draw the most interesting comparisons possible both within East Sumba and between East Sumba and Berau. These also contain as many treatment kampungs as possible. Barring any constraints from selecting these, we are conducting qualitative data collection in Tawui, Lailunggi, and Praiwitu. For comparison kampungs, we will use a combined **purposive, convenience** sampling method in which we will select the comparison kampungs that seem most salient following preliminary quantitative analysis that are close enough geographically to Tawui, Lailunggi, and Praiwitu to feasibly cover in the time allotted.

Most key informants are selected using a **purposive** sampling technique. In some cases, there may only be one person or a few specific people who are performing the role whose perspective we require as a key informant. For each round we will review program documents and work with the grantee before data collection to identify which role this is in village and regency government offices and in each contractor's office. In the event that an identified informant indicates a colleague who could provide additionally illuminating information, we will attempt to contact this colleague to serve as an additional informant (**snowball** sampling).

Community beneficiary FGD participants are selected using a **convenience** method on the basis of which community members are available to participate in an FGD when the evaluation team passes through each village. Since in the baseline we proposed qualitative field work to occur before quantitative field work, it was not necessary to avoid community members who may have been fatigued from participating in the quantitative survey. This concern of respondent fatigue will be revisited during subsequent rounds, but is not anticipated to be a barrier to participation. Given that there are reportedly few enterprises in each village, especially few that are not basic kiosks or shops, we use a **purposive sampling** technique to ensure that the firms selected represent as diverse a cross section as possible of enterprises in each treatment unit.

3.4.4 Primary Data Collection

3.4.4.1 Instruments

All KIIs and FGDs are conducted according to pre-developed and tested protocols (see Annex 3). SI has developed semi-structured protocols to direct each qualitative data collection activity. SI will utilize the same qualitative questionnaires in both East Sumba and Berau sites. As previously noted, interim and endline instruments will differ from baseline instruments, based on baseline findings and preliminary quantitative findings from interim and endline. Baseline instruments document baseline community engagement conditions and investigate the current status of energy consumption; and interim and endline instruments will explore how each SPV approach/scheme ultimately impacted the achievement of outcomes of interest (measured via indicators collected in quantitative data in both locations). The team developed parallel protocols (see Annex 3) with the same or similar questions across KIIs, FGDs, and mini-surveys (where appropriate/relevant) to enable greater data triangulation (additional information on the analysis plan provided in section 3.4.5.2). To facilitate analysis, the enterprise and kampung official protocols are principally quantitative but include qualitative elements.

Table 9**Error! Reference source not found.** below provides a summary of instruments, respondents, and estimated respondent numbers per treatment unit. These include updated versions of the instruments used at

baseline, with the exception of the Regency Official KII, which will be omitted since these individuals were hard to access at baseline and offered relatively little information of added value.

Table 9: Summary of instruments, respondents, and estimated respondent numbers per treatment unit (Qualitative Questionnaire)

Qualitative Questionnaires Summary Table				
No.	Type	Name	Respondents	Estimated Number of Respondents
1	KII	SPV Leadership	Berau: Director, Secretary, Treasurer, O&M division head, Sales and collection division head, or Finance and administration division head East Sumba: Head, Finance Manager, Secretary, or other members of thfe community appointed to the cooperative	3-5 individuals per treatment unit
2	KII	Village Official	Head of Village (Kepala Desa)	1 individual per treatment/control unit
4	KII	Project Grantee/Manager	Grantee staff; MCA-I Window 3A Manager(s); MCC RE Advisors	1-3 individuals per grantee (including both local and HQ-based, if possible); 2-3 individuals from MCA-I and MCC
5	KII	EPC Contractor	Contractor staff	1 individual per treatment unit (may be duplicates across units)
6	KII	O&M Contractor	Contractor staff	1 individual per treatment unit (may be duplicates across units)
7	FGD	Community	Household members (not selected for quantitative survey)	2 groups (1 M, 1 F including 8-10 individuals each) per treatment unit
8	KII	Enterprise	Firms and/or informal community enterprises	Up to 8 per community

3.4.4.2 Rounds and timing

Qualitative baseline data collection occurred shortly before quantitative baseline data collection, in September – October of 2017. As discussed in section 3.3.4.2, the national election, Idul Fitri, and seasonal festivals in Berau will make returning to collect interim qualitative data any earlier than August 2019 infeasible. Although August will be entering a different season than the one in which quantitative data will be collected, we still anticipate that it will be proximal enough for respondents to recall the energy consumption situation from March and explain any trends of interest. We will thus collect interim qualitative data in August and September. In

turn, for endline data collection, we will revert to the quantitative data collection schedule suggested at baseline and return for endline qualitative data collection in mid-March.

3.4.4.3 Respondents within the sample unit

Respondents within the sample unit (of six villages in East Sumba and Berau) are described in Table 9. Respondents represent sub-district and village levels and range from implementing staff and grant advisors to community members and local enterprises. If respondents are missing or absent at the scheduled time, the team will follow the sampling procedures defined in section 3.4.3.4 and identify replacement respondents (both at baseline and endline).

3.4.4.4 Staff

For the qualitative component at interim data collection[92], whose field data collection period will also include qualitative data collection for the case studies, SI proposes to field a pair of three-person qualitative sub-teams. Each sub-team will be responsible for covering one of the regencies. The first, led by Sr. Analyst Krystyna Krassowska, will cover qualitative data collection for the grants in East Sumba. Her team will be completed with a Jr. Analyst (to be named) with expertise in renewable energy and a local administrative assistant who can assist with arranging and notetaking for interviews. The second, led by Jr. Analyst Miguel Albornoz, will collect qualitative data in Berau. Mr. Albornoz's team will be completed by a local research assistant with experience in renewable energy evaluation and a local administrative assistant. By staffing sub-teams in this way, each team will have a lead evaluator, a renewable energy specialist, and two Indonesian speakers such that there is always a facilitator and notetaker who can speak fluent Indonesian.

We anticipate field data collection will cover a period of four weeks. The majority of the first week will be spent on a collaborative training between the two field teams in Jakarta to establish mutual expectations for the purpose of the evaluation, the intent of the instruments, and appropriate techniques for ethical and effective data collection, data quality assurance, and data management. We will also aim to accommodate any Jakarta-based interviews with grantee, PLN, or ESDM staff during this time. The final three weeks will be spent on data collection, such that an average of one week is allocated for data collection for each of the grants. As the qualitative field schedule is assembled, if data collection can be completed in Berau in shorter than three weeks the Berau sub-team may assist the Sumba sub-team in completing their data collection schedule.

3.4.4.5 Data processing

Interview and discussion notes from qualitative data collection activities will be created during field work with daily review by the team to ensure clarity. The team will also record all interviews and discussions to lend to eventual transcription and translation. Transcription and translation may be done through external consultants and/or members of the evaluation team. Complete transcripts will be a) anonymized for the protection of respondents and b) uploaded into qualitative data analysis software for analysis and report writing. Qualitative data will be handled solely by the evaluation team and SI-HQ management team members that provide support during baseline and endline data collection activities.

[92] The qualitative field team for baseline data collection also included two sub-teams each with a qualitative evaluator, RE specialist, and two Indonesian speakers. However, the specific members of the teams were altered to accommodate availability concerns for interim data collection.

3.4.4.6 Data quality

The data processing methods described in section 3.4.4.5 lend to high quality data at the baseline. The sub-team leaders will have the ultimate responsibility to check interview notes for completeness and accuracy during team debriefs and review sessions during fieldwork. The local evaluator on each sub-team will be tasked to review transcripts and translations to ensure accuracy of wording and phraseology used. Additionally, the Program Manager will randomly spot check interview notes and transcripts to ensure the facilitators/interviewers followed protocols and adhered to best practice for conducting qualitative data collection.

3.4.5 Analysis Plan

3.4.5.1 Coding

Interview transcripts will be coded using electronic software (Dedoose or similar software) to construct response categories and identify patterns in data, as relevant. Coding qualitative data through use of electronic software will allow SI to analyze transcripts with speed and efficiency, easily cataloging and documenting emergent themes from among respondents. Prior to fieldwork, the team will develop a preliminary coding scheme based on finalized protocols. During fieldwork, the team leader will adjust the coding scheme as new themes or areas of interest arise as relate to each evaluation question. The coding scheme will be finalized post-fieldwork and will include codes across identified themes and evaluation questions.

3.4.5.2 Analysis method/framework

At baseline, the team utilized interview notes and codes (resulting from aggregated and coded transcripts detailed in section 3.4.5.1) to detail key indicators related to evaluation questions 1 – 3 (including energy consumption, energy spending, and household economic and time use) and community engagement levels (through description of themes related to evaluation question 4). Triangulation enables the team to cross-verify and cross-validate the findings that emerge to identify correlations between findings. In particular, the team developed parallel protocols (see Annex 3) with the same or similar questions across KIIs, FGDs, and mini-surveys (where appropriate/relevant). This enables greater data triangulation because each method addresses sub-sets of the same evaluation questions, and findings are validated or refuted by the other techniques. Methodological triangulation also enables the team to strengthen the potential linkages and accuracy of its data if the results obtained through one method are less conclusive than another method.

The team plans to employ several data analysis methods to identify key findings from the collected data. The type of analyses are dependent on the specific data being assessed but will most likely include the following. The first two listed are employed at baseline, while all listed are likely to be employed for the interim and endline evaluations.

1. **Comparative Analysis** – The team will compare baseline context and interim and endline results across grants, treatment sites (villages), and stakeholder groups to assess convergence or divergence in perspectives.
2. **Trend Analysis** – Trend analysis will enable the team to examine different indicators or interest over time (from baseline to interim and endline) to identify patterns of convergence or divergence of outputs and outcomes related to the evaluation questions.

3. **Contribution Analysis** – Contribution Analysis is an approach for assessing and inferring causality in program evaluations. It provides evidence for drawing conclusions that the grant's activities have contributed to positive, documented results identified by the team. Such analysis will be most useful in confirming the relevance of the program's theory of change at interim and endline.
4. **Gender Analysis** – The team will consider at baseline the current status of women and men in the treatment sites and at interim and endline, consider whether activities and resulting outcomes specifically benefit (or do not benefit) women or men. All data collected through KIIs, FGDs, and mini-surveys will be disaggregated by gender and analyzed for effects on women and men beneficiaries of the project.

3.5 Case Study Qualitative Approach[93]

3.5.1 Methodology

Our case studies will be one-shot, *ex post* data collection events that combine primary qualitative data, secondary documentation, and photographs to communicate narrative accounts of the planned and actual theory of change, sustainability approach, and outcomes of each of the four grants as well as the sustainability outlook for any realized outcomes. These narrative accounts will be compared to the other CBOG RE grants that fall within the scope of this evaluation in the same regency to highlight shared experiences and relative advantages and disadvantages, with special attention paid to the outlook of continued utilization of the RE technology. These narratives will not aim to present quantitative estimates of program impacts (e.g. changes in income, changes in study time, etc.), but rather to highlight the perspectives of informed stakeholders on these themes that are corroborated by evidence from secondary sources.

3.5.2 Timeframe of Exposure

The case studies will be conducted concurrently with qualitative data collection for the Window 3A grants in August and September of 2019. Based on available documentation, the RE technology funded by the case study grants was commissioned between June 2017[94] and March 2018, although most of the technology appears to have been commissioned in February 2018. Thus, by interim data collection most beneficiaries will have been exposed to the new technology for around 17-18 months, although some solar lantern users will have been exposed for up to 8 months longer. We expect in this timeframe that beneficiaries of grants with simpler theories of change like those in Berau will have had the opportunity to realize the full set of anticipated outcomes. For the grants in East Sumba that aimed to establish fully functioning co-operatives or robust RE markets with service centers, we expect short-term outcomes like changes in energy use to have been realized with the more complex aspects of their theories of change potentially still in the process of developing.

[93] Note that we only outline the qualitative approach for our case studies, as the only quantitative elements of these will come from providing quantitative secondary data for context.

[94] This is an approximation: solar lanterns and charging stations were procured in Q1 of 2017 and projected to be delivered in Q2 according to the grant's Q5 Progress Report, the latest available documentation to SI.

3.5.3 Study Sample

3.5.3.1 Sample unit

The sample unit for the case studies will vary by grant. Although we will seek to sample people at the individual level, these individuals will often be selected as representatives of groups. Depending on the grant, these groups might include households, small business groups, plant or factory management groups, co-operatives, or organizations (e.g. government entities, RESCO, etc.).

3.5.3.2 Sample size

Table 10 presents notional figures for the number of times we plan to implement each instrument in the case studies and how many respondents we anticipate will be involved. As a general rule, we will try to maximize the number of KIIs and FGDs conducted for each grant with the time available, although these will include one FGD per beneficiary group at minimum and one KII per relevant management unit. We will strive to conduct two FGDs per beneficiary group in order to conduct male and female groups separately and capture both perspectives, but this may not be feasible with time constraints where there are more beneficiary groups to cover. These sample sizes will be refined further as SI communicates with grantees and gauges the relative significance of these beneficiary groups and management unit to each grant.

Table 10: Notional Case Study Instrument Sample Sizes

Grant	Instrument	Number	Respondents	Total
W2 Javlec Solar, Berau	Fishermen FGD	2	6-8	12-16
	Plant Management Unit KII	1	1-3	1-3
	Factory Management Unit KII	1	1-3	1-3
W2 PEKA Solar, Berau	Small Business Group FGD	2-4	6-8	12-32
	Trainee FGD	2-4	6-8	12-32
	BUMK KII	1	1-3	1-3
W2 IBEKA Micro-Hydro, East Sumba	Household FGD	2	6-8	12-16
	Farmer FGD	2	6-8	12-16
	Public Facility FGD	2	6-8	12-16
	Community co-op KII	1	1-3	1-3
W1 Hivos Solar/Biogas, Sumba/Sulawesi	Household FGD	2	6-8	12-16
	School Administrator KII	1 per village	1-3	1-3
	Kiosk operator FGD	2	6-8	12-16
	RESCO KII	1	1-3	1-3
Overall	Provincial/Regional PLN KII	2	1-3	2-6
	Provincial/Regional ESDM KII	2	1-3	2-6
	National ESDM KII	1	1-3	1-3

3.5.3.3 Sample frame

For the case study grants in Berau and the W2 IBEKA Micro-Hydro, East Sumba grant, the sample frame will include all beneficiaries of RE components of the grants and RE asset management units, as categorized above. We will request a roster of beneficiaries from the grantee to serve as our sample frame. If such a roster is unavailable, we will ask village officials for help in assembling a list of beneficiaries to the best of their knowledge.

Due to the scale of the W1 Hivos Solar/Biogas, Sumba/Sulawesi grant, we will be unable to include all beneficiaries in our sample frame. We will work with the grantee to identify a particular sub-district that received a wide cross-section of grant outputs and request a list of grant beneficiaries who are restricted to this sub-district. The sample frame for RESCO respondents will only include the RESCO established in Waingapu.

3.5.3.4 Sampling strategy

Although there are many types of respondents we will seek to sample within each grant, they generally fall into four categories: (i) grantees, (ii) beneficiaries, (iii) RE Management units (e.g. co-operatives, operators, RESCOs), and (iv) PLN or government stakeholders. We will pursue a different strategy with each of these types of respondents. Our point of entry in sampling respondents for each grant will be the grantees. We expect to receive a contact with each grantee from MCC, ideally selecting someone who is knowledgeable about the planned theory of change, sustainability model, and outcomes for each grant and who has access to beneficiary rosters. Understanding that this knowledge may be spread among multiple individuals with each grantee, we will employ snowball sampling from our first contact until we have fully identified these planned elements for each grant. There will necessarily be an element of convenience in sampling grantee contacts, as some who are the most knowledgeable may have left for other opportunities in the time since the grants were signed.

Table 11: Summary of Sampling Strategy by Case Study Respondent Type

Type of Respondent	Method	Source
Grantee	Purposive/Snowball/Convenience	MCC/Grantee Contacts
Beneficiary	Random (ideal); Convenience (fallback)	Grantee Contacts, Village Head
Management Unit	Purposive	Grantee Contacts, Village Head
PLN, Government	Purposive/Snowball	Grantee Contacts

In sampling beneficiaries (entrepreneurs, households, schools, etc.) for FGDs, we will seek as a first option to obtain beneficiary rosters from our grantee contacts and sample beneficiaries randomly from these lists to avoid potential selection bias. Even if these rosters don't include location information at a finer resolution than the village-level, our experience is that identified respondents can be located with the assistance of the village head. If we cannot obtain beneficiary rosters from which to sample randomly, we will sample respondents conveniently by asking village heads to assemble focus groups with individuals who they know participated in the project. This removes some of the bias from asking grantees to selectively identify respondents for the focus group, but still opens up the potential for village heads to select people who will espouse shared views on the project to their own or omit the perspective of underprivileged groups in the village. This is still preferable

to allowing grantees to select respondents, however, as grantees will have an incentive to sample respondents who will present the project in the most positive light.

When sampling individuals responsible for managing RE assets, we will purposively select individuals based on their role within their organizations. Roles that we will aim to sample include those institutionally responsible for operation and maintenance and financial administration, especially. We expect we will be able to identify these individuals through grantee contacts and/or village heads.

Finally, in the event that government officials are explicitly included in the theory of change or approach to sustainability for each grant, we will work with grantees to identify which office or official is the most suitable to provide perceptions of the grant. If time and resources permit we will also ask purposively selected officials to recommend any peers who may provide further information on themes of interest following interviews.

3.5.4 Primary Data Collection

3.5.4.1 Instruments

In a preliminary sense and based on the documentation available, we think the full list of instruments employed for the case studies will include those outlined in Table 5 in the case study design overview. However, as discussed in previous sections, we will need to confirm the final, planned theory of change, outcomes, and approach to sustainability for each of the case study grants before proceeding to finalize our instruments for primary data collection. We will use our case study grantee protocol, as outlined in Section 6.3.9, for this purpose. We will complete this semi-structured protocol iteratively by requesting additional documentation from grantee contacts for its completion and subsequently filling in any gaps through remote interviews well in advance of data collection.

Once we settle on a final set of instruments for the case studies based on our discussions with grantees, we will populate these instruments and ensure that each includes the themes below depending on whether it is targeting a grant beneficiary, management unit, or PLN/government stakeholder. We will design these instruments to be short, no longer than sixty minutes, to optimize the number of times we are able to deploy them or the number of groups we are able to target with them.

Table 12: Case Study Instrument Themes

Type of Respondent	Themes	Duration
Grantee	• Planned theory of change, outcomes, and sustainability approach • Known deviations from plans • Challenges faced • Retrospective assessment of theory of change • Location/identity of final outputs, beneficiaries	TBD, iterative
Beneficiary	• Pre-grant state of outcomes of interest, portfolio of energy sources • Post-grant state of outcomes of interest, portfolio of energy sources • Probe for unanticipated uses of RE technology • Perceived social differences in outcomes (gender, socioeconomic status, etc.) • Adequacy of RE capacity for demand • Perceptions of management units • Perceptions of tariffs/user fees for RE assets	45-60 min.

Type of Respondent	Themes	Duration
	• Perceptions of RE relative to fossil fuels	
Management Unit	• Roles and responsibilities of members of unit • Perceived capabilities of unit, preparedness of staff • Existing plans for operations and maintenance • Experienced issues, challenges with technology and causes (technical, O&M, financial, political/social/cultural, etc.) • Perceived ongoing risks, likelihood and severity of each • Existing business plans, revenue model • Perceptions of sustainability outlook • Review of any data on consumption and payments • Relationships with RE consumers, consumers of manufactured products • Relationship with PLN	60 min. (interview) 30 min. (facility tour)
PLN, Government	• Regulatory framework, policy context for RE • Plans for rural electrification in 5-10 year timeframe • Fuel mix, plans for future expansion of grid • Perception of grant-funded infrastructure, relationship with grantees and management units • Amenability to feed-in tariff or similar scheme • Perceived stability of regulatory/policy environment with administration change	45-60 min.

A key part of our data collection effort that is not included in the themes above is a tour of any facilities funded by the grants, including mini-grids and processing facilities. We will request these from management units in order to provide photographic evidence of the assets in use. In cases such as Hivos' where the assets funded may be stand-alone solar lamps or school-based PV units, we will ask village heads and/or beneficiaries for permission to photograph these assets used in the ways described in FGDs.

3.5.4.2 Rounds and timing

Qualitative data collection for the case study will have a single round, occurring concurrently with qualitative data collection for the evaluation of the Window 3A grants in late August – mid-September 2019.

3.5.4.3 Respondents within the sample unit

Respondents within the sample unit are described in Table 10.

3.5.4.4 Staff, Data Processing, and Data Quality

The staff, data processing, and data quality arrangements for case studies will mirror those described in sections 3.4.4.4-3.4.4.6 for the evaluation of the Window 3A grants.

3.5.5 Secondary Data

We will request secondary data to corroborate our primary qualitative data from MCC, grantees, PLN, and management units of RE assets. We will use the post-Compact indicator tracking table (ITT) from MCC to characterize the final realized scale of grant outputs and their contribution to larger CBOG RE portfolio and

Green Prosperity objectives. We will primarily request secondary documentation from grantees that establishes the planned theory of change and management arrangements for RE assets, as well as the actual level of use of the RE assets. We will specifically request anonymized information from grantee consumption and billing databases where such databases are maintained. In the ideal case, this documentation will allow us to construct a logic model for each grant, to harvest final output and outcome indicators from M&E plans, to establish design functionality of RE assets, to obtain O&M plans for RE assets, to track consumption and payment, and to understand long-term financial and ownership arrangements for the assets that can be verified in the field. Specific documents we may seek to obtain these documents are M&E plans, M&E reports, final reports, engineering design documents, design reviews, O&M plans, commissioning documents, and business plans. Our junior analyst and program manager will review M&E documents while our Renewable Energy Senior Analyst will review infrastructure design and financial documentation to assess the technical, operational, and financial sustainability of the RE assets. We will seek any gaps in this documentation or updated versions of this documentation from management units. Finally, we will seek secondary documentation from PLN and government stakeholders to understand any long-term strategic planning for rural electrification in the study areas.

3.5.6 Analysis Plan

We will largely pursue the same analysis plan with qualitative data from the case studies as described in section 3.4.5 for the Window 3A evaluation methodology. However, in order to compare the relative advantages and disadvantages of the various approaches employed by the grants we need to construct a normative framework for what it means for an off-grid RE intervention to be sustainable. We have devised four dimensions of sustainability, which we will use to guide our instruments and analysis strategy for evaluation question 3. These dimensions, as outlined below, are interlinked. The adequacy of O&M plans is informed in part by the sufficiency of funding for their execution, for example, just as unintended environmental costs of RE assets are dependent on the technology selected and the environment in which it will be deployed. However, by establishing these dimensions, we can discuss the sustainability of the various grants using common language and criteria. These dimensions will be informed by aspects of all of our instruments, although they will be most informed by discussions with management units, PLN, and ESDM.

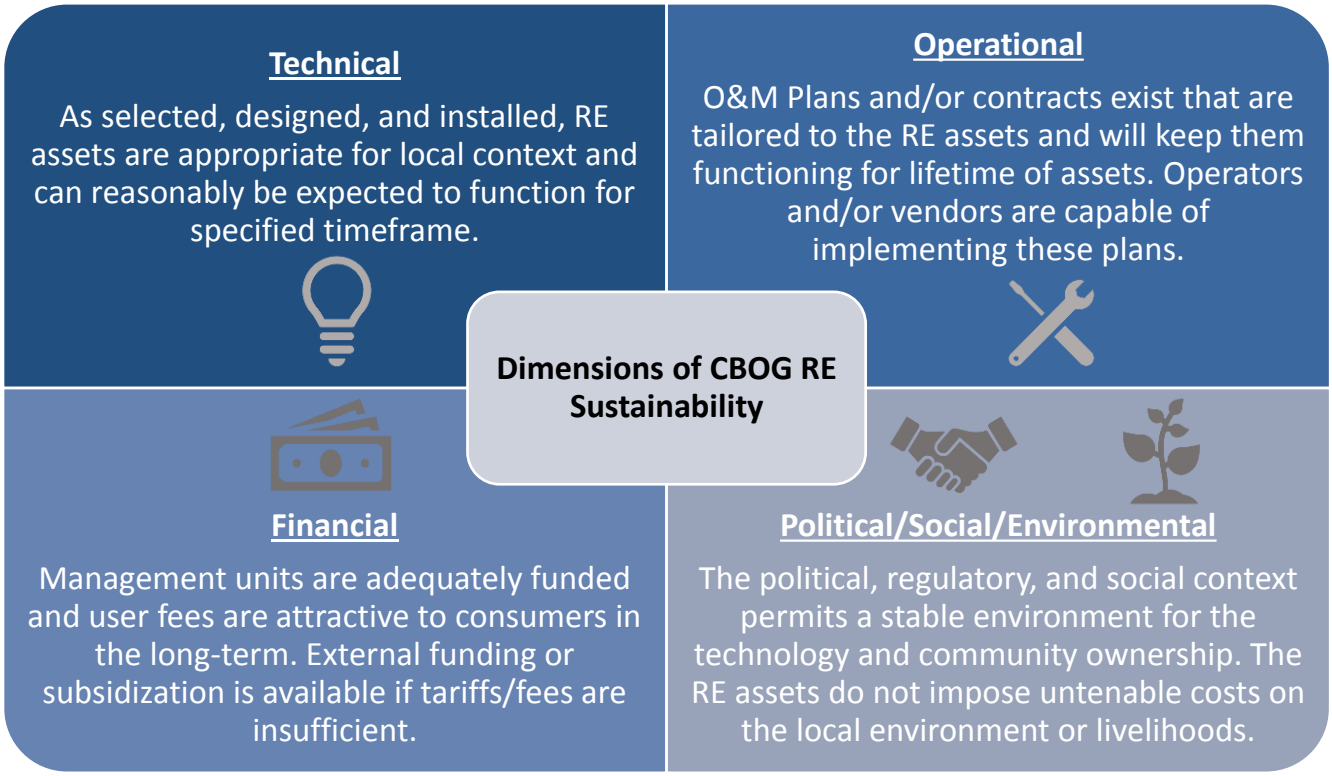

Figure 9: Dimensions of CBOG RE Sustainability

3.6 Portfolio Evaluation Challenges & Limitations

3.6.1 Risks to the W3A Anekatek Solar, East Sumba Impact Evaluation Design

This section describes a variety of potential risks with our impact evaluation approach for the W3A Anekatek Solar, East Sumba grant as well as our proposed mitigation strategies. Specifically, we consider the most important risks as summarized in Table 13 and discuss them in greater detail below.

Violation of CIA assumption. A major risk is related to the assumption that conditional on control for baseline observable characteristics through the matching process, the expected outcomes of treatment and comparison groups are similar. Given that the selection of treatment kampungs was neither random nor did it follow a systematically documented approach, it would be impossible to exhaustively model the treatment process or control for all relevant factors. However, based on discussions with a variety of stakeholders, we believe that the potential comparison areas are quite similar to treatment areas along demographic, social, economic, and energy use characteristics. Moreover, we will collect extensive data at baseline on which to match, and the DiD approach eliminates this concern for any time-invariant unobserved characteristics.

Table 13: Categorization of threats to identification of impacts, and mitigation strategy

Type of risk	Description	Mitigation strategy
Violation of CIA assumption	Imperfect control for factors that influence program outcomes	-Conduct balance tests at baseline -Test for systematic differences following baseline -Use CEM based on variables from an extensive baseline -Use DiD approach to control for time-invariant factors
Lack of statistical power	Power may be too low to identify expected effect sizes	-Use conservative assumptions in power calculations -Oversample, particularly in comparison areas, to limit effects pruning and minimize the effect of clustering
Confounding	Outcome variables may be affected by time-varying factors that are not related to treatment (e.g. electrification in comparison kampungs)	-Review and interviews with regional stakeholders to identify plans for electrification -Relatively short measurement time horizon makes installation of new systems during IE unlikely -Oversampling of comparison kampungs
Seasonal Bias	Changes observed in interim data collection may be caused by difference in season, rather than the program.	-Select a month for data collection that is proximal to but outside peak rainy season -Maintain endline data collection in the same season as baseline - Use of a control group mitigates this risk as the seasonal differences can be expected to be similar in treatment and control areas
Other important considerations (not discussed in detail in following text)	1) Attrition in sample 2) Spillovers/general equilibrium effects 3) Incomplete program implementation prior to compact close	1) Power calculations allow for 15 percent loss to follow-up 2) Spillovers unlikely, but oversampling of kampungs to permit dropping as needed

Type of risk	Description	Mitigation strategy
		3) Track monitoring data and maintain flexibility in data collection timing

Lack of statistical power. Another distinct concern has to do with the potential lack of statistical power to reliably measure impacts of the MCC investments. This is of particular concern in this case due to the very low number of treatment kampungs, which makes power very sensitive to ICC. Moreover, any specific events that would require removal of a treatment kampung from analysis (for example, lack of completion of installation in a kampung) would have a large effect on power. A third concern relates to the pruning process during matching. If many households (or even perhaps whole kampungs) are pruned due to lack of a suitable match, power will further decrease. To mitigate this risk, we have been relatively conservative in estimating parameters for power calculations. We also propose oversampling at baseline to allow for pruning, as well as sampling additional comparison kampungs to gain power (due to the diminishing returns of increasing the sample of households in each treatment kampung).

Confounding. Another potential source of bias in our estimates of impact could emerge from confounding by time-varying factors affecting treated and untreated comparison units differentially. Perhaps the most important confounder would be electrification of comparison kampungs, either by PLN or another project. To mitigate this risk, we will do a systematic review of other stakeholders involved in electrification in E Sumba and through interviews identify (and exclude from our comparison kampung population) any areas planned for electrification. Through this review and because of the relatively short duration of the IE, in comparison to the time typically taken for permitting and installation of electrification, we do not expect this to be a significant threat in practice. Moreover, we intend to oversample comparison kampungs, which would permit dropping a very small number of comparison kampungs if they are electrified.

Seasonal Bias. We have introduced a risk to our study at interim data collection by electing to conduct interim data collection in March of 2019 rather than November of 2018 or 2019. Since energy usage and relevant covariates might be expected to vary naturally with the seasons over the course of a year (e.g. more lights may be used during seasons with shorter periods of daylight, income may vary with planting/harvesting seasons, etc.), collecting follow-up data during a different season than baseline data collection introduces the possibility that changes observed in these variables may be caused in part by seasonal variation rather than the intervention. Unfortunately, given that data collection in November 2018 was unfeasible, the only way to completely mitigate this risk is to amplify the risk of confounding described previously. Namely, waiting to collect data until November 2019 increases the risk that comparison kampungs are electrified by PLN or another project. We consider accepting this risk of confounding to be unreasonable, given that it would be feasible to collect data in March in a season that is reasonably similar to November in our study areas. Namely, our data collection partner informs us that March is the end of the rainy season with a similar amount of rain and daylight as November at the beginning of the rainy season. Moreover, by using a comparison group, this risk is significantly mitigated as the changes in seasonality are likely to be similar across treatment and comparison areas. Furthermore, planning for endline data collection in November of 2020 will allow us to collect data in the same season as baseline again at a future data collection period. In short, we feel that we stand to lose more validity in our experimental design by accepting the risk of confounding contamination than

we stand to gain in precision of our impact estimates by waiting for the exact same season as baseline data collection.

3.6.2 Risks to the Non-Experimental Designs in the Portfolio Evaluation

Non-experimental methodologies are not meant to produce estimates of outcomes or impacts that can be causally linked to programs and tend to focus more on implementation and case studies or perceptions of change in key outcomes. These methodologies can be pursued when quasi-experimental or experimental methodologies are infeasible (as is the case with W3A Akuo Energy Solar/Micro-Hydro, Berau) or misaligned and/or superfluous in the context of evaluation objectives (e.g. the four case study grants). However, non-experimental methodologies are still meant to produce reliable descriptive information about their subject programs and participants that responds to guiding evaluation questions. Risks to our non-experimental methodologies' ability to accomplish this objective are described below.

Recall Bias. Since we cannot rely on a baseline, counterfactual-based comparison group and/or statistical methods to estimate changes in program outcomes or impacts, we must often gauge whether program outcomes were realized through the recollection of program beneficiaries. For both the pre/post performance evaluation of the W3A Akuo Energy Solar/Micro-Hydro, Berau grant and the four case studies, we attempt to do this at least in part by asking beneficiaries to qualitatively compare the present state of outcomes of interest to their recollection of the state of these outcomes before the interventions took place. Their response to these prompts may be fallacious simply because they cannot recall their energy usage or other related outcomes a year or more in the past. For the pre/post performance evaluation, this potential source of bias is mitigated by having quantitative estimates for outcomes of interest in the household survey that can corroborate the information provided in FGDs. For the case studies, on the other hand, we can only combat this risk through proper phrasing of questions and skillful FGD facilitation. Our instruments will avoid leading questions, or questions that suggest a response (e.g. "Wouldn't you say that your consumption of energy has increased relative to 2017?"), since respondents may be inclined to follow where the question is leading rather than work to recall the actual state of affairs. Additionally, facilitators will work to ensure that there is vigorous group discussion around questions that involve recall, since other participants may raise points that help each other recall more carefully. In doing so, they will work with respondents to tie recall periods to commonly remembered events in the community.

Response Bias. Some respondents may perceive that a certain kind of response is most desirable and decide to offer that response instead of sharing their true perspective. Examples that may motivate this kind of response include the desire to present oneself positively in front of one's peers (e.g. not revealing that you do not consume electricity because you cannot afford it in an FGD with other households, or agreeing with a probe by the facilitator to conceal that you do not understand it) or the desire to provide a response that motivates additional programming in the future (e.g. providing a positive point of view on a failing utility with the hopes that this may motivate continued external assistance or funding). Survey design and facilitation are also key in mitigating these potential sources of bias. For example, phrasing questions in simple, commonly used, open-ended language and piloting instruments to ensure that respondents understand them will avoid respondents tersely acquiescing to the facilitator. Our FGD sampling methodology, which will ensure that respondents are of the same sex, will aim to avoid creating uncomfortable social dynamics that lead to respondents concealing their perspectives. We will use our informed consent scripts to ensure that all

respondents understand that their confidentiality will be protected, that FGD respondents are expected to respect each other's confidentiality, and that there is nothing for anyone to gain from participating in our study aside from helping the evaluation team and evaluation users learn about the programs that have already occurred. Finally, facilitators will aim to create a comfortable environment where respondents can be forthcoming with their perspectives.

3.6.3 Limitations of Interpretations of the Results

While the approaches outlined above should generate reliable information for the six grants studied, including representative information for the two Window 3A grants, we are limited in our ability to generalize these results to other RE grants, particularly those operating on other islands or using other RE technologies. Furthermore, given that we have selected grants for this portfolio evaluation on the basis of the quality of available documentation and their suitability for quantitative evaluation, it stands to reason that they may have been better prepared grants on balance than the ones that were not selected. Thus, interpreting the results of these six grants as if they represented the results of the portfolio might positively bias one's view of the success of the portfolio. By including three grants each from a pair of different islands, however, we are able to at least observe the ways that outcomes and sustainability may vary according to different approaches in the same geographic context and different geographic contexts using the same approach. In sum, while the knowledge products of this evaluation will not present a complete narrative of the CBOG RE grant portfolio, they stand to generate valuable and defensible lessons learned from nearly a quarter of the grants in the portfolio.

As described previously, only the results from the evaluation of the W3A Anekatek Solar, East Sumba grant can be interpreted causally. In all other cases, even if we are able to speak about outcomes in a quantitative sense, we will be speaking about them descriptively. This means that while real and perceived changes in outcomes of interest may suggest program impact, we will be limited in our ability to conclusively demonstrate that these changes were the result of the grants. The claims will rely principally on secondary data sources and perceptions of respondents. This limitation extends naturally from the way the grants were implemented—methodologies that would yield a causal result were not possible to implement for most of the grants.

4 ADMINISTRATIVE

4.1 Summary of IRB Requirements and Clearances

In conjunction with MCC's commitment to respect and follow the Common Federal Policy for the Protection of Human Subjects where feasible, SI will pass the approved evaluation design through IRB review prior to data collection. SI has an in-house Institutional Review Board (IRB) that can review applications for human subjects research. SI's internal IRB has established protocols for gathering informed consent, protecting anonymity and identifying information, and ensuring ethical data collection—including from children and other vulnerable populations. It is registered with the U.S. Department of Health & Human Service's Office for Human Research Protections.

In addition, SI closely monitors and adheres to human subject research regulations in its countries of operation to ensure all evaluations are registered and fully compliant with local law. In this case, in accordance with Government Decree No: 41/2006,[95] SI will ensure that, if required, research activities under this evaluation and staff supporting these activities apply for and receive the appropriate permits from the GoI's Ministry of Research, Technology, and Higher Education (Ristekdikti).

4.2 Data Protection

SI's process for respecting privacy of respondents during data collection, transfer, storage, analysis, disposal and dissemination is governed by SI's data security guidelines, which are aligned with MCC's microdata guidelines.

4.3 Preparing Data for Public Use

SI will adhere to MCC's open data policy with regard to preparing data for publication. All primary quantitative data collected by the evaluation will be prepared and submitted to MCC according to the most updated version of the Disclosure Review Board (DRB) guidelines available at the time of data collection. On an instrument-by-instrument basis, SI and MCC will weigh the utility of publishing primary qualitative data (even in a restricted-access database) against (i) the risks of respondent re-identification and (ii) the risks of adverse effects on data quality from disclosure. In the event that the utility of this data outweighs the risk of re-identification, and that respondents can be adequately informed via a consent script as to the data's intended use without jeopardizing their willingness to be forthcoming with interviewers, SI will submit this primary qualitative data to MCC as part of the DRB process.

4.4 Dissemination Plan

Since reporting and dissemination must be completed prior to Compact closeout, SI will present the baseline evaluation findings in draft form after receiving feedback from MCC and local stakeholders on the baseline draft evaluation report. One presentation will be given in Washington to MCC, while another will be given to

[95]MINISTRY OF RESEARCH, TECHNOLOGY AND HIGHER EDUCATION. "RESEARCH PERMIT PROCEDURES for Foreign Universities, Research and Development Institutions, Companies and Individuals, Regarding Research and Development Activities in Indonesia." *Http://Www.international.itb.ac.id*, Republic of Indonesia, 2015, www.international.itb.ac.id/web/wp-content/uploads/2010/05/Foreign_Research_Permit_Procedure_2015.pdf., Annex 1

local stakeholders in Jakarta including MCA-I, implementing grantees, and relevant GoI stakeholders. We recommend a similar set of presentations in both Jakarta and Washington for follow-up reports given the importance of this sector to the GoI and other stakeholders.

4.5 Evaluation Team Roles and Responsibilities

The evaluation team will be comprised of a field evaluation team and support staff at SI headquarters. In some cases, evaluation team members will have a role both as field evaluators and management support staff. The evaluation team includes all personnel described in Table 11.

Table 14: Evaluation Team

Personnel	Role	Technical/Support	Responsibility
Mike Duthie	Program Manager	Both	Principal Investigator, responsible for technical oversight and senior-level evaluation expertise. Will lead evaluation design, data collection, reporting, and dissemination. Also responsible for oversight of overall contract performance for SI-HQ.
Krystyna Krassowska	Sr. Analyst, Qualitative	Technical	Will advise on qualitative instruments and sampling strategy, lead a sub-team for qualitative data collection, and participate in qualitative data analysis and writing.
Jörg Peters	Sr. Analyst, Renewable Energy	Technical	Expert in the evaluation of RE programming, responsible for advising evaluation team on sector-appropriate evaluation design and instruments. Will contribute to the oversight of field data collection as instructed by Principal Investigator, as well as data analysis and reporting. Will be specifically responsible for analyzing engineering and O&M documentation for RE assets to assess technical sustainability.
TBD	Jr. Analyst	Technical	Subject matter expert in solar photo-voltaic technology and programming, will advise on quantitative and qualitative instruments and plan for field data collection. Will contribute to the oversight of field data collection as instructed by Principal Investigator as well as data analysis and reporting.
Miguel Albornoz	Jr. Analyst	Both	Mid-level evaluator. Will contribute to evaluation design, data collection, analysis, and reporting as instructed by the Principal Investigator. Primarily responsible for managing the data collection subcontractor and overseeing data quality assurance. Will participate in qualitative field team.

Personnel	Role	Technical/Support	Responsibility
Upik Sabainingrum	Quantitative Research Assistant (local)	Technical	Local research assistant that will participate in enumerator training and oversee quantitative data collection effort.
TBD	Qualitative Research Assistant (local)	Technical	Local research assistant that will assist in arrangement of case studies and Window 3A qualitative data collection and serve as an interviewer/facilitator.
TBD	Administrative Assistant(s) (local)	Both	Will arrange logistics and serve as notetakers for qualitative field data collection sub-teams.
Carly Farver	Research Assistant (HQ)	Support	Will serve as the evaluation manager for SI-HQ support staff, and thus manage finances, personnel, scheduling, and contractual compliance for the evaluation.
Julia Higgins	Administrative Assistant (HQ)	Support	Project assistant responsible for administration and project backstopping. Will contribute to data quality assurance as instructed by the Principal Investigator.

4.6 Evaluation Timeline and Reporting Schedule

Table 15 displays the schedule for the evaluation, with a detailed breakout for interim data collection.

Table 15: Evaluation Timeline and Reporting Schedule

Name of Round	Data Collection[96]	Data Cleaning & Analysis	First Draft Report Expected	Final Report Expected
Baseline	October/2017 – November/2017	November/2017 - December/2017	January/2018	February/2018
Follow-up 1	March/2019 – September/2019	April/2019 - November/2019	December/2019	March/2020
Follow-up 2	November/2020 – April/2021	December/2020 - May/2021	June/2021	August/2021

[96] Per MCC's EDR Template, a Data Collection Summary Table is available in Annex 5: Data Collection Summary Table.

Task	Deadline
Draft Evaluation Design Report (EDR) Submission	July 21, 2017
Institutional Review Board and Ristekdikti Materials Submission	July 28, 2017
Feedback on EDR Received	Aug. 11, 2017
Data Collection Subcontractor Selected	Aug. 25, 2017
Final EDR Submission	Aug. 21, 2017
Baseline Qualitative Data Collection	Sep. 18 – Oct. 5, 2017
Baseline Quantitative Piloting/Enumerator Training	Oct. 16 – 20, 2017
Baseline Quantitative Data Collection	Oct. 23 – Nov. 30, 2017
Summary of Quality Control Checks Submission	Dec. 15, 2017
Draft Baseline Evaluation Report Submission	Jan. 12, 2018
Feedback on Baseline Evaluation Report Received	Jan. 31, 2018
Draft Baseline Findings Presentation Delivered - Washington	Week of Jan. 15, 2018
Draft Baseline Findings Presentation Delivered - Jakarta	Week of Jan. 22, 2018
Final Baseline Evaluation Report Submission	Feb. 23, 2018
Revised EDR Submission	Dec. 5, 2018
Institutional Review Board and Ristekdikti Materials Re-Submission	Jan. 15, 2019
Feedback on EDR Received	Dec. 31, 2018
Data Collection Subcontractor Procured	Feb. 1, 2019
Final EDR Submission	Jan. 11, 2019
Interim Quantitative Piloting/Enumerator Training	Week of Feb. 25, 2019
Interim Quantitative Data Collection	Mar. 4 – Mar. 29, 2019
Summary of Quality Control Checks Submission	Apr. 30, 2019
Interim Qualitative Data Collection	Aug. 19 – Sep. 13, 2019
Draft Interim Evaluation Report Submission	Dec. 20, 2019
Feedback on Interim Evaluation Report Received	Jan. 31, 2020
Draft Interim Findings Presentation Delivered - Washington	Week of Jan. 13, 2020
Draft Interim Findings Presentation Delivered - Jakarta	Week of Jan. 20, 2020
Final Interim Evaluation Report Submission	Feb. 21, 2020

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6 ANNEXES

6.1 Annex 1: Stakeholder Comments and Evaluator Responses

The comment matrix below applies to the draft version of this EDR submitted in December 2018 in advance of interim data collection. It does not include comments from MCC and MCA-I on a previous draft version of this EDR, submitted prior to baseline data collection.

6.1.1 Local Stakeholder Comments and Evaluator Responses

Although the draft EDR revised for interim data collection was shared with local stakeholders for review, they did not provide any comments.

6.1.2 MCC Evaluation Management Committee Comments and Evaluator Responses

Reviewer Name/ Institution	**Page Number** (in draft EDR)	**Comment**	**Evaluator Responses**
Evaluation Lead/MCC	10+	Table 1: I think it's important to update this table, since this is a 2018/9 version of the EDR. I suggest adding a column with the "Disbursed Project Value with Co-financing" and the "Grant Status" (terminated/completed). You can find this information, by grant, in columns K and BZ of the closeout ITT in the "Input to ITT" tab. You can use column D to filter by Window, and it should be easy enough to match the grant name/number.	These fields have been added to the table per the "Input to ITT" tab. Note that in some cases column BZ is empty in the ITT. In these cases, we have listed "N/A" in our table. Additionally, we assume that grants listed with an "active" status in the ITT should be considered completed, since the Compact has ended. We have relocated this table, now Table 16, to Annex 4 due to its excessive size.
Evaluation Lead/MCC	17 and throughout	The section title of 2.1.2.1 "Pre/Post Grants" is not accurate, since the analysis for Anekatek is treatment vs. comparison. I understand how this distinguishes approaches, since the two prior grants' analyses involve pre and post data, but it will be confusing to the reader on methodology. This needs to be addressed throughout the report in the section headings, as well as the text in Section 3. You could distinguish the two sets of grants by W3A and W2, rather than methodology.	We have adjusted language accordingly throughout the report, although we note that the Hivos grant was funded through Window 1. So, headings now refer to "Window 3A" and "Other"or "Case Study" grants.
Evaluation Lead/MCC	41 and 46	When justifying the timing of data collection, please also reference the exposure period (i.e. exposure to treatment), not just time between rounds of data collection. My understanding was that the interim report would report ~1-	This is mostly correct, as most of the works were commissioned in March 2018, although some kampungs in East Sumba had mini-grids commissioned up to four months before the last mini-grids were commissioned in March. So, interim data collection

Reviewer Name/ Institution	Page Number (in draft EDR)	Comment	Evaluator Responses
		year impacts, while the end line would report 2-year impacts. Now it's 1 and 2.5, with the understanding that grants finished implementation in March 2018? In sections 3.3.2 and 3.4.2. (timeframe of exposure), the exposure periods are also not clearly stated, just time between rounds of data collection.	will be 12-16 months of exposure to the mini-grids and endline will be 32-36. We have updated these sections to reference timeframe of exposure.
Evaluation Lead/MCC	44	I suggest focusing the Hivos case study on the solar lantern component, since that was the largest part. I imagine the transport costs to convene farmer FGDs would be prohibitive.	Noted. We have removed the farmer FGD from the table and will focus on the school-based components for the case study, with a particular focus on the solar lanterns.
Evaluation Lead/MCC	General	Please add the table noted on page 3 of MCC's EDR template into an annex to the report (or wherever else you think it fits). This table should cover all distinct rounds of data collection. [Data collection / Timing/ Sample Unit / Instrument / Exposure Period.	Table added in Annex 5.
Sector Lead/MCC	27	WRT main theory of change, there doesn't seem to be any assumption around ability/willingness to operate and maintain power system. Our understanding pre-project was that many other similar donor or GoI funded initiatives had failed because despite a willingness to use the technology, there was either an inability or unwillingness to maintain/repair these systems once furnished. the theory of change of the W3a grants is that by partnering with experienced and incentivized developers, our projects would be less likely to suffer a similar fate. i would like this to be explicitly stated as it formed the basis for W3a and we would very much like to test this assumption as it is central to our theory of change.	This was listed as an example at the end of the fourth assumption, but we have made it its own additional assumption in the updated text. We note that we have already listed capacity building in O&M as a core tenet of the ToC, although we recognize that the sufficiency of this capacity building is assumed. We also added that the assumption that external constraints don't preclude communities from fulfilling their responsibilities in O&M.
Sector Lead/MCC	29	WRT IBEKA grant, there should be some mention of the fact that the project proponent is an NGO that manufactures their own hydropower equipment that they claim is easier and cheaper to maintain, which should improve its uptake and/or energy production and expense profile over time.	We were previously unaware of this aspect of the grant based on available documentation, but we have included the following text based on this comment:

Reviewer Name/ Institution	Page Number (in draft EDR)	Comment	Evaluator Responses
		the reason MCC was interested in studying this grant further is that it seemed to be another sustainability 'model' worth exploring, due to the nature of the technology and capacity of the NGO involved.	"We can assert based on preliminary discussions with MCC that a key component of this grant's approach to sustaining outcomes is the project proponent's ability to manufacture their own hydropower equipment that is easier and cheaper to maintain than commercially available equipment. If this holds true, this grant may be more able to sustain O&M challenges to the MHP's long-term operation and, so long as the decreased expense of operation is filtered down to end-users in the form of lower tariffs, encourage better uptake of the technology from community members."
Sector Lead/MCC	30	WRT Hivos grant it might be worth mentioning that beyond the RESCOs, the project does another thing differently than most diffused small home solar systems…it aggregates the energy source/charging station at more centralized locations where there are already educated personnel and built-in habitual users (schools, health centers, etc) as well as productive use (education, health provision, etc). this is an interesting and noteworthy change to the typical model of giving out solar kits to HHs and having the panels and all hardware spread out in that fashion.	Most of the grants involved in the portfolio evaluation are centralized, but definitely a notable difference compared to other grants encouraging small-scale RE use. We have included the following paragraph in this section: "Relative to strategies employed by other grants in encouraging small-scale RE usage in similar contexts, another differentiating factor of the Hivos grant is the aggregation of RE sources and charging stations in centralized locations where there are educated personnel and built-in habitual users, such as schools and health centers. By dispersing individual- or home-level technologies around these hubs, the grant aims to reduce the risk of equipment falling into disrepair or falling out of use. "
Environment and Social Performance 1/MCC	28	Outcome 2 in log frame assumes a reduction in or avoidance of GHG emmissions. Based on our conversations with beneficiaries, most (if not all) intended to keep using the non-renewable electricity sources they'd used before the project. Further, these conversations revealed that most beneficiaries perceived the electricity made available to them through renewable means as a resource to complement, not replace, their existing gensets, etc. Thus it can't necessarily be assumed that households will be spending less on electricity, or that it will predominantly	We agree. We have questions that investigate the full range of energy sources used and have added questions to understand why different sources are used. This will be further explored in the qualitative data collection.

Reviewer Name/ Institution	Page Number (in draft EDR)	Comment	Evaluator Responses
		come from a renewable source post project. Seems this evaluation should take the ongoing use of pre-project electrical sources into account as well.	
Environment and Social Performance 1/MCC	115	In relation to the point above, it might be good to complment the first question about electricity use (i.e. "Do you have the following electricity sources in your household?') with another asking which technologies are in use on a daily basis, in what combination, and based on what preference. Again, the renewable technologies that are being studied are more likely to be part of a household's strategy to meet its electricity needs rather than the primary means to do so.	We agree. We have added questions to further explore this (see questions 46-48 of the household survey instrument) and intend to review this in more detail during qualitative data collection.
Environment and Social Performance 2/MCC	General	SI notes rightly that Siberut is a case apart as the only biomass-based project in the off-grid portfolio. Given that status, it would follow that for the evaluation of those 3 sites the questionnaire should be supplemented to also address (at both FGD and household levels) issues of sustainability related to bamboo as fuel for both phases (imported and planted/harvested in place) and covering matters of land availability/displacement of other crops; gender-differentiated roles in planting and harvesting; and functioning or the Village-Level Enterprises and equity of households in said VLEs.	This is outside our scope--MCC did not select this grant to include among those evaluated.
Gender and Social Inclusion Lead/MCC	General	how were the PSGIP drafted, were women and men consulted for development of PSGIPs? Were PSGIPs developed and implemented well? Did PSGIP help increase women's access to and benefit from projects? If yes, what were the achievements? How many women directly benefitted from the off-grid RE projects such as receiving technical training, earning income as technicians of RE system, becoming a member of SPV management and O&M, how many women benefitted from establishing or expanding their businesses? what types of busieness? are	Our evaluation will comment on gender-disaggregated outputs and outcomes of interest both quantitatively and qualitatively where relevant to our evaluation questions, but investigating the PSGIPs specifically is outside the scope of our evaluation questions. We do note that many outcomes of interest are household-level outcomes, and thus do not make sense to disaggregate by gender.

Reviewer Name/ Institution	Page Number (in draft EDR)	Comment	Evaluator Responses
		the income from busness increased already or showing potential for increase? will these enterprises, women's economic activities income generation be sustainable?	
Gender and Social Inclusion Lead/MCC	General	what were the process of developing the SPV or management and O&M of the RE facility? Any community consultation for drafting and agreement of SPVs? Did women and men of the communities provided inputs to SPV establishment, management and O&M?	The evaluation will look at whether the SPV, ownership models, and OM approaches were actually implemented as designed. We will also probe with key stakeholders and community members to identify issues that might affect sustainability, including levels of participation in development and implementation of the SPV and OM.
Gender and Social Inclusion Lead/MCC	General	did grantees conduct LLA analysis? If yes, did the findings helped any adjustment of the project activities, especially risk identifucation and mitigation?	Based on our evaluation questions, our evaluation will only comment on these questions tangentially, to the extent that stakeholders feel they are critically important to the sustainability of the community ownership approach.
Gender and Social Inclusion Lead/MCC	General	"community ownership model", were the communities able to "own" these RE facilities? Is yes, how, if not why not? Any elite capture over these facilities? If not, what made it possible not to have elite capture?	The evaluation will look at whether the SPV, ownership models, and OM approaches were actually implemented as designed. We will also probe with key stakeholders and community members to identify issues that might affect sustainability, including elite capture.
Gender and Social Inclusion Lead/MCC	General	were any community women part of BUMDES? If yes, how many and where? If women were not part of any BUMDES, what were the fauilure? Were any elected local government women part of BUMDES?	Based on our evaluation questions, our evaluation will only comment on these questions tangentially, to the extent that stakeholders feel they are critically important to the sustainability of the community ownership approach.
Gender and Social Inclusion Lead/MCC	General	Reduction in GHG Emissions: Valuing the reduction in GHG emissions will rely on internationally accepted standards of valuation for GHG emissions. New research has resulted in models that can generate the social cost of carbon from a single country's perspective. A recent study by Ricke, et al (2018), allows for the estimate the social cost of carbon for Indonesia. Ricke, Katharine, Laurent Drouet, Ken Caldeira, and Massimo Tavoni. "Country-level social cost of carbon". Nature Climate Change (2018), Volume 8, pages 895–900.	We appreciate the commenter bringing this article to our attention, although we note that the evaluation is not tasked with estimating the benefit of reduced GHG emissions from the grants. Rather, the evaluation is only expected to estimate the extent to which the grants may have reduced GHG emissions based on changes in energy consumption caused by the grants.

Reviewer Name/ Institution	Page Number (in draft EDR)	Comment	Evaluator Responses
Gender and Social Inclusion Lead/MCC	General	Nationally Determined Contribution (NDC) will provide estimation of GHG by districts.	Our estimation of GHG emissions will be done at the grant level, so we do not need district-level GHG estimates.
Economic Analysis Lead/MCC	40	"placed the highest emphasis on which grant would lend itself the most to an impact evaluation design" While practical from the cost perspective, identifying projects in this way likely introduces selection bias. Evaluable grants are likely to be the grants with the largest impacts which in turn could give an overly optimistic view of the impact of the grants portfolio as a whole. The text needs to more clearly state that evaluation results will apply only to the sampled grants and do not necessarily carry over to the portfolio.	"given that we have selected grants for this study on the basis of the quality of available documentation and their suitability for quantitative evaluation, it stands to reason that they may have been better prepared grants on balance than the ones that were not selected. Thus, interpreting the results of these six grants as if they represented the results of the portfolio might positively bias one's view of the success of the portfolio."
Economic Analysis Lead/MCC	49	"match the treatment aggregations as closely as possible (and not to represent the entire sample frame of potential comparisons), settlement aggregations are selected using a non-random method." A non-random/purposive sampling approach can be acceptable if the selection process is designed to minimize bias. Can you expand on how this non-random selection process will work? In particular, can you explain "closest to a treatment settlement aggregation"? Does this refer to geographic proximity? Population? Socio-economic distance? An index of some combination of these? Depending on the specific approach, can you discuss the potential sources of bias which might creep into the analysis as a result?	We have clarified in the text that this refers to geographic proximity. Prior to baseline data collection we only had GIS and population data outside of the data used to define the sample frame, hence our use of geographic proximity to select the comparison group. We discussed the degree to which this approach yielded similar treatment and comparison kampungs in our baseline report and reference this discussion in an updated footnote on pg. 49. Essentially, comparison kampungs ended up similar to treatment kampungs prior to the intervention in terms of electricity access and consumption and different in terms of wealth and remoteness (distance to a main road, public facilities, etc.) Since we restricted our comparison sample frame to households not targeted by PLN for electrification, this difference likely reflects that the grantee and PLN alike are targeting households with a more promising ability to pay tariffs for electricity.
Monitoring and Evaluation Lead/MCC	54	"A priori, the desired respondent is the person most responsible for decisions related to energy use and expenditures, likely the household head. If this person is unavailable at the time of survey administration, we would permit the survey to be conducted with another adult household member who is involved in and informed of	At baseline, we found that in practice households with more than one resident often preferred to respond to the survey as a group. So, a household member mostly engaged in domestic tasks might respond to most of the survey while their spouse might respond to the questions on income-generating activity. There were cases where a household member might correct another member's

Reviewer Name/ Institution	Page Number (in draft EDR)	Comment	Evaluator Responses
		decisions related to energy use." - What did your baseline data collection effort indicate about household roles/division of labor? Though a household might be headed by a man on paper, a woman might be the one who is more responsible for energy use and expenditures. How did/will you identify and address this?	response, and the two would come to a consensus on the correct response. Thus, although there are certainly gender roles in these communities, we found that allowing for households to respond to the survey as a group frequently mitigated any risk of bias that these roles might pose. Since responding as a group was not a clear option in the original text, we have amended the text to reflect this.
Monitoring and Evaluation Lead/MCC	69	As Table 13 indicates that respondents will have to describe pre-intervention conditions at least one year before, some discussion of how to mitigate the risk of recall bias is needed.	We have updated and restructured the limitations section (3.6) to discuss the risk of recall and response bias to our non-experimental designs.
Monitoring and Evaluation Lead/MCC	71	The financial dimension could be discussed further. If external funding or subsidization is needed, does it mean that the particular off-grid RE model/approach does not work, as it is not self-sufficient?	We will certainly look at whether external subsidization is required for sustained operation as part of our review of sustainability. If continued external subsidy is required, this would imply that it is not self-sufficient, but a donor may wish to still support the project if it provide public or equity benefits.
Monitoring and Evaluation Lead/MCC	174	In the case of a grant that did not have a clearly defined program logic/theory of change, how will you mitigate the risks that the grantee respondent 1) may not remember exactly what the logic was or 2) has revised it, intentionally or not, to align with what actually happened during implementation?	Our protocol requests documentation to support any notion given by the grantee of the original theory of change. If documentation cannot be provided, we will try to triangulate with other grantee informants that the first informant has recalled the ToC correctly. We will be sure to report our degree of confidence in the "planned" ToC in the final evaluation report. Added a footnote to this effect

6.2 Annex 2: Evaluation Budget

Per MCC's instructions regarding sensitivities around future procurements, the evaluation budget corresponding to this Evaluation Design Report has been provided to MCC separately.

6.3 Annex 3: Instruments

This annex includes the English version of all instruments that we plan to use in the evaluation, as they were referenced in Sections 3.3.4 and 4.3.4. W3A Anekatek Solar, East Sumba/W3A Akuo Energy Solar/Micro-Hydro, Berau Household Survey.

6.3.1 Household Questionnaire

HOUSEHOLD QUESTIONNAIRE

Impact Evaluation Baseline Study 2017

Green Prosperity Renewable Energy Grant

1. Questionnaire N° _____

2. Site code _____

3. Geo coordinate _____

4. Date _____

5. Hamlet _____

6. Interviewer's name _____

7. Starting Time of Interview _____ : _____ h

8. The walls of the main building consist of…

1	☐	Bamboo
2	☐	Wood
3	☐	Coconut stem
4	☐	Unburnt bricks

9. The main roofing material is …

1	☐	Ijuk
2	☐	Palm leaves
3	☐	Wood
4	☐	Iron sheets

10. The main flooring material is…

1	☐	Earth
2	☐	Bamboo
3	☐	Wood
4	☐	Concrete
5	☐	Bricks

5 ☐ Burnt bricks	5 ☐ Concrete	6 ☐ Stones
☐ Other_____	6 ☐ Tiles	7 ☐ Ceramics
	☐ Other_____	☐ Other_____

11. Are the windows fitted with glass?

1 ☐ Yes
0 ☐ No

12. Is the building plastered?

1 ☐ Yes
0 ☐ No

[COMMENTS]

Basic Information

13.	**14.**	**15.**	**16.**		**17.**	**18.**	**IF CODE 2. or 3.**	
							19.	**20.**
Who are the permanent residents of this household? What relationship does each member have to the head of household? **[Only include household members who are at least 11 years of age]**	Sex	Age	Education **1.** Level of education	**2.** Number of years	First Occupa-tion	Second Occupa-tion	Where does he/ she exercise this occupation?	How much does he/ she earn per month?
	m / f	*years*	*code*	*Years* **[WITHOUT RE-PETITIONS**	*code*	*code*	*code*	*IDR*
a. ☐ _____							1.	1.

								2.	2.
b. ☐ _____								1.	1.
								2.	2.
c. ☐ _____									
d. ☐ _____									
e. ☐ _____									
f. ☐ _____									
g. ☐ _____									
h. ☐ _____									
i. ☐ _____									
j. ☐ _____									
k. ☐ _____									
l. ☐ _____									
m. ☐ _____									
n. ☐ _____									

21. Who is the head of household?

LETTER OF Q.13

22. Who is the interviewee?

LETTER OF Q.13

23. Is any female household member pregnant?

LETTER OF Q.13

24.

CODE of Q.13

1. Head of household
2. Spouse
3. Father/ mother
4. Brother/ sister
5. Son/ daughter
6. Grandchild
7. Other relative
8. Servant
9. Other non-relative

CODE of Q.17 and 18

1. Farmer (**independent**)
2. Farmer **(dependent)**
3. Civil servant **[SPECIFY]**
4. Other **dependent** occupation **[SPECIFY]**
5. Other **independent** occupation **[Specify]**
6. Studies
7. Domestic work, child rearing
8. Without occupation/work

How many children between 6 and 11 years live in the household?

25. How many children younger than 6 years live in the household?

26. **[TOTAL NUMBER OF PERSONS IN HOUSEHOLD.]**

CODE of Q.16.1

0. None
1. Primary school
2. Junior high school
3. Senior high school.
4. Vocational training
5. University
9. Retired

CODE of Q.21

1. Same village
2. Village in same Kecamatan
3. Village in same Kabupaten

[COMMENTS]

27. How many buildings does your house have?

28. How many rooms are there in your main house [excl. bathroom]?

29. How long have you been living on this plot of land?

30.

Do you own the following means of transportation?

[IF SEVERAL, GIVE NUMBER]

0	☐	No			
1	☐	Bicycle	____	4 ☐ Cart	____
2	☐	Motorcycle	____	5 ☐ Tractor	____
3	☐	Car	____	6 ☐ Other:	_____

2. Persons migrated

31.	Have any former household members migrated?	1 ☐ Yes	
		0 ☐ No	→ **q.37**

	32. What relationship does he/ she have to the head of household?	**33.** What is his/ her age?	**34.** What is his/ her education level?	**35.** Where did he/ she migrate to?	**36.** For what reason does he/ she live somewhere else?
	0. He/ she is the head of household 1. Father 2. Mother 3. Son 4. Daughter 5. Spouse 6. Other	*age*	0. None 1. Primary school 2. Junior high school 3. Senior high school 4. Vocational training 5. University	1. Jakarta 2. Village in same Kecamatan 3. Village in same Kabupaten 4. Makassar 5. Padang 6. Other, – specify	1. Seasonal work 2. Daily wage 3. Regular work 4. Scarcity of land 5. Lack of work 6. Studies 7. Marriage 8. Other, specify?
1.					
2.					
3.					
4.					

[COMMENTS]

3. Electric energy

37. Do you have the following electricity sources in your household? [**SEVERAL ANSWERS POSSIBLE**]

0	☐ None	→ **q.38**
1	☐ Car battery (without solar panel)	→ **q.41.1**
2	☐ Individual genset	→ **q.41.2**
3	☐ Connection to a MHP	→ **q.41.3**
4	☐ Individual traditional waterwheel	→ **q.41.3**
5	☐ Traditional waterwheel in the village	→ **q.41.3**
6	☐ Genset in the village	→ **q.41.2**
7	☐ Genset shared with neighbour	→ **q.41.2**
8	☐ Solar panel (installed on roof)	→ **q.41.3**

[COMMENTS]

9	_____kW of solar panel	
10	☐ Solar panel (not installed on roof)	→ **q.41.3**
11	_____kW of solar panel	
12	☐ Solar PV Kit	→ **q.41.3**
13	☐ PLN	→ **q.41.4**
14	☐ SPV-managed solar mini-grid	→ **q.41.4**

		a	b	c	d	e	f	g
		MHP	Car battery	Genset	Traditional water wheel	Solar panel	PLN	No
38.	Have you ever used an electricity source in this household? If so, which type?	1	2	3	4	5	6	0
39.	How many years has it been since your household was disconnected from the electricity source or since the source become non-functional?	_____ years	_____ years	_____ years	_____ years	_____ years	_____ years	-3
40.	Why are you no longer connected to the electricity source? 1. No longer interested 2. Not able to pay the bill 3. Other: ____							-3

→ **q.46**

	1.	2.	3.	4.
41.				

	When did you receive the battery?	When did you receive the genset?	When did you receive this electricity source ?	When did you get connected to the grid? (SPV Mini-Grid or PLN)?
	_____ YEAR	_____ YEAR	_____ MONTH -YEAR	_____ MONTH -YEAR
42.	How many times per year do you charge the battery?	Which fuel do you use for the genset?	How much did you pay for the connection?	How much did you pay for the connection?
	_____ TIMES	1 ☐ petrol 2 ☐ diesel	_____ IDR	_____ IDR
			How much did you pay for the electric installation in your house?	How much did you pay for the electric installation in your house (in-house wiring)?
			_____ IDR	_____ IDR
	_____		Did you make any additional payment to get connected?	Did you make any additional payment to get connected?
			_____ IDR	_____ IDR
43.	How much do you pay for charging the car battery?	How many litres of this fuel do you consume per month?	How did you pay for it?	How did you pay for it?
	_____ IDR	_____ LITRES	1 ☐ Cash/savings 2 ☐ Credit 3 ☐ Donation 4 ☐ Other _____	1 ☐ Cash/savings 2 ☐ Credit 3 ☐ Donation 4 ☐ Other _____

44.	How long does it take you to reach the place where you charge the battery?	How much do you pay per litre for the corresponding fuel?		
	______ IDR	______ IDR		
45.		How much did you pay for the maintenance and repair of this electricity source last year?	How much did you pay for the maintenance and repair of in-house wiring over the last year?	How much did you pay for maintenance and repair of in-house wiring over the last year?
		______ IDR	______ IDR	______ IDR
46.	How often are you using the battery?	How often are you using the genset?	How often are you using this electricity source?	How often are you using this electricity source?
	1 ☐ daily 2 ☐ several days per week ➞ **q.48** 3 ☐ once a week ➞ **q.48** 4 ☐ once a month ➞ **q.48** 5 ☐ less than once a month ➞ **q.48**	1 ☐ daily 2 ☐ several days per week ➞ **q.48** 3 ☐ once a week ➞ **q.48** 4 ☐ once a month ➞ **q.48** 5 ☐ less than once a month ➞ **q.48**	1 ☐ daily 2 ☐ several days per week ➞ **q.48** 3 ☐ once a week ➞ **q.48** 4 ☐ once a month ➞ **q.48** 5 ☐ less than once a month ➞ **q.48**	1 ☐ daily 2 ☐ several days per week ➞ **q.48** 3 ☐ once a week ➞ **q.48** 4 ☐ once a month ➞ **q.48** 5 ☐ less than once a month ➞ **q.48**
47.	How many hours are you using the battery daily?	How many hours are you using the genset daily?	How many hours are you using this electricity source daily?	How many hours are you using electricity source daily?
	______ HOURS	______ HOURS	______ HOURS	______ HOURS
48.	For which purpose are you using the battery? *Select multiple*	For which purpose are you using the genset? *Select multiple*	For which purpose are you using this electricity source? *Select multiple*	For which purpose are you using this electricity source? *Select multiple*
	1 ☐ Lighting	1 ☐ Lighting	1 ☐ Lighting	1 ☐ Lighting

2 ☐ Entertainment 3 ☐ Productive use 4 ☐ Cooking 5 ☐ Blackout of mini-grid to power large appliances 6 ☐ Other:	2 ☐ Entertainment 3 ☐ Productive use 4 ☐ Cooking 5 ☐ Blackout of mini-grid to power large appliances 6 ☐ Other:	2 ☐ Entertainment 3 ☐ Productive use 4 ☐ Cooking 5 ☐ Blackout of mini-grid to power large appliances 6 ☐ Other:	2 ☐ Entertainment 3 ☐ Productive use 4 ☐ Cooking 5 ☐ Blackout of mini-grid to power large appliances 6 ☐ Other:
→ **q.41.2, if genset used by household**	→ **q.41.3, if other electricity source in household;**	→ **q.41.4, if PLN or SPV Mini-Grid.** → **q.62, if not.**	

49.

Which of the following ways is electricity paid for?

1 ☐ KWh Meter (post-paid)

2 ☐ Prepaid meter (prepaid) →**Q.51**

3 ☐ Fixed payment (flatrate)

4 ☐ Payment by number of equipment or appliances

50.

How often are payments for electricity made?

1 ☐ Bimonthly

2 ☐ Monthly

3 ☐ Weekly

4 ☐ Payments periods vary

5 ☐ other:

51.

How much was the last payment made for electric energy?

IDR

52.

When have you bought electricity for the last three times (dates)? How many kWh did you buy and how much did it cost **[RECEIPT]**?

	Date	kwh	Cost (IDR)	includes debt collected	Receipt
a.				☐	☐
b.				☐	☐
c.				☐	☐
d.				☐	☐
e.				☐	☐

** including digital receipts (e.g. mobile)*

53.

Have you been without electricity in the last two months (60 days) because of missing credit on your meter?

1 ☐ yes

0 ☐ no → **q.Q55**

54.

For how many days in total?

DAYS

55.

1 ☐ 0 kWh

2 ☐ 1-5 kWh

5 ☐ 20-30 kWh

6 ☐ 30-50 kWh

At the time of recharging, how many kWh do you usually roughly still have on your meter?	3 ☐ 5-10 KWh		7 ☐ 50-100 kWh	
	4 ☐ 10-20 kWh		8 ☐ >100 kWh	

	1.	2.
56.	How often have you experienced power blackouts within the last month? ☐ Announced: ___ ☐ Unannounced: ___ NUMBER	How often have you experienced power blackouts within the last month? ☐ Announced: ___ ☐ Unannounced: ___ NUMBER
57.	How long did the last three blackouts last? ☐ 1st blackout: ___ ☐ 2nd blackout: ___ ☐ 3rd blackout: ___ MINUTES	How long did the last three blackouts last? ☐ 1st blackout: ___ ☐ 2nd blackout: ___ ☐ 3rd blackout: ___ MINUTES
58.	Are you satisfied with the price per kWh of this electricity source? 1 ☐ very satisfied 2 ☐ satisfied 3 ☐ a bit satisfied 4 ☐ not at all satisfied	Are you satisfied with the price per kWh of this electricity source? 1 ☐ very satisfied 2 ☐ satisfied 3 ☐ a bit satisfied 4 ☐ not at all satisfied
59.	Are you satisfied with the quality of this electricity source? 1 ☐ very satisfied 2 ☐ satisfied	Are you satisfied with the quality of this electricity source? 1 ☐ very satisfied 2 ☐ satisfied

	3 ☐ a bit satisfied 4 ☐ not at all satisfied	3 ☐ a bit satisfied 4 ☐ not at all satisfied
60.	Are you satisfied with the hours per day of electricity provision of this electricity source?	Are you satisfied with the hours per day of electricity provision of this electricity source?
	1 ☐ very satisfied 2 ☐ satisfied 3 ☐ a bit satisfied 4 ☐ not at all satisfied	1 ☐ very satisfied 2 ☐ satisfied 3 ☐ a bit satisfied 4 ☐ not at all satisfied
61.	Are you satisfied with the operator of this electricity source?	Are you satisfied with the operator of this electricity source?
	1 ☐ very satisfied 2 ☐ satisfied 3 ☐ a bit satisfied 4 ☐ not at all satisfied	1 ☐ very satisfied 2 ☐ satisfied 3 ☐ a bit satisfied 4 ☐ not at all satisfied

4. Energy for appliances and lighting

	62. Do you use any of these appliances or machines in your home? **[READ ALL]** If yes, how many?		**63.** Do you use the appliance(s)/ machine(s) to produce goods to sell at home? If yes, for how much time?	**64.** Does any household member use any of the appliances/ machines outside the household? If yes, where? 1 = At a friend's place 2 = At work 3 = At a neighbour's house 4 = other, specify
0.	None ☐ → **q.65**			
1.	Iron			
	a. Charcoal	___	☐No☐ Yes YEARS: ___	

	b. Electric	____	☐No☐ Yes	YEARS: ____			
2.	Refrigerator						
	a. Fuel-run	____	☐No☐ Yes	YEARS: ____			
	b. Electric	____	☐No☐ Yes	YEARS: ____			
3.	Electric stove	____	☐No☐ Yes	YEARS: ____			
4.	Electric kettle	____	----------				
5.	Rice cooker	____	☐No☐ Yes	YEARS: ____			
6.	Magic Jar	____	☐No☐ Yes	YEARS: ____			
7.	Ventilator	____	----------				
8.	Landline telephone	____	☐No☐ Yes	YEARS: ____	☐No☐ Yes	PLACE: ____	
9.	Mobile phone	____	☐No☐ Yes	YEARS: ____	☐No☐ Yes	PLACE: ____	
10.	Radio		----------		☐No☐ Yes	PLACE: ____	
	a. Battery only	____	----------				
	b. Bivalent	____	----------				
	c. Line power only	____	----------				
11.	CD / VCD	____	☐No☐ Yes	YEARS: ____			
12.	TV	____			☐No☐ Yes	PLACE: ____	
	a. Black and white	____	☐No☐ Yes	YEARS: ____			
	b. Color	____	☐No☐ Yes	YEARS: ____			
13.	Satellite receiver	____	----------				
14.	Computer	____	☐No☐ Yes	YEARS: ____			
15.	Printer	____	☐No☐ Yes	YEARS: ____			
16.	Mill	____					
	a. Fuel-run	____	☐No☐ Yes	YEARS: ____			
	b. Electric	____	☐No☐ Yes	YEARS: ____			

17.	Sewing machine	____		
	a. Mechanical	____	☐No☐ Yes YEARS: ____	
	b. Electric	____	☐No☐ Yes YEARS: ____	
18.	Other :_____	____	☐No☐ Yes YEARS: ____	

	65. Do household members use electric appliance(s)/ machine(s) to produce goods/ offer service **outside home**?	**66.** Who is the household member **[use code Q.13]**?	**67.** Which are the three most important electric appliance(s)/ machine(s) the household member uses?
1	1 ☐ Yes 0 ☐ No → **q.68**	_____	A _____ B _____ C _____
2	1 ☐ Yes 0 ☐ No → **q.68**	_____	A _____ B _____ C _____
3	1 ☐ Yes 0 ☐ No → **q.68**	_____	A _____ B _____ C _____
4	1 ☐ Yes 0 ☐ No → **q.68**		A _____

		_____	B _____ C _____
5	1 ☐ Yes 0 ☐ No → **q.68**	_____	A _____ B _____ C _____

[COMMENTS]

68. Do you charge your mobile phone(s) at home?	**69.** What is the distance to the place where you charge the phone?	**70.** How much do you pay per charge?	**71.** How often did you charge your mobile phone last week?	**72.** How many times did you personally use your mobile phone in the last week?
yes 1 ☐ → **q.71** 0 ☐ No	_____ 1 ☐ Metres 2 ☐ Min. by foot	_____ IDR	_____ TIMES	_____ TIMES -3 ☐ You do not have a

-3 ☐ No mobile phone in the household

→ **q.73**

_____

☐ _____

mobile phone

73. How many flash lights **[PORTABLE]** are there in the household?

_____

74. How many sockets are there in the household?

_____

75. How often do you use candles?

1 ☐ Minimum once per day
2 ☐ Minimum once per week
3 ☐ Only in the case of fuel shortage
4 ☐ Only in the case of blackout
5 ☐ Never
☐ Other: _____

		1.	3.	4.	5.
76.	Which lighting sources do you use in your household **[INCLUDING EXTERIOR LIGHTING]**?	Normal electric bulb ☐	Neon/ fluorescent tube ☐	Energy saver ☐	1. Hurricane lamp ☐ 2. Tin lamp ☐ 3. Gas lamp ☐ 4. Battery-driven LED ☐ 5. Rechargeable bulb ☐
77.	How many of these lamps do you use?	Outside _____ Inside	Outside _____ Inside	Outside _____ Inside	

		_____	_____	_____	_____
78.	How many hours per day do you use the lamp(s)?	Outside ___ HOURS	Outside ___ HOURS	Outside ___ HOURS	
		Inside ___ HOURS	Inside ___ HOURS	Inside ___ HOURS	_____
79.	How often are you satisfied with the lighting quality of the lamp? 1. Always 2. Often 3. Seldom 4. Never	_____	_____	_____	_____
80.	How many rooms do you illuminate with these lamps?		_____		_____
81.	What is this room used for? 1. Living room 2. Head of HH's room 3. room of other HH members 4. Kitchen 5. Toilet 6. Other [SPECIFY]				
82.	Within the last year, how many of these bulbs/lighting sources you had to replace because they were broken?				
83.	What do you do with the neon lights / energy savers when they are broken?				1. Throw away with garbage 2. Throw away in the toilet 3. Throw away into nature

			4. Return it to the place where I bought it 5. Other (SPECIFY)

5. Energy sources

		1. Candles	2. Gas	3. Kerosene	4. Charcoal	5. Fire wood	6. Coconuts	6. Batteries
			kg	*litres*	*kg*	*bundles*	*number*	
84.	How many units of ____ do you consume per month?	_____ CANDLES	_____ KG	_____ for lighting	_____ for cooking	_____ collected	_____ for cooking	_____ for lighting
				_____ for cooking	_____ for ironing	_____ bought		_____ for radio
				_____ for other purposes	_____ other purposes			_____ other purposes
85.	How much do you pay per unit?	_____ IDR per candle	_____ IDR per kg	_____ IDR per litre	_____ IDR per kg	_____ IDR per bundle	_____	_____ IDR per battery
		MIN	MIN	MIN	MIN	MIN		MIN
86.	**[If HH uses batteries]** What do you do with the batteries when they are empty?			1 ☐ Throw away →**Where ?** _____ 2 ☐ other : _____			Throw away-where: 1. Into garbage 2. Into toilet 3. Into nature	

87.

Do you sell charcoal or other forest products? If yes, how much do you earn per month in sales?

0 ☐ No ☐ Yes _____ , IDR

88. Do you see negative impacts induced by electricity?

1 ☐ Yes

0 ☐ No → **q.90**

89. Which negative impacts have you observed?

_____

_____

90. [☐ HOUSEHOLD **HAS A MODERN ELECTRICITY SOURCE** → **Q.91**

☐ HOUSEHOLD **DOES NOT HAVE AMODERN ELECTRICITY SOURCE** → **Q.96]**

91. Which are the main advantages of your electricity source?

1. _____
2. _____
3. _____

☐ -6 None

92. Have any of this household's appliances been damaged due to voltage fluctuation? If yes, which appliance(s)?

1 ☐ No → **q.91**

0 ☐ Yes

93. Which appliance has been damaged?

1 Light bulb/energy saver/neon
2 TV
2 Rice cooker
3 Water cooker
4 Radio
5 Other, SPECIFY

94. Do you wish to see any improvement in the electricity supply?

1 ☐ Yes

0 ☐ No → **q.93**

95. Please specify.

6. Agriculture

96. Do you cultivate farm land?

1 ☐ Yes

0 ☐ No → **q.111**

97. What is the property status of your farm land?

1 ☐ Your property

2 ☐ Rented

3 ☐ Bagi Hasil

[COMMENTS]

[EXPLAIN THE DIFFERENCE BETWEEN NON-TRANSFORMED AND TRANSFORMED PRODUCTS]

	98. Please indicate your five most important agricultural products:	**99.** Which products did you sell in a non-transformed way last year?	**100.** How much did you sell within the last 12 months in a non-transformed way?	**101.** For how many IDR do you sell each unit? **[UNIT OF Q.82]**
1	Apple ☐	☐No☐ Yes	_____ kg	
2	Shallot ☐	☐No☐ Yes	_____ kg	
3	Hot Pepper ☐	☐No☐ Yes	_____ kg	
4	Cocoa ☐	☐No☐ Yes	_____ kg	
5	Maize ☐	☐No☐ Yes	_____ kg	
6	Orange ☐	☐No☐ Yes	_____ kg	
7	Soy Bean ☐	☐No☐ Yes	_____ kg	
8	Beans ☐	☐No☐ Yes	_____ kg	
9	Peanut ☐	☐No☐ Yes	_____ kg	
10	Kangkung ☐	☐No☐ Yes	_____ kg	
11	Rubber ☐	☐No☐ Yes	_____ kg	
12	Potato ☐	☐No☐ Yes	_____ kg	
13	Cucumber ☐	☐No☐ Yes	_____ kg	
14	Coffee ☐	☐No☐ Yes	_____ kg	
15	Cabbage ☐	☐No☐ Yes	_____ kg	
16	Pumpkin ☐	☐No☐ Yes	_____ kg	

17	Mango ☐	☐No☐ Yes	_____ kg	
18	Mangosteen ☐	☐No☐ Yes	_____ kg	
19	Pineapple ☐	☐No☐ Yes	_____ kg	
20	Rice ☐	☐No☐ Yes	_____ kg	
21	Papaya ☐	☐No☐ Yes	_____ kg	
22	Banana ☐	☐No☐ Yes	_____ bunches	
23	Watermelon ☐	☐No☐ Yes	_____ kg	
24	Cassava ☐	☐No☐ Yes	_____ kg	
25	Sugar ☐	☐No☐ Yes	_____ kg	
26	Tea ☐	☐No☐ Yes	_____ kg	
27	Tobacco ☐	☐No☐ Yes	_____ kg	
28	Eggplant ☐	☐No☐ Yes	_____ kg	
29	Sweet Potato ☐	☐No☐ Yes	_____ kg	
30	_____		_____	_____
31	_____		_____	_____
32	_____		_____	_____

102. How much do you earn per year selling non-transformed agricultural products?

_____
IDR

[COMMENTS]

103. Do you transform agricultural products?

1 ☐ Yes

0 ☐ No → **q.111**

	104. What is the basic product?	**105.** Who trans-forms the product?	**106.** By which means does he transform the product?	**107.** Into what?	**108.** What is the unit?	**109.** What are the approximate quantities that you sell per year?	**110.** For how much do you sell each unit?
	[USE THE CODE OF Q.105]	1. Family Member (male) 2. Family Member (female) 3.Employee 4.Other, specify	1.Motorized appliance 2.Electric appliance 3. Tools 4. By hand 5. Other, specify	1. De-shelled rice 2. Hulled coffee 3. Flour 4. Beverage 5. Oil 6. Grilled product 7. Other- what?	Sack of *x* kg, Bottle of *x* ml, ...	**[IN UNITS OF Q.90]**	**[UNIT OF Q.901]** *IDR*
1.							
2.							
3.							
4.							

7. Livestock

111. Do you own domestic animals?

1 ☐ Yes

0 ☐ No → **q.114**

112. **113.**

	Which animals do you currently own?		How many of these animals do you own?
1.	☐	Pig	
2.	☐	Sheep	
3.	☐	Goat	
4.	☐	Rabbit	
5.	☐	Buffalo	
6.	☐	Horse	
7.	☐	Cow	
8.	☐	Poultry	
9.	☐	Dog	
10.	☐	Other,specify _____	

8. Financial Situation

114. Do you have an account at a bank or savings association?

1 ☐ Yes, at a bank

2 ☐ Yes, at a savings association

0 ☐ No

115. Do you save money at home?

1 ☐ Yes

2 ☐ No

116. Did the household take up a loan during the last two years?

1 ☐ Yes

0 ☐ No → **q.119**

117. Where? **[SEVERAL ANSWERS POSSIBLE]**

1. Kepada keluarga atau orang lain
2. Di toko
   Ddi lembaga keuangan
   Bbank
3. Lainnya – sebutkan

_____

118. How many remittances do you receive per month?

_____
IDR

119. To cover family needs, your household income is…

1 ☐ Sufficient
2 ☐ Tight
3 ☐ Not sufficient

[COMMENTS]

9. Expenditures

	120. Do you spend money on the following expenditures? If Yes, how much do you roughly spend? **[TRY TO GET THE INFORMATION ON MONTHLY LEVEL]** -9. Paid in kind		**a.** per week *IDR*	**b.** per month *IDR*	**c.** per year *IDR*
1.	1 ☐ Yes 0 ☐ No	Rent (house and fields) (in money)			
2.	1 ☐ yes 0 ☐ no	Food (for the whole family)			
3.	1 ☐ yes 0 ☐ no	Crop transformation			
4.	1 ☐ yes 0 ☐ no	Transport (public and private)			
5.	1 ☐ yes 0 ☐ no	Telecommunication			
6.	1 ☐ yes 0 ☐ no	Water			
7.	1 ☐ yes 0 ☐ no	Schooling expenses for children (material, school fees, transport, etc.)			
8.	1 ☐ yes 0 ☐ no	Agricultural expenses (seeds, fertilizer, dung, pesticides, and worker)			
9.	1 ☐ yes 0 ☐ no	Livestock breeding			
10.	1 ☐ yes 0 ☐ no	Family and religious ceremonies			
11.	1 ☐ yes 0 ☐ no	Remittances **to** family members who do not live at home			
12.	1 ☐ yes 0 ☐ no	Medical expenses [excl. health insurance]			
13.	1 ☐ yes 0 ☐ no	Cigarettes			
14.	1 ☐ yes 0 ☐ no	Clothes (for the whole family)			

	121.
	What other large investment **[>230.000 IDR]** did you make during the last 12 months?
1.	
2.	
3.	

		122.
	[SEVERAL ANSWERS POSSIBLE]	Who manages the household budget?
1.	Male	☐
2.	Female	☐

		123.	124.
	On working days, when does the ... in the household usually...	Father/ man	Mother/ woman
0.		☐ No father/ man in household → **q.121**	☐ No mother/ woman in household → **q.122**
1.	wake up?	_ _: _ _ h	_ _: _ _ h
2.	perform income generating activities **[INCLUDING FARMING]**?	From _ _: _ _ h till _ _: _ _ h From _ _: _ _ h till _ _: _ _ h From _ _: _ _ h till _ _: _ _ h	From _ _: _ _ h till _ _: _ _ h From _ _: _ _ h till _ _: _ _ h From _ _: _ _ h till _ _: _ _ h
3.	perform household duties?	From _ _: _ _ h till _ _: _ _ h From _ _: _ _ h till _ _: _ _ h From _ _: _ _ h till _ _: _ _ h	From _ _: _ _ h till _ _: _ _ h From _ _: _ _ h till _ _: _ _ h From _ _: _ _ h till _ _: _ _ h
4.	watch television?	From _ _: _ _ h till _ _: _ _ h From _ _: _ _ h till _ _: _ _ h	From _ _: _ _ h till _ _: _ _ h From _ _: _ _ h till _ _: _ _ h
5.	perform other leisure activities?	From _ _: _ _ h till _ _: _ _ h From _ _: _ _ h till _ _: _ _ h	From _ _: _ _ h till _ _: _ _ h From _ _: _ _ h till _ _: _ _ h
6.	go to bed?	_ _: _ _ h	_ _: _ _ h

125.	126.	127.

On working days, when do the ... in the household usually...		children of age 6-11	**male** children of age 12-17	**female** children of age 12-17
0.		☐ No children of age 6-11 in household → **q.123**	☐ No male children in household of age 12-17 → **q.124**	☐ No female children in the household of age 12-17 → **q.125**
1.	wake up?	_ _: _ _ h	_ _: _ _ h	_ _: _ _ h
2.	study at home after school?	From _ _: _ _ h till _ _: _ _ h From _ _: _ _ h till _ _: _ _ h	From _ _: _ _ h till _ _: _ _ h From _ _: _ _ h till _ _: _ _ h	From _ _: _ _ h till _ _: _ _ h From _ _: _ _ h till _ _: _ _ h
3.	study outside the house after school?	From _ _: _ _ h till _ _: _ _ h	From _ _: _ _ h till _ _: _ _ h	From _ _: _ _ h till _ _: _ _ h
4.	watch TV?	From _ _: _ _ h till _ _: _ _ h From _ _: _ _ h till _ _: _ _ h	From _ _: _ _ h till _ _: _ _ h From _ _: _ _ h till _ _: _ _ h	From _ _: _ _ h till _ _: _ _ h From _ _: _ _ h till _ _: _ _ h
5.	go to bed?	_ _: _ _ h	_ _: _ _ h	_ _: _ _ h

[COMMENTS]

128. [☐ HOUSEHOLD **WATCHES TV AT HOME** → **Q.129**
☐ HOUSEHOLD DOES NOT **WATCH TV AT HOME** → **Q.131**]

129. Who decides what kind of program you watch on TV?

1 ☐ Adult male
2 ☐ Adult female
3 ☐ Child < 18

		130. Which TV programs do the household members watch?	131. Which other activities **[THAN Q.135 – 136]** do the household members carry out after nightfall?
		[DO NOT READ] 1. Cartoons 2. Movies 3. News 4. Soap operas 5. Sports 6. Other, specify	1. Radio 2. Reading 3. Praying 4. Playing 5. Going out 6. Household duties 7.Other, specify
a.	Father/ man	1. _____ 2. _____	
b.	Mother/ woman	1. _____ 2. _____	

132. Does any member of the household collect firewood?

1 ☐ Yes

0 ☐ No → **q.133**

133. | **1.** | **2.** | **3.** | **4.**

	Who normally collects wood?	Code Q. 13	Code Q. 13	Code Q. 13	Code Q. 13
134.	How much time does he/ she need to collect wood per week?	_____ HOURS	_____ HOURS	_____ HOURS	_____ HOURS

11. Health

135. Did any members of your household in the last six month suffer from ...?

		1. Adults >=18 years		2. Children <18 years	
		m. Male	f. Female	m. Male	f. Female
a.	Headaches	☐	☐	☐	☐
b.	Respiratory disease	☐	☐	☐	☐
c.	Eye disease	☐	☐	☐	☐

136. Do you have a health insurance?

1 ☐ Yes

0 ☐ No

137. How much do you pay per _____?

IDR. _____

Year / Month /

12. Security

138. How many days per week do the members of your household go out after nightfall?

1.	Man	_____
2.	Woman	_____
3.	Boys 12-17	_____
4.	Girls 12-17	_____
5.	Children <12	_____

139. Are you concerned for their safety when they go out?

1. Yes 0. No

-3. Not applicable

1.	Are you outside after nightfall?	___
2.	Are your female children outside after nightfall?	___
3.	Are your male children outside after nightfall?	___

140. Do you think that darkness is dangerous?

1 ☐ Yes

0 ☐ No

13. Environmental awareness

141. Which environmental issue concerns you the most? Why?

_____

_____

_____

☐ -6 None

How much do you agree with the following statements:	Strongly disagree	Somewhat disagree	Somewhat agree	Strongly Agree

		☐	☐	☐	
142.	Good air quality is a depletable good				
143.	Solar power is a depletable good				
144.	Wood is a depletable good				
145.	I consciously try to conserve energy.				
146.	I am interested to know about environmental problems				
147.	I dispose of garbage in dustbins				
148.	Everyone has the responsibility to preserve the environment.				

		A	B	Please explain. [Write down keywords]
149.	Do you know what "Renewable Energy " is?	1 ☐ Yes 0 ☐ No → **Q.150**		

150.	Do you think your community should use Renewable Energy?	1 ☐ Yes 0 ☐ No **→ Q.151**	
151.	Do you think Renewable Energy is better for the environment than alternative electricity sources?	1 ☐ Yes 0 ☐ No **→ Q.152**	
152.	Do you know how to support longevity of a community mini-grid as community member?	1 ☐ Yes 0 ☐ No **→ Q.153**	

14. Gender Equality Awareness

	Do you think that…		
153.	Women should take care of housework	0 ☐ No 2 ☐ No opinion	1 ☐ Yes
154.	Women are good in making business	0 ☐ No 2 ☐ No opinion	1 ☐ Yes
155.	Women have the same capacities to gain money as men	0 ☐ No 2 ☐ No opinion	1 ☐ Yes
156.	Women should do what their husbands tell them to do	0 ☐ No 2 ☐ No opinion	1 ☐ Yes
157.	Men are better political leaders than women	0 ☐ No 2 ☐ No opinion	1 ☐ Yes

	Do you think it is justified that men use violence against women in the following situations		
158.	She burns food	0 ☐ No 2 ☐ No opinion	1 ☐ Yes
159.	She leaves the house without informing him	0 ☐ No 2 ☐ No opinion	1 ☐ Yes
160.	She neglects her children	0 ☐ No 2 ☐ No opinion	1 ☐ Yes
161.	She argues with him	0 ☐ No 2 ☐ No opinion	1 ☐ Yes
162.	She wants to earn money independently	0 ☐ No 2 ☐ No opinion	1 ☐ Yes

[COMMENTS]

15. Conclusion

				became much better	became better	stayed the same	became slightly worse	became much worse
163.	In comparison with the situation 1 year ago, the living conditions…	**1.**	In your family…	①	②	③	④	⑤
		2.	In your village…	①	②	③	④	⑤

164. How?

1. _____
2. _____

165. Which is your main source of information?

1 ☐ Radio
2 ☐ TV
3 ☐ Newspaper
3 ☐ Neighbour/ friends
4 ☐ Other _____

166. Household has mobile phone 1 ☐ Yes 0 ☐ No

[COMMENTS]

167. Please, could you give us your first and your family name?

_____

_____

168. Could you give us your telephone number?

_____

[FINAL COMMENTS / QUESTIONS BY INTERVIEWEE]

[FINAL COMMENTS BY ENUMERATOR]

169.	Finishing time of interview	:	h

THANK YOU VERY MUCH FOR YOUR PARTICIPATION!

6.3.2 SPV Leadership KII Protocol

This KII should be issued *at minimum* with the following roles (or equivalents) of SPV leadership:

1. SPV Head
2. Secretary
3. Treasurer
4. Other division heads (e.g. O&M, sales and collection, finance and administration, environment/community officers)

Questions	EQ	KII	Theme
What do you understand the SPV's responsibilities to be as a whole with respect to [grant] and the Solar PV facility in your area? What are the specific responsibilities of your role on the SPV?	4	All	Sustainability
What is your role in your community? Have there been conflicts with community members due to your role in the SPV?	4	ALL	Sustainability
Is the SPV better prepared to provide electricity to the community in the long-term than PLN or a private enterprise? Why (not)?	4	ALL	Sustainability
How would you describe your existing relationship with [grantee] to this point? Are they still engaged with the SPV following the grant? What is their role?	4	All	Relationship with grantee/contractors
How are routine and preventative O&M tasks handled for this mini-grid? What about complex O&M tasks or repairs? Are these handled by the SPV, through a contract with an O&M provider, or both? Please describe how the SPV responded to any significant O&M challenges to the mini-grid in the past year, and how often these challenges occur. Are you confident the SPV will be able to respond to significant O&M challenges in the future?	4	O&M	Sustainability
How easy and affordable is it to find replacement parts when they are needed? How long has it taken for replacement parts to arrive? If you use external technicians for repairs or maintenance, how long does it typically take from when you request service for service to be completed?	4	O&M	Sustainability
Do you feel that operators are adequately trained to handle their responsibilities in O&M? Has there been any need to pursue additional training to the training provided by the grant? Are the people who received training from the grant the same ones currently responsible for O&M, or has there been turnover?	4	O&M	Sustainability
Have there been other significant challenges for the SPV, like political, social, or financial challenges? [If	4	All	Sustainability, optimism, cooperation with other villages

Questions	EQ	KII	Theme
SPV includes cooperation among treatment units] How have [treatment units] cooperated with one another?			
What sorts of enterprises have taken advantage of the new renewable energy resource? Have community members started new businesses since the micro-grid was commissioned? If so, what kinds of businesses?	2	Head	Productive uses
How would you compare the performance of the mini-grid relative to your expectations? Do you feel it will sustainably provide electricity that meets your communities needs for the foreseeable future? Have you been satisfied with the quality and reliability of the electricity supply from the mini-grid?	4	All	Optimism
How are responsibilities within the SPV distributed between females and males?	4	ALL	Sustainability
How were responsibilities in day-to-day operation and maintenance be handed over to you? Was this process reasonable?	4	O&M	Sustainability
Has your training prepared you for your role in the SPV? What part or parts of your training have seemed the most useful? Are there any situations you have encountered for which you felt you were not adequately prepared? Did you receive your training from the grant or from another source?	4	All	Sustainability, relationship with grantee/contractors
How much are community members charged to use electricity from the mini-grid? Have members of your community been willing and able to pay this amount?	2, 4	All	Sustainability
How has your SPV chosen to use surplus electricity or revenue, if a surplus exists?	2	Head, Treasurer	Productive uses
Have you experienced any challenges in payments or sustainability of the system? How often do people fail to pay their bill, or elect not to use any electricity due to financial hardship? Have you had any issues with fraud, or tampering with meters? How do you deal with these problems?	2,4	All	Sustainability
What actions have your SPV taken to ensure gender equality and social inclusion in benefits from the new RE systems? Were these actions successful? Why or why not?	4	Head, Community Officer	Gender
How confident are you that the SPV is prepared, in terms of capacity, equipment, and legal status, to operate the infrastructure in the long term?	4	Head	Optimism

6.3.3 Village Official Quantitative Survey Protocol

Date: ☐☐ ☐☐ ☐☐

I. Basic Sub-village Data

Name of Data collector: _____

Name of sub-village: _____

Site code : _____

Name of interviewee : _____

Role of interviewee : _____

Phone number of interviewee: _____

→ *All questions shall refer to the sub-village listed above*

1. Demographic Data ***Sub-village***

1.1. Population, male	
1.2. Population, female	
1.3. Population, total	
1.4. Number of households, total	

II. Infrastructure and Services in the sub-village

2. Availability and conditions of basic infrastructure

a. Roads: *(road condition, construction work,* ***access during rainy season)***

a.1 Distance from main road	a.2 To which city does the main road connect?	a.3 Access to main road (circled the appropriate one)	a.4 Can the road be travelled year-round

	(the nearest town or rural center)		**by four-wheeled vehicles?**
.....		1. Asphalt pavement 2. Stone pavement 3. Earth pavement	1. Yes 0. No

b. Transportation:

b.1 **Transport possibilities in the village (circle the appropriate)**	**b.2** **Price to reach the next urban center (for each option circled in b.1)**	**b.3** **If public transport is available, how frequently does it arrive per week?**
1. Bus/ public transport 2. Mototaxi 3. Taxi 4. Donkey cart 5. Other, define: _____	1. _____ 2. _____ 3. _____ 4. _____ 5. _____	

c. TV, radio and mobile phone network reception:

Type of network	**Receivable?**			If YES: **quality of reception?**			
	Yes	No	Don't know	Good	Medium	Bad	Don't know
1. Radio	1	0	- 1	1	2	3	-1
2. Mobile Phone Network	1	0	- 1	1	2	3	-1
3. TV	1	0	- 1	1	2	3	-1
4. Internet mobile phone	1	0	- 1	1	2	3	-1
5. Internet landline	1	0	-1	1	2	3	-1

[COMMENTS]

_____

3. Availability and conditions of social infrastructure (SI)

Type of SI	Public or Private	Uses electricity source (M)?
code	1. Public 2. Private	1. PLTMH 2. Battery 3. Solar panel 4. Genset 5. PLN 6. Kincir

1. Primary school (SD)
2. Junior high school (SMP)
3. Senior high school (SMA)
4. Islamic boarding school (*Pesantren*)
5. Other school – specify
6. Community health center (*Puskesmas*)
7. Community health subcentre (Pustu)
8. Health service post (Posyandu)
9. Midwife house *(house of bidan)*
10. Traditional Healers
11. Other health structure, specify
12. Church
13. Mosque
14. Other religious building
15. Administrative office, specify

[COMMENT]

4. Availability and conditions of social infrastructure

a **Main access to water (circle the appropriate response)**	
1. River or lake	3. Fountain (unprotected)
2. Fountain (protected)	4. Private connection
	5. Other, specify _____

IV. Income generation

1. **Enterprises:**

Type of business unit	**Number**	**Electricity Sources of each** 0. None 1. PLTMH 2. Kincir 3. Battery, 4. Genset 5. Solar panel 6. Other, specify	**Gender of Owner of each** 0. Male, 1. Female
Kiosk /warung			
Store			
Carpenter			
Wall-maker/ builder			
Tailor			
Beauty salon			
Flour miller			
Rice huller			

Sawmill			
Auto workshop			
Welding workshop			

2. *Quality of land in sub-village* *(fertility, acidity, erosion)*

Fertility – majority of land	1. Very fertile 2. Fertile 3. Less fertile 4. Not fertile
Erosion	1. Often eroded 2. Seldom eroded 3. Never eroded

3. ***Sub-village market (held at least once per week)***

Is there a market in the sub-village?

1. Yes, there is ☐

0. No, there is not ☐ Where is the nearest market (distance)? _____km

V. Socio-economic issues

4. *Involvement in sub-village activities:*

**Include definition of organization. Should include SPV if already formed at time of interview (in treatment sites).*

Organization	**Type of organization:** 1. Religious **2.** Non- religious	**Main activity**	**Activity Frequency per month**	**How many participants** 1).0-10 2).10-

6.3.4 Village Official KII Protocol

Questions	EQ	Theme
Has health service quality been affected by access to RE? If so, how? What about for the health and wellbeing of pregnant women in particular?	1, 2	Community details
Has school service quality been affected by access to RE? If so, how?	2	Productive Uses, Community details
What did you learn from grant trainings about renewable energy and using RE in your community? Was the information in grant trainings new information for you? Do you think Renewable Energy is better for the environment than alternative electricity sources? Explain.	1, 4	Sustainability
How are you or other community members supporting the longevity of the mini-grid?	1, 4	Sustainability
Are there economic activities in this community that have benefitted from access to the mini-grid? What are these activities? How have they benefitted?	2	Productive Uses
Were any grant trainings especially helpful for increasing economic activities in your villages? Please describe these trainings and how they were helpful.	2	Productive Uses
Have any community members started new businesses using electricity from the mini-grid? Do you know of any that are planning to start a business, but have not done so? What is stopping them?	2	Productive Uses
What are typical productive activities pursued by women in your community? Have these been affected by the mini-grid or grant trainings in any way? How so?	2	Productive Uses, Gender
Have the general living conditions (particularly poverty level) in the sub-village changed within the last 2 years? How so? Do you think the new RE mini-grid has affected this situation?	4	Sustainability
Has safety and security in this community been affected in any way by access to electricity?	4	Community details
What do you understand the SPV's responsibilities to be as a whole with respect to [grant] and the Solar PV facility in your area?	4	Sustainability
What challenges do you anticipate will occur with the SPV given your knowledge of your community? Have there been any significant challenges with the SPV or mini-grid to date?	4	Sustainability
To your knowledge, have there been any problems with households paying for or being able to afford electricity from the mini-grid? Do households ever resort to fraud or tampering with meters to afford electricity? Are you confident households will be able to afford electricity from the mini-grid in the long-term?	4	Sustainability

Questions	EQ	Theme
What about major challenges with outages or malfunctioning of the mini-grid? How long does it typically take for these to be repaired? How have these issues affected your community?	4	Sustainability
How would you compare the performance of the mini-grid relative to your expectations? Do you feel it will sustainably provide electricity that meets your communities needs for the foreseeable future? Have you been satisfied with the quality and reliability of the electricity supply from the mini-grid?	4	Sustainability

6.3.5 Grantee KII Protocol

**Note: Some questions in this protocol may be skipped based on the informant's role in the implementing organization, or the implementing organization's role in an implementing consortium. For example, engineering firms will not be asked about community engagement plans for SPVs, unless they are somehow involved.

Question	EQ	Theme
1. Please describe your role on this grant.	4	NA
2. Please describe the grant's status in [village name; regency name] at the end of the Compact. Was there any outstanding work that needed to be completed after Compact closure? Does [grantee] have any role with the SPV or mini-grid still?	4	Project Details, Sustainability
3. Were SPV members adequately prepared to fulfill their roles and responsibilities at the end of the Compact period? Were any additional trainings required to prepare SPV staff? To your knowledge, are the individuals trained by the grant still the ones in their respective roles with the SPV or has there been turnover?	4	Project Details, Sustainability
4. Please describe any changes made to the business plan you were pursuing in creating the SPV(s) for this project since November 2017. What is the governance process in terms of managing cash flow and assets? Have dividends been reinvested in the community and, if so, how?	4	Project Details, Sustainability
5. What is the final selling price for electricity in each village/kampung? Please describe how you arrived at this figure and, if it has changed, why.	1	Energy Consumption

Question	EQ	Theme
6. How did you transition ownership to the SPV after construction was completed?	4	Sustainability, Sustainability
7. Has PLN expanded into the villages/kampungs targeted by this grant? Describe how the SPV mitigated this, if it came to fruition.	1 and 4	Sustainability
8. Have you tapped into additional resources besides those provided by MCA-I to ensure the sustainability of the project? If so, what actions have you taken?	4	Sustainability, Sustainability
9. What are the main challenges you see to the Solar PV Facility development? (ask about SPV leadership and role, if not mentioned) What challenges have you observed in terms of sustainability? How does the SPV's actualized sustainability status compare to the expectations of sustainability you had at the project's inception?	4 (though potentially all EQs)	Sustainability, Sustainability
10. In each of the targeted areas, what have been the main outcomes from your project? Have you observed business expansion or the creation of new businesses? If so, what kinds? How long did it take before these businesses developed or expanded?	1-4	Sustainability, Sustainability
11. In your view, what is the outlook for the sustainability of the mini-grid once it is completely left to the SPV to manage? What are the biggest threats to sustainability? If you were to implement this grant again, is there anything you would suggest doing differently to improve grant outcomes or sustainability?	4	Sustainability

6.3.6 Community Beneficiary FGD Guide

Question	EQ	Theme
Energy		
1. What is your HH's main use for electricity (appliances, lighting, productive uses)? Has this changed since you were connected to the mini-grid?	1, 2	Energy Consumption, Productive Uses
2. Please describe a typical day or week in terms of your energy usage. Which energy sources do you use most often, or prefer to use? Are there certain times of day, or certain times of the year, when you use some energy sources more than others?	1	Energy Consumption
3. Are you satisfied with the price per kWh of electricity your family uses currently? What are the main reasons for your satisfaction/dissatisfaction? Please discuss.	1	Energy Consumption
4. Are you satisfied with the quality of electricity your family currently receives? What are the main reasons for your satisfaction/dissatisfaction? Please discuss.	1	Energy Consumption
5. Are you satisfied with the hours per day of electricity your family currently receives? What are the main reasons for your satisfaction/dissatisfaction? Please discuss.	1	Energy Consumption
6. Are you satisfied with the operator of the electricity your family uses currently (SPV/PLN)? What are the main reasons for your satisfaction/dissatisfaction?	1	Energy Consumption
7. How would you compare the performance of the mini-grid relative to your expectations? Do you feel it will sustainably provide electricity that meets your communities needs for the foreseeable future? Have you been satisfied with the quality and reliability of the electricity supply from the mini-grid?	1	Energy Consumption
8. Would you prefer other types of electricity? What kinds and why?	1	Energy Consumption
9. Has access to the mini-grid in this village brought growth in economic activities? How?	2	Productive Uses
10. What else is needed in your community to raise economic wellbeing?	1	Energy Consumption
Equality, Gender, Security		

Question	EQ	Theme
1. Who has benefitted most from energy access in your community? Is there anyone who has not benefited from access to the mini-grid?	1	Energy Consumption, Gender
2. Do you think female community members have been affected equally by electricity access as male members? How has electricity access changed the life of women, and their rights and roles within the community?	1	Energy Consumption, Gender
3. Are there any ways that grant trainings were especially beneficial to women in this community?	1	Energy Consumption, Gender
4. Do you think electricity access has affected security in your community? Please discuss.	1	Energy Consumption
5. Do you feel that the way SPV members were selected to manage the mini-grid was fair? If not, why not?	4	Sustainability, Community Organization
Environment		
1. Which environmental issue concerns this community the most? Why?	3	GHG Emissions
2. Are there activities for which you used to use kerosene, diesel, or gasoline that you can now do using electricity from the mini-grid instead? Do you think less of these fuels is used in your community now than before the mini-grid was commissioned? If so, how has this change effected your finances, health, or the local environment?	3	GHG Emissions
Project Details and SPV		
1. Overall, please discuss your satisfaction with [Project name/grantee name]'s work in your community. Is there any way that they are still engaged with the community?	NA	Project Details
2. Please discuss your satisfaction with the SPV in charge of your mini-grid, and your confidence in their management of the mini-grid in the long term.	4	Sustainability
3. Has the introduction of the SPV in your community affected interpersonal or social community dynamics in any significant way? How so?	4	Sustainability

Question	EQ	Theme
4. If PLN were to extend the grid into your community or village, would you prefer to consume electricity from PLN or the SPV? Why?	4	Sustainability
5. To your knowledge, have SPV profits been reinvested in the community in any way? Does the SPV or the community make any arrangement to assist less wealthy households in paying for their electricity?	4	Sustainability
Conclusion		
1. In comparison with the situation 2 years ago, have the living conditions in this village improved? If yes, how? If not, why not? To what extent do you feel these changes were caused by the mini-grid? *If not raised independently, probe specifically about changes in firewood consumption, health (headaches from generator or smoke from firewood), security, and media consumption (internet, television, telecommunications)*	1, 4	Sustainability

6.3.7 Enterprise KII Guide

ENTERPRISE QUESTIONNAIRE Impact Evaluation Baseline Study 2017 Green Prosperity Renewable Energy Grant	**1** Date: _____
	SUB-VILLAGE NAME
	SUB-VILLAGE SITE
	INTERVIEWEE/ENTERPRISE NAME
	MALE/FEMALE
	OWNER OR MANAGER/STAFF EMPLOYEE
	INTERVIEWER NAME

STARTING TIME:	

A. Basic Information and Customers

Q1. Line of business	
Q2. Enterprise age	

Q3. Type of electricity available
Q4. Since when is it available?
Q5. In case of solar panel, what's the size of the panel (kW)?

1	*None*	
2	*Connection to a MHP*	☐ *Since when (Month, Year)* _____
3	*Car battery (without solar panel)*	☐ *Since when (Month, Year)* _____
4	*Solar panel (installed on roof)*	☐ *Since when (Month, Year)* _____ *kW* ☐ *of solar panel*_____
5	*Solar panel (not installed on roof)*	☐ *Since when (Month, Year)* _____
6	*Individual genset*	☐ *Since when (Month, Year)* _____ *kW* ☐ *of solar panel*_____
7	*Genset in the village*	☐ *Since when (Month, Year)* _____
8	*Genset shared with neighbors*	☐ *Since when (Month, Year)* _____
9	*PLN*	☐ *Since when (Month, Year)* _____

10	*Individual traditional waterwheel*	☐ *Since when (Month, Year)* _____	
11	*Traditional waterwheel in village*	☐ *Since when (Month, Year)* _____	

Q6. Kind of products and services offered by the enterprise (USE CODES) **Q7. Price per piece or unit (define)**		*price*	*organize hierarchically*
1			
2			
3			
4			
5			
6			

CODE of Q.13

1. Sale of small products (for example cigarettes, batteries, petrol)
2. Food or Drinks
3. Cupboard
4. Tables
5. Chairs
6. Bedsteads
7. Window and door frames
8. Doors
9. New clothing
10. Cloth repair and alteration
11. Rice hulling
12. Coffee milling
13. Coffee procession
14. Coconut milling
15. Baking
16. Metal products
17. Welding products
18. Woven products
19. Hair cutting
20. Wedding styling
21. Make-up

Q8. Structure of customers	*This sub-village ___percent; This village ___percent; Other villages ____percent; Traders ____percent | Others _____percent Next city _____percent* **[Specify]** _____ *Number of Customers (supplied) per day:* _____

B. ENERGY AND PRODUCTION

Q9. *Which of the following appliances does this enterprise use?*		Appliance	**Q10.** *What powers the appliance?* a) Electricity b) Diesel/Petrol c) Mechanic d) Other, define.
	1	Lighting	
	2	Sewing machine	
	3	Refrigerator	
	4	Rice cooker	
	5	Carpentry equipment	
	6	Brush	
	7	Coconut grinder	
	8	Chili grinding machine	
	9	Blender	
	10	Mill	
	11	Other:	
	12	Other:	
	13	Other:	
	14	Other:	

Q11. *Which of the following energy sources does this enterprise use for its production process (including lighting)? Multiple entries are possible.*			**Q12.** *For which of the following purposes do you use…[use Codes from Q1. or define]?*		**Q13.** *In a regular month, how much does this enterprise spend on …?*		
		ENERGY SOURCE	Lighting	Operating equipment SPECIFY	Reg		
	1	PLTMH					
	2	Diesel/petrol for generator			Litre		
	3	Kerosene			Litre		
	4	Candles					
	5	Gas (LPG / LNG)					
	6	Charcoal / briquettes					
	7	Firewood					

	8	Car or other rechargeable battery					
	9	Solar Panel					
	10	Other:					

C. LIGHTING

Q14. Operation time of enterprise on regular day?

Q15. *How many of the following lighting devices does this enterprise use?*		**Q16.** *What is the number of hours you use lighting per day?*
ENERGY SAVER		
INCANDESCENT BULB (ORDINARY BULB)		
FLUORESCENT TUBE (NEON)		
TIN LAMP (KEROSENE)		
HURRICANE LANTERN		
CANDLE		
BATTERY-RUN LANTERN		
GAS LAMP (PRESSURIZED)		
Other (specify):		

D. EMPLOYMENT

Q17. *How many employees does this enterprise have in total (including owner)*	
Q18. *How many of the employees work the more than 7 hours per day on 5 days?*	
Q19. *How many of the employees receive payment?*	
Q20. *How many of the employees are family members?*	

Q21. Discuss how micro-grid access could change use of labor

E. PRODUCTION AND BUSINESS EXPANSION

Q22. Would you purchase machinery/appliances in case of electrification?

Q23. In case, new machinery/appliances were/would be purchased, why didn't you/don't you buy a generator to run machinery appliances?

Q24. Why don't you produce more of products you produce? (Bottlenecks…)

Q25. In case of bottlenecks, what is needed to overcome them?
Q26. Do you think that access to a micro-grid has helped to overcome these obstacles?
Q27. Do you think micro-grid connection could change your production and prices? If yes, how?
Q28. In your opinion, if you were able to produce/offer more of your product – through, for instance, longer hours, better equipment, more workers - would there be sufficient demand for the additional products?
Q29. Are you currently in a high/low demand period compared to the rest of the year?

6.3.8 PLN/Mini-Grid Manager Form

The purpose of this form is to understand the cost of service and fuel mix for the PLN grid and mini grid(s) in our Window 3A study areas. Although this information may be available in standard secondary documentation, we are not aware at this stage what this documentation is called or with what frequency it is updated. Hence, using either secondary documentation or an interview, we would aim to complete the items on this form with these stakeholders.

Fuel Mix

1. What is the installed generation capacity of the [grid/mini-grid] serving [Berau/East Sumba/treatment area]?

_____ kWp/MWp

2. What is the fuel mix for the installed capacity of the [grid/mini-grid]?

Renewable: ___%	Diesel/Oil: ___%	Coal: ___%	Gas: ___%	Other: ___%

3. How much electricity has the [grid/mini-grid] serving [Berau/East Sumba/treatment area] generated in the past year?

_____ kWh/MWh

4. What is the fuel mix for the electricity that has been generated in the past year?

Renewable: ___%	Diesel/Oil: ___%	Coal: ___%	Gas: ___%	Other: ___%

Cost of Service

5. What is the cost per kWh to [PLN/SPV] of generating electricity at peak capacity?

_____ IDR/kWh

6. What has been the average cost per kWh to [PLN/SPV] of generating electricity over the past calendar year?

_____ IDR/kWh

7. How much are (rural) customers charged per kWh to consume electricity? Is this tariff cost covering?

_____ IDR/kWh, Yes/No

Grid Expansion (PLN only)

8. Please describe planned extensions of the PLN grid in [East Sumba/Berau] in the near-term (next 1-2 years), providing supporting documentation if any is available.
9. Please describe planned extensions of the PLN grid in [East Sumba/Berau] in the 3-5 year timeframe if this is known, providing supporting documentation if any is available.
10. Please describe planned extensions of the PLN grid in [East Sumba/Berau] in the 5-10 year timeframe if this is known, providing supporting documentation if any is available.
11. Are you aware of any plans to purchase electricity generated from independent mini-grids encountered during grid expansion? If so, are you aware at what price per kWh this electricity will be purchased?

_____ IDR/kWh

6.3.9 Grantee Case Study Protocol

This protocol is meant to be employed iteratively, in a semi-structured fashion, with case study grantees prior to field data collection. It aims to construct or confirm the final, planned version of the grant's theory of change, planned outcomes, and approach to sustainability. It can be employed in email form or through an interview, whichever is most convenient for the grantee. As part of this protocol, it is important to establish for the grantee at the outset which documents we have and when these documents are dated.

Planned Theory of Change

As part of our case study, we need to develop a detailed understanding of the [project] theory of change. To do this, we would like to obtain or construct a logic model that summarizes the grant from main activities through to final outcomes. Ideally, this logic model should include assumptions inherent between major nodes (e.g. outputs and outcomes).

If we already have a logic model from previous documentation (e.g. Hivos):

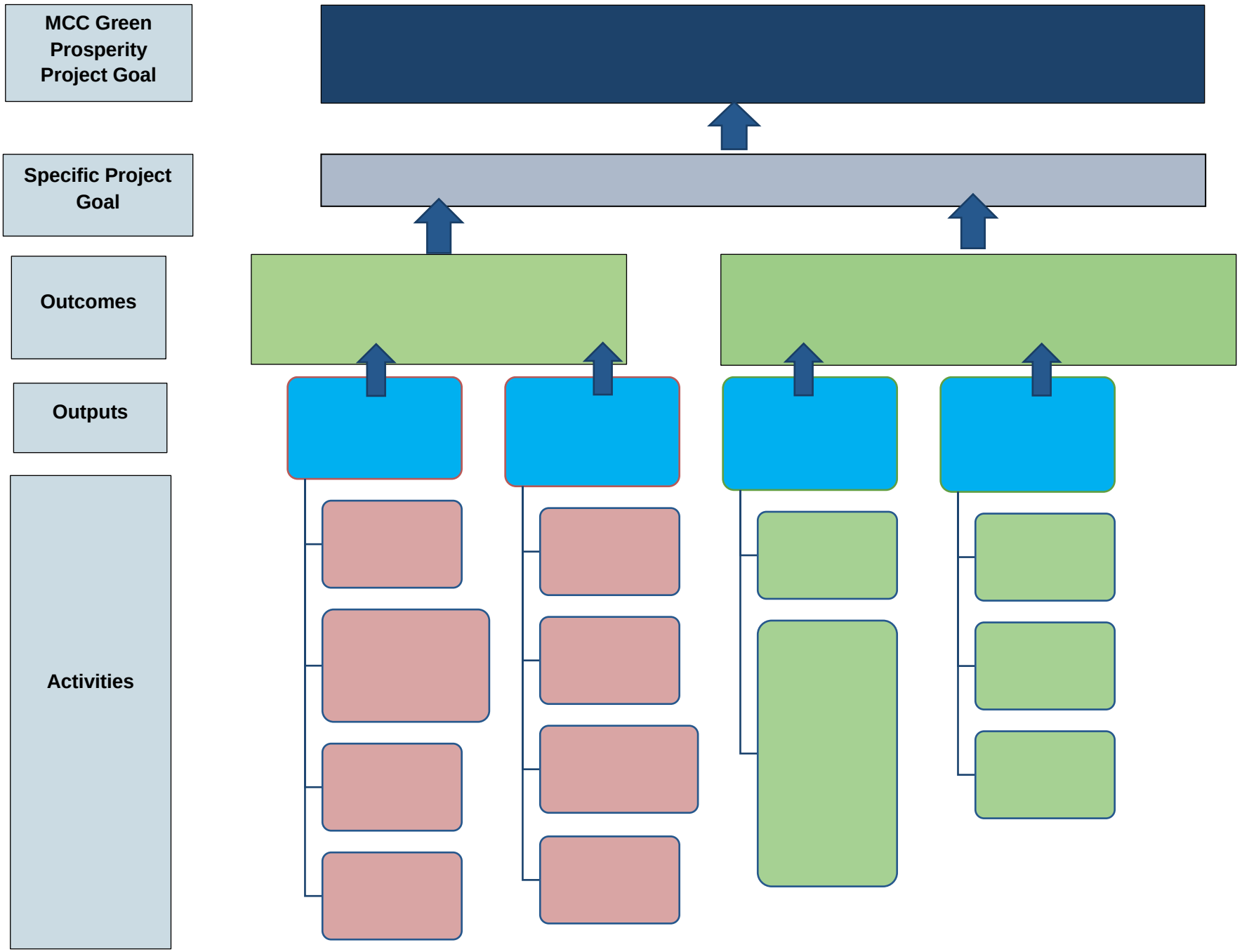
1. This is the most recent logic model we have available for your grant. Is this the final version of the grant's logic model?
    a. *If not*: Is there an updated version of this logic model you could share with us from other documentation?
        i. If not: Could you point out specific pieces of this logic model that must be updated to reflect the grant's final, planned theory of change?
    b. If the logic model does not include key assumptions: Do you have a document that outlines the key assumptions connecting the key nodes of this logic model?
        i. If not: What are the fundamental assumptions that you believe are required for the theory of change outlined in this logic model to be achieved? In other words, if this logic model were to be followed faithfully and desired outcomes were not to be achieved, why do you think that would be?

If we do not have a logic model from previous documentation (e.g. IBEKA):

1. Was a logic model ever constructed for your grant? If so, could you share the final version of this logic model with us?
    a. If not[97]: [show blank template of logic model, below] I would like to complete this template with specific reference to your grant so that I can understand how the grant aimed to achieve desired outcomes.
        i. *After completing:* What are the fundamental assumptions that you believe are required for the theory of change outlined in this logic model to be achieved? In other words, if this logic model were to be followed faithfully and desired outcomes were not to be achieved, why do you think that would be?

Both: To your knowledge, where there anyways that the final results of grant implementation deviated from this planned theory of change? For example, were there activities that were not completed, extra outputs that had not been anticipated, etc.?

[97] If no documentation of a logic model is available, triangulate planned ToC with multiple grantee employees, if possible.


MCC Green Prosperity Project Goal
Specific Project Goal
Outcomes
Outputs
Activities

Anticipated Outcomes and Targeted Beneficiaries

1. According to the post-Compact ITT, the final outputs and outcomes for your grant were [the following]. Are there major outcomes that are not included in the ITT?
    a. *Be sure to specify those that appear in the logic model but not the ITT.* Is there any M&E documentation you can share with us where these other outcomes are measured and reported?
2. For each of the outcomes specified, who were the beneficiaries targeted? Where are these beneficiaries located?
    a. Can you provide a roster of beneficiaries, ideally including names, telephone numbers, and locations? We would use this list to contact beneficiaries for focus group discussions.
3. Were there any unanticipated outcomes that you know occurred as a result of the grant? Please describe them.

Community Ownership, RE Asset Management, and Model for Sustainability

For each of these questions, ask for documentation of these plans first. If the plans cannot be discerned from documentation, ask for references to grantee staff who may be able to describe these plans in detail in an interview or email exchange.

1. Briefly describe the grant's approach to ensuring grant outputs and outcomes could be sustained over time. Is there any documentation you have available that outlines this overall approach in detail, such as a sustainability plan?
2. **Technical Sustainability:** Can you share any design documents, design reviews, or commissioning documents for the RE assets funded by the grant? These would include any documents that justify the technology selected, specify capacity, output, and/or functioning requirements of the technology, set expectations for how long the assets are expected to function to specification, and describe the extent to which assets were installed as designed.
    a. *If not:* To the best of your knowledge, why did the grant choose to fund the RE assets that it did compared to potential alternatives? How did you know these were suitable for the local context? What is the output capacity of the RE assets funded by the grant, and for how long are they expected to function? Were the RE assets installed as they had been designed?
3. **Operational Sustainability:** Can you share any operations and maintenance plans for RE assets funded under the project? In whose possession were these plans when the grant ended? How did the grant ensure that operators and vendors of the assets were capable of executing these plans after the grant period ended?
4. **Financial Sustainability:** Can you share any business plans or documentation that describes user-fees, O&M funding, and management funding for the RE assets? Was the arrangement for revenue collection, capital funding, and profit-sharing from use of the RE assets specified by the grant or developed by local communities? How could the grantee be assured that this arrangement would function after the grant had ended?
5. **Political/Social/Environmental Sustainability:** Is there any documentation available, such as a gender and social integration plan (GSIP) or Landscape-Lifescape Analysis, that analyzes the suitability of the political, social, and environmental context for long-term operation of RE assets? Was there any plan in place to encourage knowledge about and enthusiasm for the use of RE in benefitting communities? Are there records of any discussions between the grantee and PLN about the potential for grid expansion into villages in which the grant was operating?

6.4 Annex 4: Project Descriptions of Non-Selected Grants

In this annex, we present an overview of all grants featured in the CBOG RE Portfolio as well as more detailed descriptions of grants that were considered, but not selected by MCC or SI for this portfolio evaluation. Grants that do not appear in without any further background in this report are those for which no documentation was available as of July 31, 2017.

Table 16: CBOG RE Grants Signed[98]

Win-dow	Grant Year / Number	Grantee	Project Title	Project Location	Planned Capacity (KW)	Technical Assistance Grant Value	Project Grant Value	Total Project Value with Co-financing	Description of RE works	Disbursed Project Value with Co-Financing	Grant Status
SOLAR											
2	2016 Grant 044	Yayasan Javlec Indonesia	Developing Eco-friendly Businesses	Berau, East Kalimantan	100	N/A	$1,187,822	N/A	Solar PV & small-scale ice cube processing unit for fisherman; Mangrove Information Center	N/A	Completed
2	2016 Grant 039	Yayasan Peduli Konservasi Alam (PEKA)	Utilization of Natural Resources and Sustainable Renewable Energy for Community Welfare Improvement	Berau, East Kalimantan	320	N/A	$870,469	N/A	Solar PV (Sumber Agung) and seaweed/ fish cake processing unit; Solar PV (Giring Giring) and cocofiber processing unit	$831, 782	Completed

[98] According to Indicator Tracking Table dated December 26, 2018

Win-dow	Grant Year / Number	Grantee	Project Title	Project Location	Planned Capacity (KW)	Technical Assistance Grant Value	Project Grant Value	Total Project Value with Co-financing	Description of RE works	Disbursed Project Value with Co-Financing	Grant Status
2	2016 Grant 037	Yayasan Dian Tama	Natural Resources Management of Peat Swamp Forest	Kapuas Hulu, West Kalimantan	6	N/A	$1,848,953	N/A	Solar PV (APDS); Solar PV (APMB); Solar PV (APMP); Solar PV (APNL); Solar PV (APBS); Honey Production Houses (Central and each location); Ecotourism (Selimbau)	N/A	Completed
2	2016 Grant 047	PT Cahaya Inti Trimanunggal	New renewable energy development utilizing solar power	Malinau, North Kalimantan	101	N/A	$1,764,363	N/A	Solar PV (Metut); Solar PV (Long Berang)	$1,695,632	Completed
2	2016 Grant 035	Lembaga Kajian dan Pengembangan Sumber Daya Manusia – Pengurus Besar Nahdlatul	Improvement of poor household income through green business practices	Solok Selatan & Tanjug Jabung Timur, West Sumatra	86	N/A	$1,241,250	N/A	Solar Home System (SHS) (Rawasari); SHS (Sungai Rambut); SHS (Bukik Bulek)	$1,071,540	Completed

Win-dow	Grant Year / Number	Grantee	Project Title	Project Location	Planned Capacity (KW)	Technical Assistance Grant Value	Project Grant Value	Total Project Value with Co-financing	Description of RE works	Disbursed Project Value with Co-Financing	Grant Status
		Ulama (LAKPESDAM – PBNU)									
2	2016 Grant 071	Bumi Manira	Subur Makmur DAS Kadahang	Sumba Timur & Sumba Tengah	[pump]	N/A	$827,943	N/A	Solar water pump	N/A	Completed
2	2016 Grant 024	Burung/ Konsorsium Sumba Hijau	Enhancing Community Livelihood and Conserving Environment	Sumba	[pump]	N/A	$1,813,475	N/A	Irrigation; Small Retention Basin; Rainwater reservoir; Deep Wells	N/A	Completed
2	2016 Grant 032	Kemitraan	Building a productive and Sustainable Social Forestry Entrepreneurship	Sumba Timur	7.8	N/A	$1,370,264	N/A	Solar PV	N/A	Completed

Win-dow	Grant Year / Number	Grantee	Project Title	Project Location	Planned Capacity (KW)	Technical Assistance Grant Value	Project Grant Value	Total Project Value with Co-financing	Description of RE works	Disbursed Project Value with Co-Financing	Grant Status
2	2016 Grant 029	YPK Donders	Cacao commodity development and food crop plantation	Sumba Barat Daya	4	N/A	$1,203,938	N/A	Nursery house (capacity 10.000 seeds); Barsha pump 10 unit; Solar Water Pump (SWP)	N/A	Completed
3A	2017 W3A-59	Anekatek Consortium		Sumba	492	$498,350	$9,200,000	$10,091,279	Solar PV	$9,571,626	Completed
3A	2017 W3A-68	Puriver Consortium		Wakatobi, South Sulawesi	800	$648,302	$7,857,472	$8,833,169	Solar PV	$8,171,718	Completed
3A	2017 W3A-80	Sky Energy Consortium		Mamuju, West Sulawesi	598	$561,523	$5,786,266	$6,588,883	Solar PV	$6,036,294	Completed
BIOMASS											
3A	2017 W3A - 56/7/8	PT Charta Putra Indonesia		Siberut Island, Mentawai Island, West Sumatera	700	$973,288	$11,946,181	$13,417,229	Bamboo &/or biomass power plant	$11,567,079	Completed

Win-dow	Grant Year / Number	Grantee	Project Title	Project Location	Planned Capacity (KW)	Technical Assistance Grant Value	Project Grant Value	Total Project Value with Co-financing	Description of RE works	Disbursed Project Value with Co-Financing	Grant Status
2	2016 Grant 056	Yayasan Lembaga Bantuan Hukum Lingkungan Jambi (YLBHL)	Optimizing land use to support food and energy souvereignity	Jambi, Central Sumatra	[1 household (HH) bio-digester]	N/A	$411,498	N/A	Biogas/ Biodigester (Muaro Pijoan); Communal Cow Cattle (Muaro Pijoan); Rehabilitation Irigation (S. Duren)	N/A	Completed
2	2016 Grant 054	Yayasan Lembaga Alam Tropika Indonesia (LATIN)	Supporting community based forest management	Solok Selatan, Sub District Sangir, West Sumatra	[7 HH bio-digesters]	N/A	$1,378,080	N/A	Biogas/Biodigester (Lubuk Gadang); Ecotourism (Solok Selatan)	N/A	Completed
Hydro											
1	2015 Grant/014	WWF Indonesia		Riau, and Jambi Sumatra Barat	150	N/A	$5,500,000	$10,000,000	Dusun Tuo 150 KW micro-hydropower plant (RE component of grant: $1,125,872)	$5,884,526	Completed

Win-dow	Grant Year / Number	Grantee	Project Title	Project Location	Planned Capacity (KW)	Technical Assistance Grant Value	Project Grant Value	Total Project Value with Co-financing	Description of RE works	Disbursed Project Value with Co-Financing	Grant Status
2	2016 Grant 060	Lembaga Penelitian dan Pengembangan Sumberdaya dan Lingkungan Hidup (LPPSLH)	Development of Community-based Sustainable Agriculture Model	Sintang, West Kalimantan	154	N/A	$1,063,038	N/A	Micro hydro (Rantau Malam); Microhydro (Jelundung); Irigation & Small Bridge (Jelundung); Farmer Hut (Jelundung); Rubber Production Unit (Rantau Malam); Tempoyak (Fermented Durian) Production House (Rantau Malam)	$1,154,198	Completed
2	2016 Grant 048	Yayasan Pena Bulu	Utilization of Small Hydropower Renewable Energy for Households Electrification and	Mahakam Ulu, East Kalimantan	64	N/A	$1,454,393	N/A	Microhydro (Tepuse); Microhydro (Suwan); Cocoa Production House (Long Apari); Cocoa	$1,560,176	Completed

Win-dow	Grant Year / Number	Grantee	Project Title	Project Location	Planned Capacity (KW)	Technical Assistance Grant Value	Project Grant Value	Total Project Value with Co-financing	Description of RE works	Disbursed Project Value with Co-Financing	Grant Status
			Improvement of Community Cacao Business						Production House (Long Pahangai)		
2	2016 Grant 061	Komunitas Konservasi Indonesia WARSI (KKI Warsi) - initiative Sumatera Barat	Improvement of community's Welfare through inclusive livelihood	Solok Selatan, Pesisir Selatan, West Sumatra	120	N/A	$866,097	N/A	Microhydro (Pulakek Koto Birah); Biodigester/ Biogas; Animal Watching Shelter (Solok Selatan); Composting Production Unit (Solok Selatan & Pesisir Selatan); Rice Milling (Solok Selatan & Pesisir Selatan)	N/A	Completed

Win-dow	Grant Year / Number	Grantee	Project Title	Project Location	Planned Capacity (KW)	Technical Assistance Grant Value	Project Grant Value	Total Project Value with Co-financing	Description of RE works	Disbursed Project Value with Co-Financing	Grant Status
2	2016 Grant 062	Komunitas Konservasi Indonesia WARSI (KKI Warsi) - initiative Jambi	Strengthening green development practices to improve the environment's carrying capacity	Kerinci, Merangin, Muaro Jambi, Tanjung Jabung Timur, Central Sumatra	200	N/A	$1,016,817	N/A	Microhydro (Beringin Tinggi); Microhydro (Rantau Kermas)	N/A	Completed
2	2016 Grant 063	Indonesian Institute for Energy Economics (IIEE)	Economic improvement through Renewable energy-based Center of Knowledge (CoK)	Solok Selatan, Sub District Towoti,West Sumatra	50	N/A	$1,378,980	N/A	Microhydro (Wonorejo)	$808,183	Completed
2	2016 Grant 066	IBEKA	Pro Poor for community based RE development, watershed management, ecotourism, and sustainable agriculture	Sumba Timur	160	N/A	$1,923,000	N/A	Micro Hydro (Kutta); Micro Hydro (Kalilang); Micro Hydro (Kamanjara); Knowledge Center Facilities	$1,767,957	Completed

Win-dow	Grant Year / Number	Grantee	Project Title	Project Location	Planned Capacity (KW)	Technical Assistance Grant Value	Project Grant Value	Total Project Value with Co-financing	Description of RE works	Disbursed Project Value with Co-Financing	Grant Status
3A	2017 W3A-04	Lombok Utara Hijau Consortium		Bayan and Santong, North Lombok, West Nusa Tenggara	1,320	$930,315	$7,375,360	$10,845,768	Mini hydro	$0.00	Terminated
Combination											
1	2015 Grant/018	HIVOS - PG		Lombok, Sumba	50	N/A	$4,700,000	$9,400,000	3,200 home bio-digesters; 55 school or kiosk solar charging stations (RE component of grant: $727,782)	$6,209,195	Completed
2	2016 Grant 046	Koperasi Kredit (CU) Keling Kumang		Sub District: Benua Tengah District: Kapuas Hulu Province: West Kalimantan	150	N/A	$1,489,100	N/A	Microhydro (Lebuk Lantang); Microhydro (Lanjau); Microhydro (Sungai Buluh); SHS(Benua Tengah); Pipe Water Supply	N/A	Completed

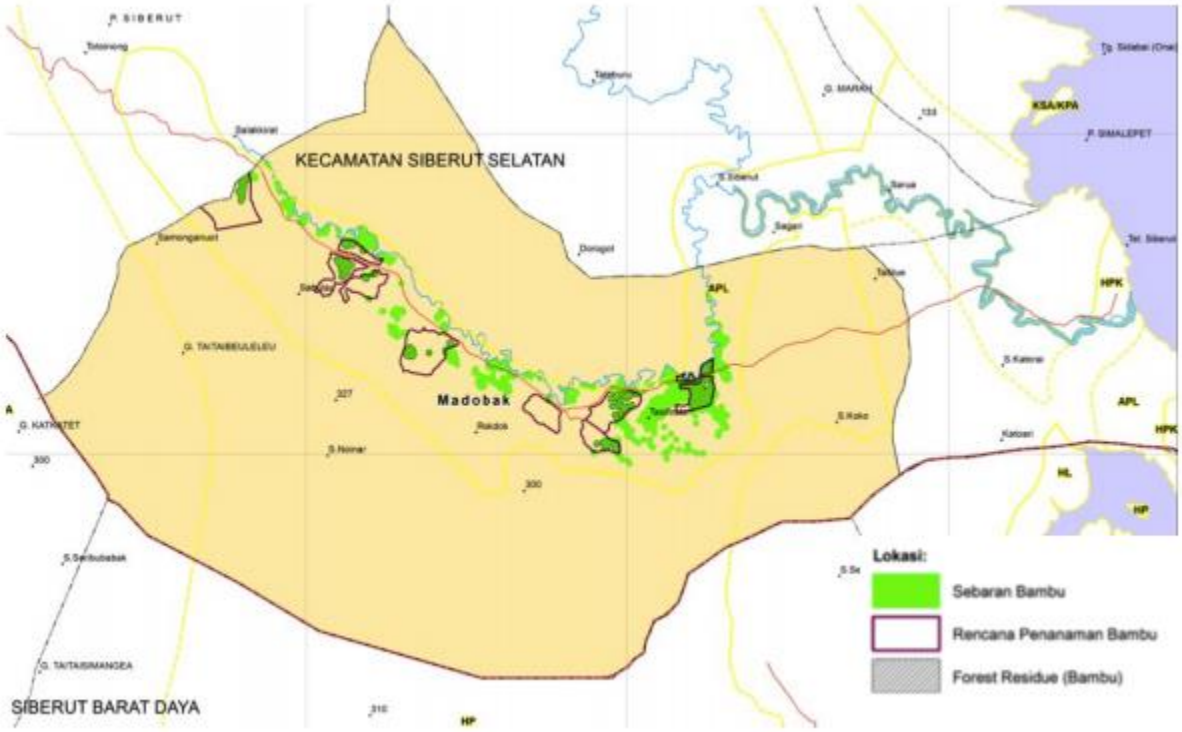
Win-dow	Grant Year / Number	Grantee	Project Title	Project Location	Planned Capacity (KW)	Technical Assistance Grant Value	Project Grant Value	Total Project Value with Co-financing	Description of RE works	Disbursed Project Value with Co-Financing	Grant Status
									(Benua); Pipe Water Supply (Riam Batu); Homestay (Sunagi Utik); Ecotourism (Lebuk Lantang) & Solar home system		
3A	2017 W3A-33	PT Akuo Energy Indonesia		Berau, East Kalimantan	1,243	$921,673	$9,796,525	$10,705,875	Solar PV/mini hydro	$10,284,225	Completed

6.4.1.1 W3A Charta Putra Biomass, Siberut Island

The Siberut Aggregated Biomass Gasification Power Plant Project (W3A Charta Putra Biomass, Siberut Island) targets three villages on Siberut Island in the Mentawai Islands regency of West Sumatra, including Madobag and Matotonan in South Siberut and Saliguma in Central Siberut. The project is targeting all households in the South Siberut villages for connection to the new biomass off-grid system, and all but thirty to forty households in Saliguma. The non-targeted households in Saliguma are not being considered for collection because of their distance from the rest of the households of the village, although the project still hopes to improve their access to electrification via rechargeable batteries or some other means.

The project implementer, PT Charta Putra Indonesia (also known as Clean Power Indonesia, or CPI) selected the Mentawai Islands regency for the project because it has the lowest rate of electrification in Western Indonesia. Siberut Island is the largest of the Mentawai Island chain, and CPI claims that the three villages targeted by the project were selected because, together, they "represent the whole island." The selected villages include culturally and ecologically critical portions of the island (Madobag and Matotonan), as well as a new, coastal village which is the poorest in the regency (Saliguma). CPI would ideally like to replicate the Biomass-based micro-grids across the remaining seventeen villages of Siberut Island, although this activity would not be funded under the grant issued by MCA-I. The three villages targeted by the MCA-I grant can be found in **Error! Reference source not found.**.

Figure 10: Map of Target Villages for W3A Charta Putra Biomass, Siberut Island



The Siberut Aggregated Biomass Gasification Power Plant Project is due to commission all seven of its biomass gasifier facilities in March of 2018. These facilities will be split among three villages with the capacity indicated in **Error! Reference source not found.**. As of July 2017, these facilities are under construction.

Table 17: W3A Charta Putra Biomass, Siberut Island Summary of Physical Outputs

Location	Technology	Number of facilities	Capacity (kW)	Household connections
Madobag	Biomass	3	300	537
Matotonan	Biomass	2	150	270
Saliguma	Biomass	2	200	397
TOTAL		**7**	**650 kW**	**1,204**

As this grant is the only one to implement biomass-based micro-grids, it has a unique economic model and community engagement mechanism relative to the other Window 3A grants. The project will construct an SPV[99] co-owned and operated by local villagers (as represented by three Village-Level Enterprises, or VLEs), regency government representatives (as represented by a Badan Usaha Milik Daerah, or BUMD), and the project implementer (CPI).

The VLEs will harvest and supply bamboo as feedstock for the grids, at first from indigenous sources before ultimately harvesting from a new bamboo plantation. These VLEs are the majority owners of the SPV and primary beneficiaries of the project. The BUMD is responsible for guaranteeing the financial viability of the power plants, monitoring electricity demand from local industries and businesses, and encouraging productive uses of the electricity through government programming or subsidy. CPI is responsible for the project implementation, including appropriate vocational training of local villagers as both bamboo farmers and power-plant managers and operators.

Representatives from each of these three groups will be involved in two separate teams: an SPV Project Management team that will dissolve after the project has been fully implemented, and an O&M Team that will persist through the lifetime of the power plants. Each team will manage a contractor related to its role in implementation. In the case of the O&M team, the O&M contractor will be appointed for five years with an option for an additional five-year extension. See **Error! Reference source not found.**, below.

[99] The SPV approach described here is based on the DFS, which is the most updated SPV plan available to SI as of July 2017. SI acknowledges based on MCA-I comments that this approach has been updated since this time.

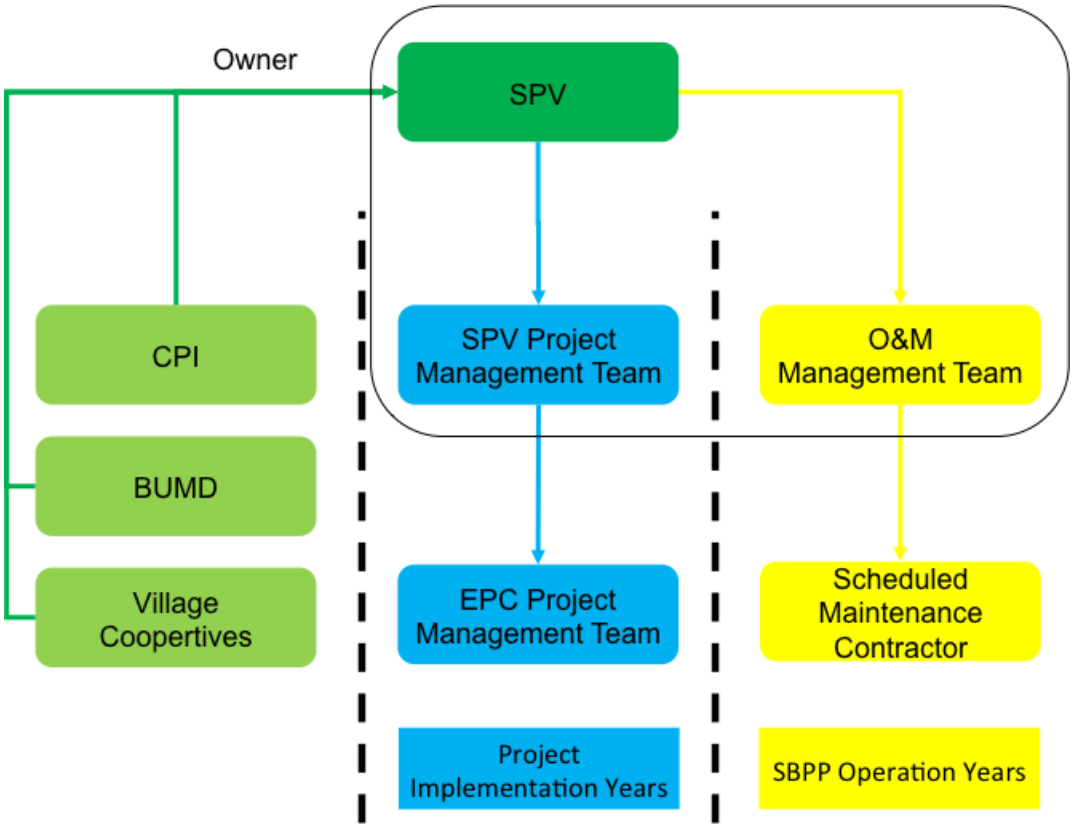


Figure 11: W3A-56-58 SPV Organization and Management[100]

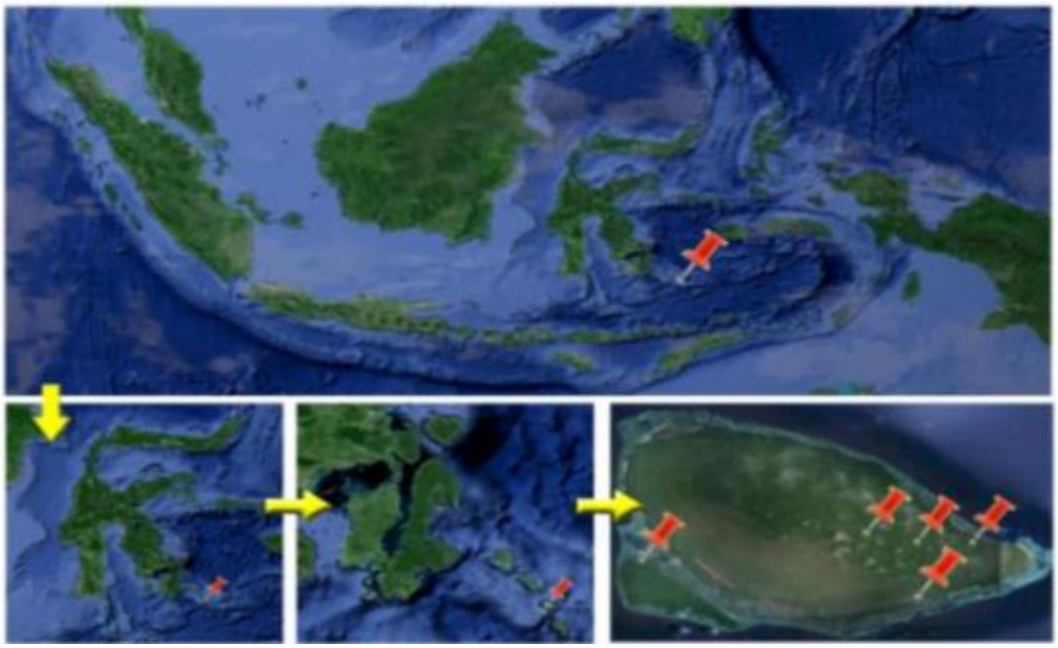
6.4.1.2 W3A Puriver Solar, Tomia Island

The Solar Photovoltaic Electricity for Tomia Island: A Green Prosperity Model Project (W3A Puriver Solar, Tomia Island) targets all 987 households in the Kahianga, Wawotimu, Kulati, Dete, and Lamanggau villages of Tomia Island, one of the Wakatobi Islands in Southeast Sulawesi. These five villages were selected because they are excluded from the PLN's Electrical Power Provision Business Plan for 2015 – 2024 and it would not be economically or environmentally feasible to integrate them into existing power grids on the mainland of Sulawesi or other surrounding islands.[101]

Figure 12: Map of Target Villages for W3A Puriver Solar, Tomia Island

[100] As pictured on pg. 26 of W3A 56-58 DFS.

[101] Detailed Feasibility Study, pg. 16



6.4.1.3 W3A Sky Energy Solar, Karampuang Island

The Solar Photovoltaic Electricity for Karampuang Island Project (W3A Sky Energy Solar, Karampuang Island) targets all 784 households in Karampuang Village, which covers all of Karampuang Island in the Mamuju regency of West Sulawesi. Although the criteria by which this island was selected for this grant are uncertain, the project's DFS indicates that demand for electricity on the island far outstrips the baseline supply provided by ten community diesel generators and supplemental household generators. This project site is unique compared to its surroundings, as is depicted in **Error! Reference source not found.**, since it is a lone island ff the coast of West Sulawesi.

Figure 13: Map of Targeted Village for W3A Sky Energy Solar, Karampuang Island

According to the schedule laid out in the grant agreement, procurement and construction of all Solar PV facilities on Karampuang Island was underway by February of 2017. The four plants will be commissioned between September and December of 2017. Their combined capacity, as laid out in **Error! Reference source ot found.**, will be sufficient to connect all 784 households on the Island.

Table 18: W3A Sky Energy Solar, Karampuang Island Summary of Physical Outputs

Location	Technology	Number of facilities	Capacity (kW)	Household connections

Karampuang Island	Solar PV	4	599	784
TOTAL		**4**	**599 kW**	**784**

The structure of the SPV[102] for W3A Sky Energy Solar, Karampuang Island is centered on a Village-Owned Enterprise (Badan Usaha Milik Desa, or BUMDes) headed by the village chief as CEO (Chief Executive Officer) and supported by a Secretary, O&M Coordinator, and Treasurer. In addition to these technical roles within the BUMDes, there will be two BUMDes representatives for each of the four sub-villages responsible for maintaining relationships between the villagers and the BUMDes. Besides these central roles within the BUMDes, the SPV will also include "Shareholders" responsible for stepping in to address major problems in the SPV and an O&M Contractor responsible for major O&M problems that cannot be resolved by BUMDes O&M staff. Chapter 11 of the W3A-80 DFS clearly maps out the roles and responsibilities of each of these parties across several business processes, including procurement, routine O&M, major O&M, and voucher sales.

According to the schedule found in the grant agreement, public consultation, technical training, and managerial training of the SPV is due to take place between March and September of 2017. MCA-I will complete handover to the SPV in January of 2018.

6.4.1.4 W2 Green Sumba Solar, Central Sumba

This Window 2 grant is implemented by the Green Sumba Consortium (GSK)[103] in 79 villages in 13 sub-districts in the Central Sumba Landscape (*Bentang Alam Sumba Bagian Tengah* (BA-SBT)). The area covers 260,000 hectares (ha) in three districts including Central Sumba, West Sumba, and East Sumba (70 percent, 18 percent, and 12 percent, respectively, from the area of BA-SBT), and an estimated 90,000 citizens. The project aims to strengthen natural resource management (NRM) to increase prosperity, leading to climate resilience as well as contributing to climate change mitigation and to the preservation of the natural ecosystem in BA-SBT.

This project is expected to result in renewable energy (RE), forest management, and sustainable agriculture benefits. The project has three high-level outcomes as follows:

- Outcome A: Strengthened livelihoods of people in BA-SBT through natural resources management and capacity building of village level organizations
- Outcome B: Strengthened practice of land management to increase forest cover and strengthened practice of utilizing renewable energy
- Outcome C: The mainstreaming of the development of productive and sustainable BA-SBT management

[102]The SPV approach described here is based on the DFS, which is the most updated SPV plan available to SI as of August 2017. SI acknowledges based on MCA-I comments that this approach has been updated since this time.

[103] The grant agreement is between MCA-I and Perhimpunan Pelestarian Burung Liar Indonesia (Burung Indonesia), the lead institution in the Consortium. The Consortium, in addition to Burung Indonesia, includes Lembaga Peduli Sejahtera dan Lestari Sumba (Pelita Sumba), Yayasan Bahtera, Yayasan Wahana Komunikasi Wanita, Forum Perempuan Sumba (FOREMBA), and Forum Jaringan Manupeu Tanadaru (JAMATADA).

Specifically related to RE, Outcome B includes an output titled 'Increased households which utilize renewable energy'. The consortium expects activities focused on promoting household solar power lighting (*penerangan lampu tenaga surya rumah tangga* (PLTS)) to help provide electricity to 13 villages covering around 283 households in the project implementation area.

The project importantly includes a community-based approach to the promotion of RE sources toward the goal of sustainability post-implementation. In order to improve the livelihoods of local communities, the project not only focuses on improving agriculture and animal husbandry, but also technical capacity, social investment, and social organization. At the village level, the project develops community groups that discuss access to natural resources, park boundaries, and monitoring of resource use. These groups promote village-level agreements and regulations to better manage their lands. The project encourages participation in the government-established musrenbang and village development planning process, so that they play a key role in achieving a productive and sustainable landscape.

The grant began in July 206 and will conclude activities within 18 months of its start date in December 2017.). It is currently completing work in quarter 5 of the grant agreement and is on track with most planned activities.

6.4.1.5 W2 Yayasan Dian Tama Pontianak Solar, Kapuas Hulu

The goal of this project is to increase productivity and value added of community products through the use of renewable energy, management of peat forests to increase people's incomes, management of peat swamp forests, and reduction of dependence on fossil fuel in and around conservation areas in Kapuas Hulu. The project has two expected outcomes, as follows:

- Outcome 1: Increased productivity, product added value, product standardization and marketing networks in three ecotourism management groups and five solar energy sub-centers of honey (39 groups of fish and processed products farmers, 5 groups of fishermen women) without the use of fossil fuel.
- Increased management of peat land ecosystems, aquaculture ecosystems, ecotourism destinations and habitat of bees through sustainable use of land.

These outcomes are further specified by seven specific outputs, including forest fire mitigation/management, ecotourism development, a market study, RE (solar energy) sub-center development, and information sharing within the community about renewable energy.

The RE component of this grant involves the development of five solar energy processing houses for honey and fish. The production houses (and the processes) will reduce their use of fossil fuels and reduce public spending on fossil fuels for production purposes by using 250 W solar panels. The project plans to conduct capacity building activities regarding production house (and solar panel) maintenance and operation by December 2017.

The grant will conclude activities within 18 months of its start date, in November 2017 (start date of June 2016). The houses were expected to be completed in December 2016 (with solar panels completed by June 2017). Issues noted in the quarter 3 project report included availability of funding, which has slowed implementation.

This Window 2 grant is implemented by Yayasan Dian Tama Pontianak (Lead Consortium institution) together with consortium partners.[104] They implement the project in the district of Kapuas Hulu in West Kalimantan,[105] in the Kapuas watershed and Leboyan-labian sub-watershed. This 86,000-ha area includes peat swamp forest and dry lowland forest, which are particularly vulnerable to forest fires and other land use changes. The project plans to reach 18 villages in seven sub-districts in Kapuas Hulu (namely Selimbau, Jongkong, Batang Lupar, Suhaid, Badau, Bunut Hilir, and Embaloh Hilir), and 1,014 households.

6.4.1.6 W2 CUKK Micro-Hydro/Solar, West Kalimantan

This Window 2 grant is implemented by Koperasi Kredit Keling Kuman (as the Consortium leader (CUKK), together with consortium partners.[106] CUKK has 62 branch offices, four of which are located in the project area – namely Kapuas Hulu and Sintang District in West Kalimantan. The project will work in six villages in the former district (two sub-districts), and seven villages in the latter district (one sub-district). Beneficiaries include 789 households (or 3,190 individuals) in Kapuas Hulu and 444 households (or 1,776 individuals) in Sintang.

The goal of this project is to reduce poverty and improve people's quality of life through fair and sustainable environmental management efforts for sustainable economic growth. The project will conduct empowerment, cultivation, productivity and RE activities/trainings. The project has four high-level outcomes, as follows:

- Outcome 1: Decreasing the dependency on fossil fuel by providing renewable energy.
- Outcome 2: Improving Saran and Embaloh Hulu territories governance participatorily (sic) and sustainably.
- Outcome 3: Changing community behaviors on maintaining natural resources and increasing productivity.
- Outcome 4: Optimizing catchment area functioning.

Particularly related to Outcome 1 and the RE component of this grant, various targeted villages at the time of project launch relied on diesel-fueled power plants. This resulted in high diesel prices and air pollution. The power was only provided for 3 hours at a time, and, resultingly, residents had to resort to kerosene fuel to light their homes. To address this, the project is procuring RE sources through development of Micro Hydro Power Plants (PLTMH)[107] and a Solar Power Plant (PLTS)[108]. The project will also develop a governance system to maintain these facilities, and encourage community participation in the development/construction/maintenance process.

The plants will range in capacity from 21 – 74 KW, reaching 151 KW to 273 households.

The grant will conclude activities within 19 months of its start date, in December 2017 (start date of June 2016). At inception, the project implementer already identified challenges will accessing parts to maintain PLTMH and PLTS in West Kalimantan. In their third quarterly report, the implementer reported completing

[104] Consortium partners include Yayasan Dunia Lingkungan Hidup Indonesia / World Wildlife Fund for Nature Indonesia, Perkumpulan Kahan, Koperasi Asosiasi Periau Danau Sentarum (APDS), Lembaga Pengkajian dan Studi Arus Informasi Regional (LPS- AIR), Yayasan Riak Bumi, and Komunitas Pariwisata Kapuas Hulu (KOMPAKH).
[105] APL area.

[106] The consortium includes Koperasi Produsen K77 and Aliansi Masyarakat Adat Nusantara Kalimantan Barat (AMAN Kalbar).
[107] *To be developed in Lebuk Lantang (servicing 500 households, 2 churches, 1 homestay and 1 town hall), Lanjau (servicing 90 households, 1 village office, 1 village hall, 1 primary school and 1 church) and Sungai Buluh (in some grant documents, this is listed as Rawa Bangun – 60 households, 1 village office, 1 village hall, 1 primary school, and street lighting).*
[108] *To be developed in Benua Tengah (servicing 60 households, 10 street lights, 1 church and 1 health clinic).*

participatory mapping workshops in seven villages. The project had also already received letters of recommendation regarding the development of the solar plant. The project planned to socialize and conduct focus group discussions regarding PLTS and PLTMH in March 2017.

6.5 Annex 5: Data Collection Summary Table

Data collection	*Timing MM/YYYY (include multiple rounds)*	*Sample Unit/ Respondent*	*Sample Size*	*Relevant instruments/ modules*	*Exposure Period (months)*
Window 3A Qualitative Data Collection	Baseline: 09/2017 – 10/2017 Interim: 08/2019 - 09/2019 Endline: 11/2020	SPV Leadership Officials, Village Officials, Project Grantee/Managers, EPC Contractors O&M Contractors Community members Enterprise officials	50 - 78 key informants, approximately 250 enterprises and around 120 focus group participants.	SPV Leadership KII, Grantee KII Protocol, Enterprise KII Protocol, Grantee Case Study Protocol	12-16 months (interim) and 32 - 36 months (endline)
Window 3A Quantitative Data Collection	Baseline: 10/2017-11/2017 Interim: 03/2019 Endline: 03/2021	Households clustered into settlement aggregations (East Sumba) and villages/desas (Berau); purposively-selected enterprise officials/entrepreneurs.	East Sumba: 840 households (330 treatment and 510 comparison) clustered into 11 treatment kampungs and 17 comparison kampungs; +/- 8 enterprises per kampung, 1 official per kampung Berau: 150 households clustered into 3 treatment villages; +/- 8 enterprises per village, 1 official per village	Household survey, Enterprise Survey, Community Leader Survey, PLN/Mini-Grid Form	21 – 22 months (interim) and 38 – 42 months (endline)
Case Studies	Interim (Only): 08/2019-09/2019	TBD Following Implementation of Grantee Case Study Protocol	TBD Following Implementation of Grantee Case Study Protocol	Grantee Case Study Protocol; Remainder TBD	17-18 months; 17-26 months for W1 Hivos

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