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Mobilising the Off-grid Power Supply in Indonesia:

Business Model Analysis

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About MENTARI

MENTARI Programme, led by the British Embassy Jakarta and its partners, aims to deliver inclusive economic growth and poverty reduction in Indonesia, by supporting the uptake of low carbon energy. The programme has a specific focus on developing the low carbon energy sector to best support disadvantaged communities, and specifically those in eastern Indonesia. MENTARI is a four-year programme, running from 2020-2023.

Mobilising the Off-grid Power Supply in Indonesia:

Business Model Analysis

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Mobilising the Off-grid Power Supply in Indonesia: Business Model Analysis

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Acronyms and Abbreviation

ADB	:	Asian Development Bank
APBD	:	Local Government Budget (*Anggaran Pendapatan Belanja Daerah*)
APBN	:	State Budget (*Anggaran Pendapatan Belanja Negara*)
Bappenas	:	Ministry of National Planning
BLU	:	Public Services Agency (*Badan Layanan Umum*)
BUMD	:	Local Government-Owned Enterprise (*Badan Usaha Milik Daerah*)
BUMDes	:	Village-Owned Enterprise (*Badan Usaha Milik Desa*)
DAK	:	Specific Allocated Budget (*Dana Alokasi Khusus*)
DG NREEC	:	Directorate General of New, Renewable Energy and Energy Conservation (*Direktorat Jenderal Energi Baru, Terbarukan, dan Konservasi Energi*)
DGE	:	Directorate General for Electricity (*Direktorat Jenderal Ketenagalistrikan*)
G&I	:	Gender and Inclusion
HOMER	:	Hybrid Optimisation of Multiple Energy Resources
IBRD	:	International Bank for Reconstruction and Development
IDR	:	Indonesian Rupiah
IIT-Comillas	:	Institute for Research in Technology of Comillas Pontifical University
IUPTL	:	Electricity Supply Business Licence (*Izin Usaha Penyediaan Tenaga Listrik*)
KPBU	:	Public–Private Partnership (*Kerja Sama Pemerintah dan Badan Usaha*)
KSO	:	Joint Operational Cooperation (*Kerja Sama Operasi*)
LED	:	Light Emitting Diode
MCAI	:	Millennium Challenge Account Indonesia
MCC	:	Millennium Challenge Corporation
MEMR	:	Ministry of Energy and Mineral Resources (*Kementerian Energi dan Sumber Daya Mineral*)
MHP	:	Micro-hydropower
Micro IPP	:	Small-Scale Independent Power Producer
MIT	:	Massachusetts Institute of Technology
MMK	:	Myanmar Kyat
MWh/kWh	:	Megawatt/kilowatt hour
MWp/kWp	:	Megawatt/kilowatt peak
NGO	:	Non-Governmental Organization
PLN	:	State-Owned Electricity Utility Company in Indonesia (PT PLN Persero)
PNPM	:	National Programme for Community Empowerment (*Program Nasional Pemberdayaan Masyarakat*)
THB	:	Thailand Baht
USD	:	US Dollar
Wilus	:	Electricity Business Area (Wilayah Usaha)
YMP	:	Yoma Micro Power Units

EXECUTIVE SUMMARY

The MENTARI programme is a four-year (2020–2023) cooperation between the Indonesian Ministry of Energy and Mineral Resources (MEMR) and the British Embassy Jakarta.

MENTARI's goal is to deliver inclusive economic development and reduce poverty by developing the renewable energy sector in Indonesia to best support disadvantaged communities particularly in eastern Indonesia. The programme will also accelerate the deployment of renewable energy projects countrywide. MENTARI also aims to demonstrate the potential for low carbon energy to develop Indonesia's economy, create jobs and promote gender equality and social inclusion, while helping to mitigate the impacts on the climate and environment.

This study is a joint effort by the MENTARI programme and the Ministry of Energy and Mineral Resources to review and analyse the existing off-grid regulatory framework, present new approaches to developing rural electrification and lay out off-grid business model options that are feasible within the existing regulatory landscape. The study starts by outlining current regulations, identifying the gaps in the uptake of off-grid projects and describing past programmes implemented in Indonesia. We examine and evaluate existing and proposed business model options, including their individual characteristics, requirements and performance to determine which models we will analyse in depth in future updates of this assessment. Additionally, the study recommends policies that government can consider to bridge the current gaps in the regulations and integrate gender equality and social inclusion (G&I) activities.

This study is the precursor to a more comprehensive analysis of off-grid business models that we plan to undertake in the upcoming years. We will revise and update the study by continuing to research the proposed business models and examine different methodologies in implementing them, including, for example, lessons learned from the demonstration projects that MENTARI is currently preparing.

Introduction

Indonesia has achieved an electrification rate of 98.3 per cent in spite of being an archipelago of 17,000 islands that spans over 5,000 kms. Nevertheless, roughly 1.2 million Indonesian households (some of which are female-headed households) – including 700,000 in eastern Indonesia – were still unable to access electricity at the end of 2018. The remaining unelectrified areas are often hard to access and expensive to serve through conventional grid extension so off-grid solutions play an increasingly important role in cost-effective electrification.

Off-grid solutions are defined as those that use a distributed approach to ensure electricity supply to a demand area without needing to be connected to the state electricity company

namely PT Perusahaan Listrik Negara (Persero) – PLN's grid (20 kV or above)[1] or any similar grid for the next five years[2] because PLN considers them to be economically viable. An off-grid solution can be served as individual generators (such as, a solar rooftop, battery swap and solar lighting) or as a mini-grid system with a maximum distributing voltage of 380V (for social and residential purposes).

Gap Analysis of Ministry of Energy and Mineral Resources Regulation No 38 of 2016

In the off-grid regulatory framework, the Government of Indonesia has enacted several regulations such as: Law No 30 of 2009 on Electricity, Law No 23 of 2014 on Regional Government (as amended by Law No 9 of 2015), Government regulation No 14 of 2012 on Electricity Supply Business Activities (as amended by Government regulation No 23 of 2014), the Ministry of Energy and Mineral Resources (MEMR) regulation No 28 of 2012 on the Procedure for Request of a Business Area for Public Electricity Supply (as amended by MEMR regulation No 7 of 2016) and MEMR regulation No 38 of 2016.

> MEMR regulation No 38 of 2016 allows local governments to authorise business opportunities for an off-grid supply. Under the framework, locally-owned enterprises, private businesses and cooperatives can manage a business area (at minimum, a district) through subsidy or no subsidy schemes. The regulation explains the business flow and how to determine the tariff.

Among these regulations, MEMR regulations No 28 of 2012, No 7 of 2016 and No 38 of 2016 include a framework for off-grid electrification by non-state electricity entities. MEMR regulation No 28 of 2012 establishes a process for business enterprises, including private companies, that supply electricity in a vertically integrated manner to areas defined in consultation with the state company, PLN. MEMR regulation No 38 of 2016 elaborates on the business framework and tariff determination that can accommodate a wide range of off-grid development. However, there is still room for improvement based on the following gap analysis.

In MEMR Regulation No 38 of 2016, business area refers to an area of distribution or sales for rural electrification that is designated by the ministry in close consultation with PLN. This regulation enables non-PLN off-grid power suppliers to be actively involved in developing rural electrification.

A business area can only be managed by one business licence holder and this leads to the following issues:

1. A business area covers at minimum a district (*kecamatan*). In eastern Indonesia, the population density is low and the area covered may be scattered and vast or, in some cases, it may cut across many small islands. This creates a difficult task for just one entity to manage.

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1 Definition is taken from the following studies and off-grid projects: 1) Least-cost electrification plan for Papua, Papua Barat, Maluku and Maluku Utara (MIT & ITT, 2019:10); 2) Interim evaluation report: Indonesia Green Prosperity project community-based off-grid renewable energy grant portfolio (Social Impact Inc, 2019: 171); 3) Achieving universal electricity access in Indonesia (Castlerock and ADB, 2015).

2 Millenium Challenge Account Indonesia (MCAI) approach: off-grid is also defined as 'no PLN integration in the next five years'

2. A district may already have one village with access to electricity through a government programme. And while some areas may still have no access to PLN electricity, these are not always grouped in the same location. Thus, this blocks private companies from the potential market in that business area. In other words, this minimum requirement of government approving the business area is always uncertain due to the PLN coverage. Even if private companies develop close relations with the local PLN administration, the decision rests with the MEMR and central PLN office.

3. In cases where a private entity is willing to cover only one or two villages in a district, the remaining villages (still not electrified) in the district cannot be covered by other entities because the licence is assigned to the first entity. These villages have no option but to wait until the entity can provide access. Therefore, achieving government's target of 100 per cent electrification rate for all villages depends totally on the licence holders unless the ministry can compel them to extend their coverage.

MEMR regulation No 38 of 2016 includes a formula to determine the tariff for a subsidy scheme but gives no detailed mechanism for it. Even when the subsidy is provided through a tariff, there is no clear regulatory framework from the Ministry of Finance to support the process. The absence of a clear mechanism to obtain the subsidy – whether and when the developer can access it – creates an uncertain cashflow situation for the project.

Powering Rural Communities

Selected off-grid programmes in Indonesia

Over the last decade, programmes have significantly mobilised off-grid development (see Exhibit ES-1). The programmes assessed in this study include: the National Programme for Community Empowerment (PNPM) Green programme; the Millennium Challenge Account Indonesia (MCAI) Compact Green Prosperity programme; the Directorate General of New, Renewable Energy and Energy Conservation (DG NREEC) programme and the PLN programme.

The brief analysis of these follows and summaries of each program are presented in Exhibit ES-1.

Institutional setting

The study found that each programme has different arrangements involving different ministries. The different structures also affect the level of effort required and the effectiveness of the individual off-grid projects. The National Programme for Community Empowerment (PNPM) Green was perceived as successful and started before the MEMR regulation No 38 of 2016. It was also developed before the business area provision in MEMR regulation No 28 of 2012. At that time, while business areas were designated, they were not enforced for projects run by micro-scale and non-governmental organizations. The PNPM projects were considered to be micro-scale projects. However, currently, business areas are designated for even small and off-grid projects.

Subsidy availability

Subsidies are available to cover capital expenditure for non-PLN programmes and subsidised tariffs for PLN. The Millennium Challenge Account Indonesia (MCAI) programme sourced grants from the Millennium Challenge Corporation. The PNPM has several funding sources, including: The International Bank for Reconstruction and Development (IBRD); the state budget (APBN); and regional budgets (APBD). The Directorate General of New, Renewable Energy and Energy Conservation (DG NREEC) and PLN programme funding was disbursed from PLN's own budget (APLN) as well as the state and regional budgets. These did not cover daily operational and maintenance costs for each off-grid generator, nor the distribution system costs. A subsidy on the basis of operational and maintenance costs is vital to guarantee the financial viability of these projects.

Sustainability

From the technical perspective, the institutions implementing off-grid projects have extensive experience and capability. This includes PLN and MEMR but also prominent non-governmental and other organizations in Indonesia. However, uncertainty in future demand, the lack of a comprehensive methodology for conducting feasibility studies and the unreliable supply of off-grid feedstock (particularly for biomass) may affect the long-term operation of the systems already installed.

From the economic development and financial viability perspectives, PLN grid extension projects are largely responsible for electrification in the rural areas. These employ diesel generation systems that are not sustainable or cost-effective for rural households. The absence of subsidies for operational and maintenance costs also creates financial issues for some projects by non-PLN entities.

Moreover, the directorate general and PLN projects did not record the productive economic impacts for the local communities generated by their experiences. Their key performance indicators only measured whether the project was built and how many households were covered. In terms of social development, while all programmes involved local entities, there were no specific efforts to engage the communities or to provide specific inclusive economic productive uses opportunities to both women and men or include these as part of result indicators of achievement. The MCAI projects did consider inclusive economic opportunities and productive uses. Not only that, off-grid energy can provide livelihood improvement opportunitiesThe MCAI projects have ensured active engagement of women and men in project planning, development, and implementation. They have also provided clear productive use of energy benefits to communities, ensuring both women and men and the poorest households can benefit from these[3].

3 Information from MENTARI team members who have worked on MCAI on behalf of Hivos

Exhibit ES-1: Selected off-grid programmes in Indonesia.

Programme	Period	Budget arrangement	Ministries involved	Subsidy present	Financing sources	Impacts	Productive economic activity
National Programme for Community Empowerment (PNPM)	2008–2013	Multi-year budget, allocated in advance	Ministry of Home Affairs, regional governments, village administrations	Capital expenditure 50% of USD 30.68 million	International Bank for Reconstruction and Development (IBRD), state's own budget, regional budget	155 micro-hydropower (MHP) projects in selected locations in Sumatra and Sulawesi	New business activities: bakery, chicken farming Longer hours for existing businesses: shops, carpentry shops
Directorate General of New, Renewable Energy and Energy Conservation (DG NREEC)	2011–present	Yearly basis	DG NREEC task force members	Capital expenditure (various) IDR 868.6 billion (2019)	State's own budget (special allocation fund or specific allocated budget –DAK – plus regional budgets – APBD)	Projects include solar home systems, solar lighting, LED bulb retrofits, solar power for public offices, renewable power plant revitalisation and installation (MHP, biogas, solar)	Electricity for public facilities
Millennium Challenge Account Indonesia (MCAI)	2013–2018	Project basis	Ministry of Finance, Ministry of National Planning, Ministry of Home Affairs, Grantees	Capital expenditure (total USD 62 million)	Millennium Challenge Corporation (MCC)	28 renewable energy projects (solar, hydro and bioenergy) consisting of 12.73 MW of new generation capacity through 4 on-grid projects (8 MW) and 24 off-grid projects (4.73 MW) Provided 9,095 electricity connections, including to 2,622 households	Food stalls, carpentry shops, fisheries, farming. Specific productive economic activities were created for women, for example running kiosks using energy and renting out lanterns for additional household income, and agro-processing machines and biogas usage that reduce women's burden and free up their time for productive uses
State-owned electricity facility (PLN)	1976–present	Yearly basis	Ministry of Finance, Ministry of National Planning, MEMR and local governments	Capital expenditure + subsidised tariffs (various)	State's own budget, regional budget, PLN budget	PLN successfully connected 97% of households In 2016–2019, PLN provided electricity access to 11,323 villages	Electricity for public facilities

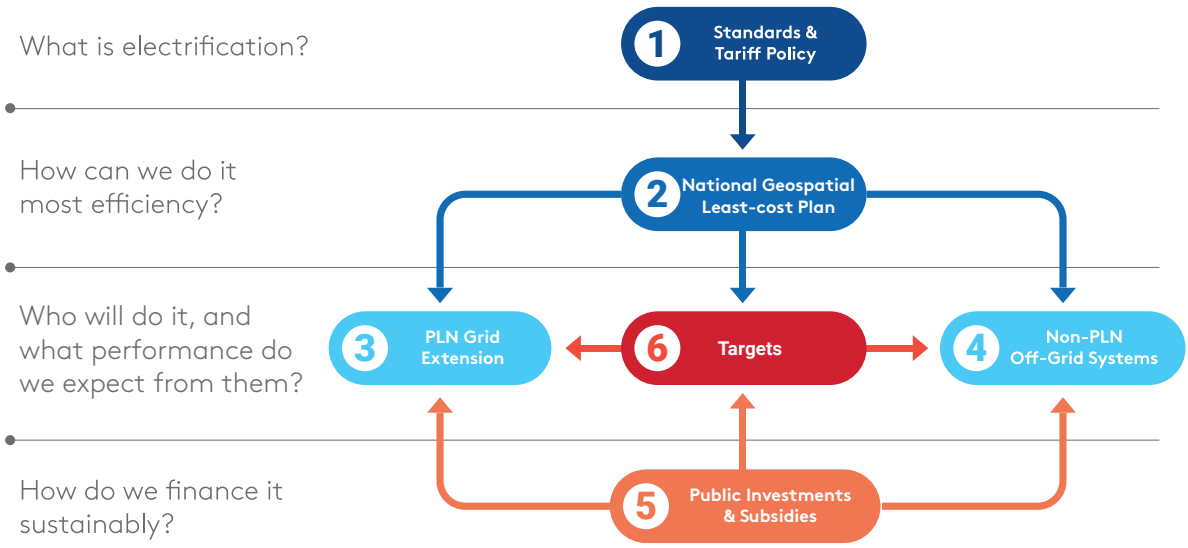
A New Approach to Rural Electrification

Cultural development, the archipelagic background and geographical conditions are the main obstacles to achieving universal access- access for all people regardless their gender, age, education, social and cultural backgrounds- to electricity in Indonesia. In some remote areas, inhabitants live far from each other or on isolated islands. However, each person in Indonesia has the right to access electricity.

Grid extension and diesel generators are an outdated approach to supplying electricity to those households. Through the village electrification programme, PLN allocates an annual budget from the state or regional budget funds for this electrification method. Grid extension requires demand to be growing consistently so less cost-effective strategies are often needed for households scattered across rural areas.

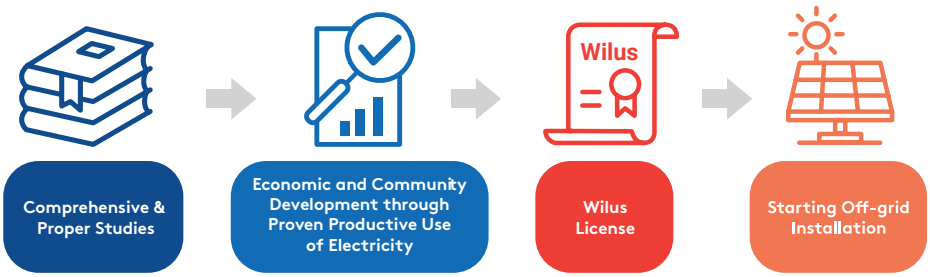
By taking a new approach to rural electrification, the government can select appropriate technologies and use different approaches or methods of servicing the remaining unelectrified households effectively. Grid extension is not the only option. Various business models for off-grid supplies are possible and adopting new approaches to rural electrification is vital. The new integrated approach, presented in Exhibit ES-2, responds to critical issues on rural electrification, proposing an additional new step called the 'national geospatial least-cost plan'.[4] In addition, pre-existing requirements (see Exhibit ES-3) must still be considered.

Exhibit ES-2: A new approach to rural electrification



4 More studies on geospatial least-cost planning include: Castlerock (2014) ; Castlerock (2017); MIT-IIT (2019)

Exhibit ES-3: Requirements for rural electrification development



Off-Grid Business Model Taxonomy

The off-grid business models can be designed by considering the following (see Exhibit ES-4):

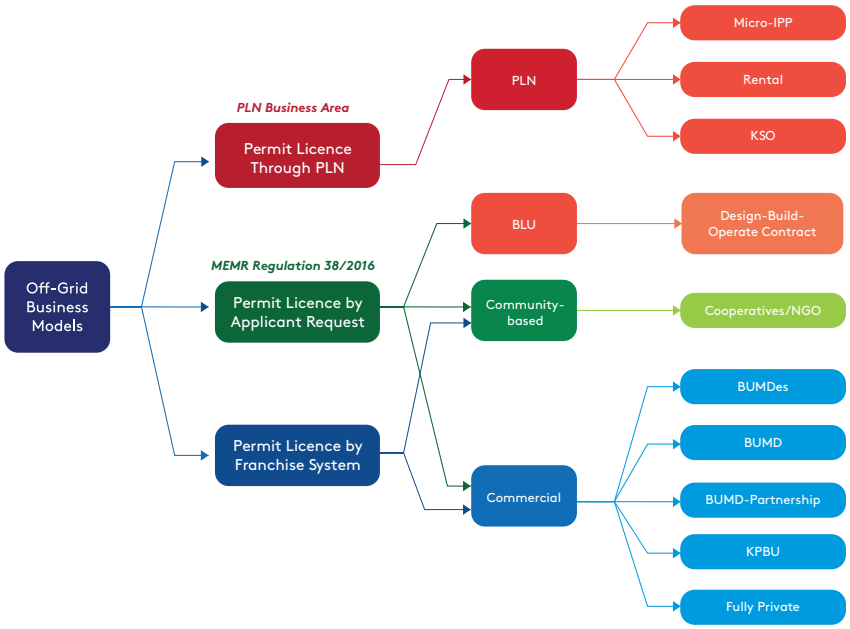
- **Level 1 – How can entities obtain the licence?**
  Three options: PLN business areas (Wilus); applications made for business area licences or offers of business area licences from MEMR (franchise). No legal support or regulatory frameworks exist yet for the franchise approach;

- **Level 2 – Who does the customer pay for services?**
  Four options: PLN, the public services agency (Badan Layanan Umum – BLU), community-based organizations and commercial entities;

- **Level 3 – How is the power plant owned and operated?**

There are ten business models available.

Exhibit ES-4: Taxonomy of off-grid business models



Summary of Each Business Model

Small independent power producer

The small- independent power producer (micro-IPP) model is based on the independent power producer framework typically used in Indonesia. The project developers build power plants and any required grid extensions and then operate and maintain them. Under a power purchase agreement, the developer sells the electricity service to the state electricity company, PLN. The developer is paid for each kWh transferred to PLN. PLN uses its grid to distribute the electricity to its customers and collects payment from them.

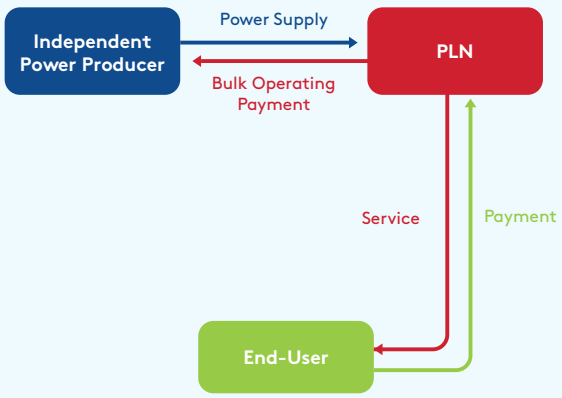


Exhibit ES-5: The small independent power producer (micro-IPP) model

Rental

PLN's rental framework is used widely across Indonesia and generally for small diesel power plants. However, this study proposes a rental model for non-diesel power plants whereby PLN runs the power plants that are owned by the project investor. The project investor receives a rental payment from PLN based on an annual contract. PLN delivers generated power directly to the customers who then pay the service fees to PLN.

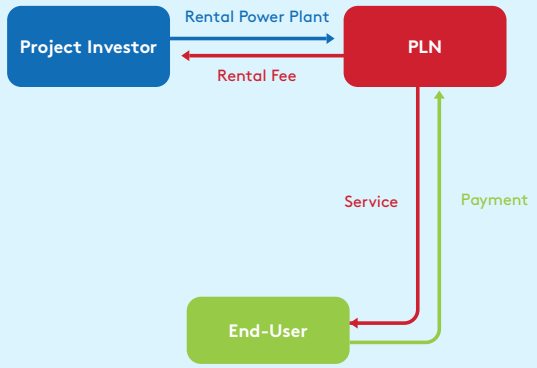


Exhibit ES-6: Rental model

Joint operational cooperation

Any private company that wants to become a project developer and operator establishes a joint operational cooperation (kerja sama operasi – KSO) with PLN for rural electrification in one or more specific areas. This joint operational cooperation framework works under a business-to-business agreement between PLN and the private company. The cooperation provides the electricity service to customers and PLN operates and maintains the plant. End-users pay PLN for the electricity service and it then pays the private company an operational fee and the capital repayment. In contrast with the rental model, the project developers can build the distribution lines and substations and operate during the contract period. PLN includes these costs in the investor's capital repayment.

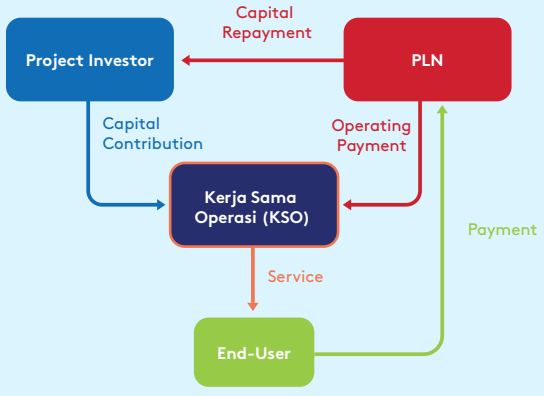


Exhibit ES-7: Joint operational cooperation (KSO)

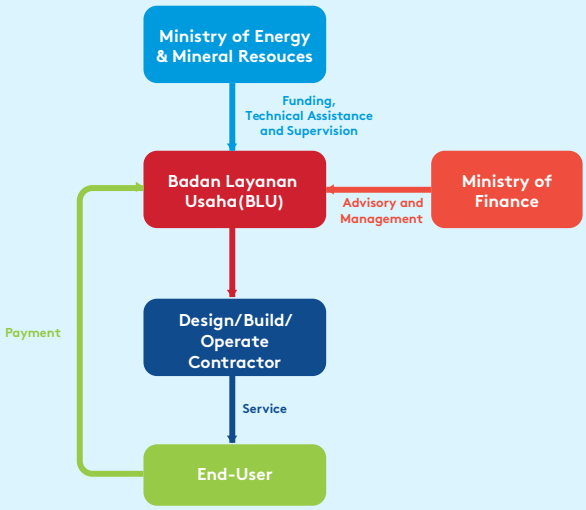


Exhibit ES-8: Public services agency (BLU) model

Public services agency

This model uses the public service agency (badan layanan umum – BLU) as the focal point in delivering an off-grid power supply. It has only one business option, as a design–build–operate contract so it includes operating and maintaining the plant.

The concept of the public service agency model is not new in Indonesia and it was defined and updated under Government regulation No 74 of 2012. The model has mainly been implemented in the health and education sectors, but this study proposes using it for rural electrification.

The Ministry of Finance establishes a public services agency supervised by MEMR. The agency calls for proposals from the private sector to design, build and operate the off-grid service. The agency owns all the assets and collects the electricity fees from the customers while it pays the contracted company on a fee-for-service basis. This concept can also be integrated with the public services agency for tariff subsidies (recommended in this study).

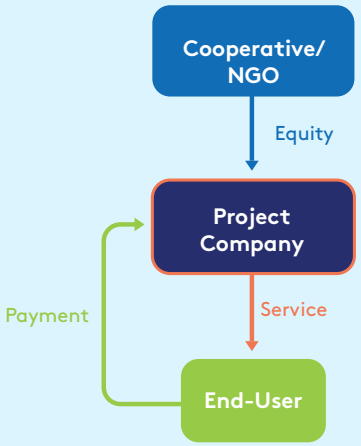


Exhibit ES-9: Cooperative or non-governmental organization model

Cooperative or non-governmental organization

This off-grid business option is initiated by a non-governmental organization or cooperative that focuses on economic development at the village level. This organization then works closely with the village community to set up a project company to deliver electricity. The project assets may be wholly owned by the organization or shared with the community. The project company is responsible for building, operating and maintaining the power plant and it collects payment from the end-users.

Local government or village owned enterprises

The village administration, with community consensus, creates a village-owned project enterprise (BUMDes) to manage the off-grid power supply. This company then creates a supervisory body to oversee the electricity service. The project company builds the power plant, delivers the electricity, operates and maintains the plant, and collects the tariffs.

Similarly, provincial or district governments can set up locally owned enterprises (BUMD) to manage the off-grid power supply with a supervisory body to oversee the process. Shares are owned by the company that manages the project from the preparation stage through to implementation. The company owns the power plant assets and collects the service fees from the customers.

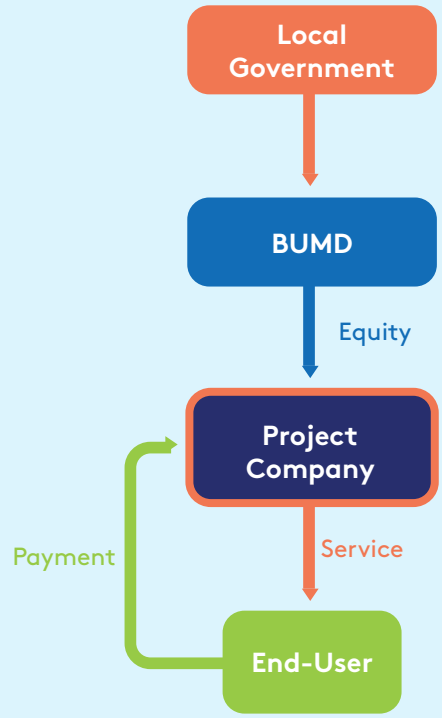


Exhibit ES-10: Local government or village owned enterprises (BUMD/BUMDes) model

Local government or village owned enterprise partnerships

Under this model, local governments still play a major role in administering the electrification project. The local government initiates a local level (BUMD) or village level (BUMDes) enterprise to provide the off-grid power supply. This company collaborates with one or more private entities to establish a supervisory body as the project company. The aim of this partnership is not only to increase equity and share the risks but also to improve institutional capacity in delivering reliable electricity access. The local government or village owned company and private entities share the project company's assets. The joint venture company manages and maintains the service and collects the fees.

Public–private partnerships – availability payment

In general, public–private partnerships offer two possible schemes: the availability payment[5] and the viability gap fund.[6]

Local governments and private investors establish a specified public–private partnership contract for an off-grid project. A project company implements the partnership agreement by building the power plant, collecting tariffs, and operating and maintaining the plant. The company assets are owned by the parties in the contract, based on the shared equity. Line ministries, such as MEMR and the Ministry of Home Affairs, can provide technical assistance to the project under this partnership. Exhibit ES-12 shows the schematic for this model.

5 An availability payment is a periodic payment by the minister or chairperson of the institution or the head of the region to an enterprise for providing infrastructure services that conform to the quality and/ or criteria specified in the public–private partnership agreement.

6 A viability gap fund is a fund provided by government to public–private partnership projects to improve the financial feasibility of the project. The fund reduces the capital needed to construct the infrastructure, so the project offers a higher investment return. Many infrastructure projects are economically viable, but they are not financially feasible. The viability gap fund can be used to make up for this.

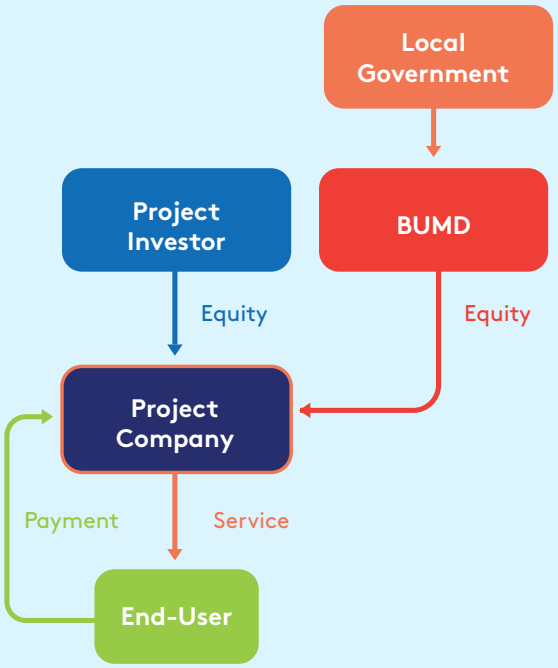


Exhibit ES-11: Local government or village owned enterprise (BUMD/BUMDes) partnership

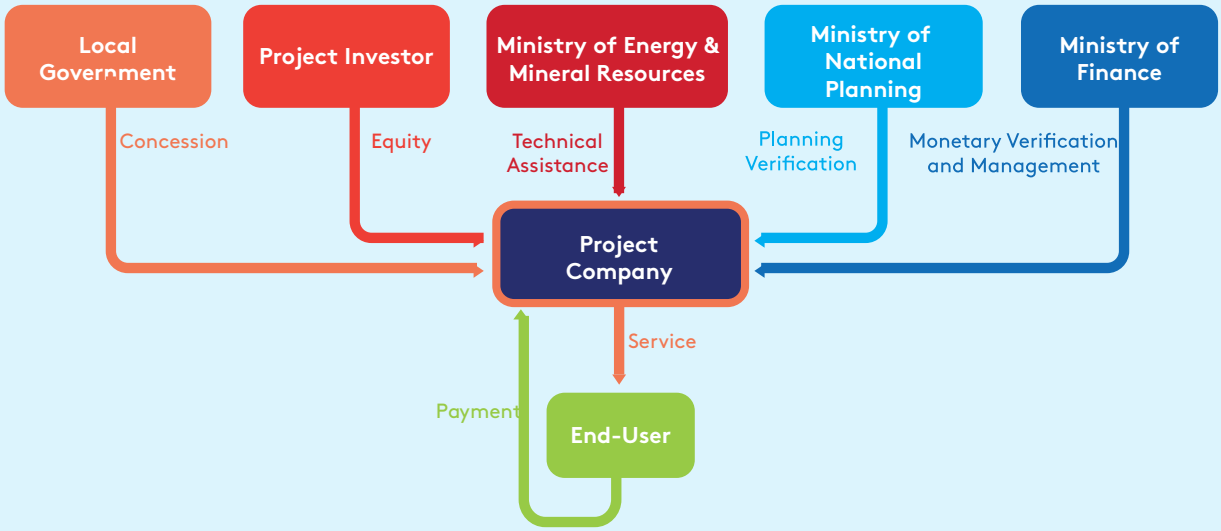


Exhibit ES-12: Public–private partnership availability payment model

Fully private company

In all the ten models, this option has the least interaction with the government and PLN. Project investors establish a project company focusing on rural electrification. This company carries out all activities related to providing the service. As a fully owned private company, the assets belong to the project company.

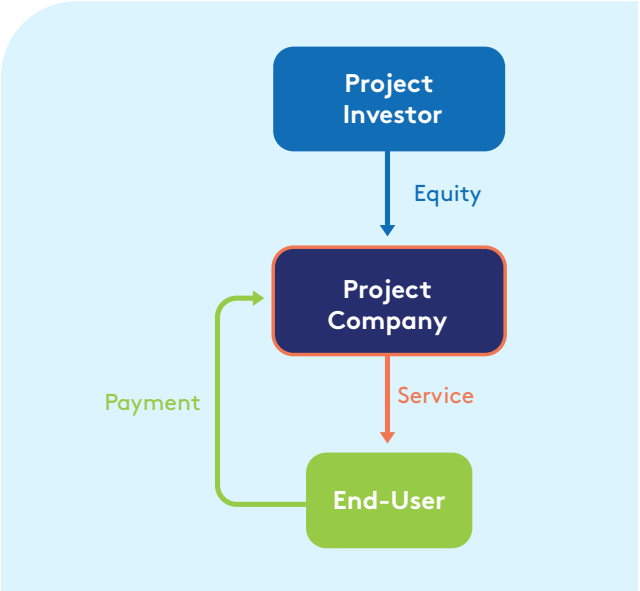


Exhibit ES-13: Fully private company model

Franchise

In implementing MEMR Regulation No 38 of 2016, applicants, whether successful or not, may encounter a number of problems, such as: uncertainty of obtaining licences; difficulty securing a district without PLN or private power utility access; uncertainty regarding the subsidies; and errors in the estimated demand. To address these issues, this study proposes a franchise system.

MEMR acts as the franchise owner and offers its business area to all existing business holders or new applicants (franchisees). The offer mimics the food franchise system but, in this context, PLN requires the franchisee to supply electricity reliably and offer a high-quality service. The franchisees follow the guidelines and requirements determined by PLN to supply electricity to the selected area.

This franchise system is much like that in article 9 of MEMR regulation No 38 of 2016 where the local government can directly appoint a local-level company to have a business area (or Wilus) licence. However, those are only for non-PLN business areas. This franchise system will not be limited to local-level companies but also be open for village level companies, private companies and other entities. This could also not be limited to PLN business areas but expanded to other communities or commercial entities.

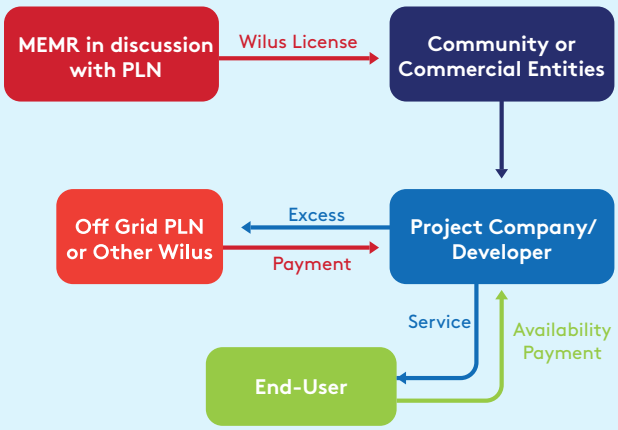


Exhibit ES-14: Franchise model

Off-Grid Business Models Evaluation and Policy Landscape: Initial Findings and Recommendations

Business model evaluation

The assessment of the different off-grid business models examines the following aspects:

- Replicability: the ability to roll-out and scale-up the model in remote regions;
- Durability: the reliability of the electricity service delivered to the customers and whether it will last over the project's lifetime;
- Effectiveness and timeliness: these critical factors are paired as implementing business models effectively means using the existing frameworks with no radical changes required and thus being able to put the system in place promptly.

To evaluate these three aspects, this study proposes the following criteria:

Criteria 1: Institutional setting

The institutional setting is measured by two sub-criteria: a) the level of effort required to secure the business area licence; b) institutional capability – the party's capacity and the institutional process or participation levels.

Criteria 2: Subsidy presence

Electricity as a basic need requires government subsidies that are applied through various forms and mechanisms and can be delivered indirectly or directly to the end-users. Subsidies can have clear Gender and Inclusion (G&I) benefits when low-wealth and female-headed households can access electricity subsidies or benefit from lower electricity tariffs.

> Each business model was evaluated based on the inherent risk that was brought to the project under each criterion and sub-criteria. Each were scored from 1 point (high risk) to 3 points (low risk). All were equally weighted and the final score was summed up to compare the different models.

Criteria 3: Sustainability

Sustainability is measured under four sub-criteria:
a) technical – the ability to deliver a reliable electricity service; b) financial – the off-grid power supplier needs a healthy cash flow situation; c) economic – the potential for a positive (and inclusive) economic impact on the community and the customers' willingness to pay the bills; d) gender and social inclusion – the level of inclusive community ownership and engagement with the model or tariff.

This study assessed each business model through a risk analysis approach following three steps: identification; assessment and verification; and risk appetite or tolerance.

In the first step, we identified the facts and recorded experiences from relevant stakeholders. For instance, we found that only a few village-owned project companies have adequate technical capacity in the electricity business. The team collected data from both past and ongoing off-grid programmes, publications, webinars and interviews.

The next step was to verify the data and assess what level of risk was possible within the parameters. This was carried out through an internal review within the MENTARI team and in consultation with local experts. The discussion included research experts from Climate Policy Initiatives and the Institute for Essential Services Reform.

Payment to & operated and/or owned by	Business models	Institutional		Subsidy	Sustainability				Gross Total
		Wilus Permit	Intitutional Capability		TechnicalF	inancial	Economic	Social	
PLN	Micro-IPP	3	3	3	3	3	3	3	21
	Rental	3	3	3	3	2	2	3	19
	KSO	3	2	3	3	3	3	3	20
BLU	Design-built-operate-Contract	2	1	3	3	3	3	2	17
Community-Based	Cooperatives/ NGO	2	3	2	3	2	3	3	18
Commercial	BUMDes	2	2	2	1	1	3	3	14
	BUMD	2	3	2	2	2	2	3	16
	BUMD-Partnership	2	3	2	3	3	3	3	19
	KPBU	2	1	2	3	3	3	3	17
	Fully Private	1	3	1	3	3	3	1	15

Each model is analysed against the criteria and is defined into three levels of risk: Low risk Medium riskH igh risk

Exhibit ES-15: Criterion-based evaluation for off-grid business models

From an institutional aspect, we evaluated a low risk (level 3) when models scored well on the ease of obtaining the business area licence, the party's capacity to run the business model, the simplicity of the institutional process and high participation from relevant stakeholders. Divergence from these scenarios are regarded as medium risk (level 2) or high risk (level 1).

On the issue of subsidy, a high certainty of obtaining a subsidy is considered as three points while less uncertainty would result in higher risk and fewer points. The total absence of subsidies for the licence holder is assigned as high risk (level 1).

Finally, from a sustainability perspective, we considered high technical capability within the organization with healthy cashflows, relevant local and inclusive and social and economic impacts and close engagement with the local community as a low-risk profile.

Exhibit ES-15 summarises the evaluation of the ten business models based on the pre-defined criteria described here.

The third step of assessing the risk appetite or tolerance is yet to be carried out and is not part of this study. This will be included in the next update of the business models study where we discuss the models more comprehensively and from a holistic perspective.

Based on our evaluations, the small independent power producer (micro-IPP) model (score: 21), the joint operational cooperation (KSO) model (score: 20) and the local government-owned enterprise partnership (BUMD-partnership) model (score: 19) emerged as some of the preferred models.

Small independent power producer (micro-IPP): This model does not require a business area licence since PLN still holds the electricity concession and plays a central role in providing rural electrification. Private involvement is based on the power purchase agreement and can be categorised as the lowest risk possible. PLN also has experience with independent power producers in larger scale, grid-connected schemes, making the institutional arrangements easier to adapt. Guaranteed government support using the power purchase agreement framework allows for a low level of risk regarding access to subsidies.

All four aspects of the sustainability criteria have the lowest risk in this model. PLN will ensure a steady power supply to end-users making the producer compliant with all quality standards. The project developer is also interested in keeping the local communities' business and productive uses high and growing to increase uptake and future demand. PLN's involvement with local communities and better social acceptance is also perceived as low risk.

From a G&I perspective, the low risk assigned to access to subsidies benefits low-wealth and female-headed households to an extent (although electricity subsidies do not recognise these two groups as requiring subsidies specifically). Potential improvements to ensure project developers specifically integrate G&I are adjusting PLN's bidding documents and PPAs to integrate G&I requirements. This can include requiring IPPs to include G&I considerations during project design (e.g. inclusive meaningful participation of women and marginalised group in project consultation and FS, developing G&I action plans), project implementation (e.g. hiring female employees), and monitoring and evaluation (e.g. collecting gender- and wealth-disaggregated data) (EIGE, n.d.).

Joint operational cooperation (KSO): PLN still owns its business area licence in this model, however, it has more responsibilities than in the independent power producer model as it also operates and maintains the project. A joint operational cooperation with an established and experienced private company thus poses a low risk. We assigned a medium risk to the institutional capability sub-criteria since adapting this model to private investors might be difficult in the short term. The sustainability aspects are at low risk levels as well. As long as government or PLN support is assured, the social risk will also be at a low level.

The G&I impact will be similar to described under the micro-IPP section.

Local government-owned enterprise (BUMD) partnership: Although provincial and regional governments are involved in defining the business area and granting the licence, we assigned this model as medium risk in the regulatory framework since the main mandate to achieve universal access is still with PLN. We also assigned a medium risk to the subsidy as it may take time to agree on the electricity tariff among local interests and parties.

From a G&I perspective, the medium risk assigned to subsidy means G&I risks might be higher than for micro-IPP and KSO as BUMD models tend to have higher electricity tariffs, reducing the inclusivity of the energy service for low-wealth households. The higher tariffs result from the fact that the BUMDes model is regulated by the local government, and not based on standard subsidised electricity tariffs from government to PLN, Yet, on the social criteria there is clear G&I potential where 1) the process of establishing the supervisory board and legal entity for the BUMD ensures women participation and representation in meaningful manners, and 2) when electricity beneficiaries mapping and tariff setting identifies the most vulnerable households and ensures they can afford the electricity services. However, previous programmes have shown that these G&I benefits do not materialise automatically, primarily due to cultural and social gender stereotyping, and hence require specific external involvement and capacity-building.

We evaluate all business models in the full report although due to the lack of legal support and a regulatory framework, we do not assess the franchise system.

Recommendations

This study concludes with general recommendations that apply to the off-grid landscape, as follows:

Clarity in business area criteria and processing steps

We recommend a transparent internal process from MEMR that includes close coordination with PLN. If applicants are rejected, they have the right to know why PLN is being asked to take over the areas and whether or when PLN will manage to cover the areas they applied for.

In addition, MEMR can create a business area map for both PLN and non-PLN areas. The government can then provide regulatory frameworks to promote non-PLN areas to private companies. In some situations, bureaucracy can delay the process and create unnecessary setbacks in project development. The process needs to be simplified if possible and follow the procedures exactly as they are laid down in the rules.

Identifying selected business areas for off-grid acceleration and problem solving

The study recommends revisiting the current minimum size of a district for an off-grid power business area. In the context of rural electrification, a district is a relatively large area. This study proposes to allow private companies to supply electricity to multiple villages via packages specific to the unelectrified villages (or village) (depending on the financial viability).

Competitive selection and application of the geospatial least-cost plan

Competitive selection guidelines are needed to avoid unclear processes, increase private participation, and ensure the best value for money. This will also support compliance to minimum standards and quality in providing electricity services under existing regulations. The competitive selection guidelines could include G&I requirements and integration in bidding documents, PPAs and project planning, development, and M&E requirements.

Requirements can include encouragement of women-owned businesses, women's labour participation, gender-sensitive labour standards, health and safety guidelines, and gender and social safeguarding standards (EIGE,n.d.; IFC, 2019).

By implementing a national geospatial least-cost plan, applying a new electrification approach will allow MEMR to identify the most appropriate technologies based on the geospatial analysis and least-cost options study.

Clarity on roles and responsibilities of local governments

In every unelectrified area in Indonesia, local governments – as mandated by some regulations – are responsible for proactively proposing rural electrification projects in their regions. However, each party's roles and responsibilities need to be clarified through subsidiary regulations and guidelines that explain their involvement in more detail.

Advanced level of performance indicators

Achieving 100 per cent electrification could also promote the sustainability and inclusivity of these projects. The study hopes the selected business models can be adopted in practice and the process can be streamlined by adjusting the ministerial key performance indicators to consider the impacts of inclusive productive economic uses and sustainability. The latter should also include specific G&I performance indicators such as affordability of electricity services to low-wealth households and productive economic opportunities created for women and low-wealth households (ESMAP, 2019).

Reliable legal and institutional framework

Stable and reliable legislation is crucial to attract long-term commercial investment and soft loans for private companies or public power utilities that want to develop these projects. Credit enhancements are a key instrument in reducing the perceived risk for lending institutions and encouraging their involvement in financing off-grid rural electrification projects.

Subsidy budget allocation

Allocations need to be earmarked in advance and we suggest various financing sources, for example, state budgets (APBN), local government budgets (APBD), private funds, green bonds or others. Subsidy portions should also be integrated to allow off-grid sustainability and economically viable sources from different government budgets. For example, the state budget or the specific allocated budget (administered by the Ministry of Finance) can fund the transmission network, while the local government budget (ABPD), administered by the Ministry of Home Affairs, can fund the distribution line to community houses, while village funds, governed by the Ministry of Villages, can fund the operations and maintenance costs.

Subsidies for connection costs and electricity tariffs can have clear G&I benefits, where it can improve affordability of low-wealth households. However, we suggest that subsidy delivery should undergo a thorough gender and inclusion assessment to identify the challenges for the most vulnerable groups (female-headed and low-wealth households) to access the subsidies, how local institutions can assist these groups, and potential other support from local government.

Involving micro-finance institutions and cooperatives

Institutions like local banks and especially microfinance institutions can offer preferential micro-credits for rural villagers to pay for electricity services (for example, if they need down payments for a solar home system) and to initiate or expand their productive activities. Coordinating with the Ministry of Cooperatives will play a large role in stimulating savings and loans for productive or income-generating activities. A G&I opportunity under this recommendation is to providing loans or credit for productive and income-generating activities for women-owned businesses and cooperatives.

Involving institutions

MEMR needs a representative institution to assess project risks. This institution can be a cross-ministerial task force, public services agency, special authorities or any organization with specific functions to manage, assess and distribute subsidies.

Choosing the right type of subsidy

Lower-income inhabitants and higher development efforts create a pressing need for subsidies to implement off-grid projects. However, the subsidy should be carefully selected so it does not overburden the state budget. The right subsidy needs to be selected for a specific area or for a particular business model. For instance, offering investment-based and connection-based subsidies would be relatively predictable and bound to physical implementation. Moreover, MEMR can set up a geographical-based factor system to measure how many subsidies are to be given in a particular area.

For example, a subsidy factor for a rural area in Java is set as reference 1.0 but Papua can be set at 5.0 or higher. The process of choosing the right type of subsidy should include a G&I assessment as described under recommendation 7, to ensure low-wealth and women-headed households can access the subsidies.

Structuring the relevant mechanism for subsidies

MEMR regulation No 38 of 2016 does not include detailed information on how its subsidy mechanism is to be distributed and sourced. This study proposes concepts taken from best practices from other ministries:

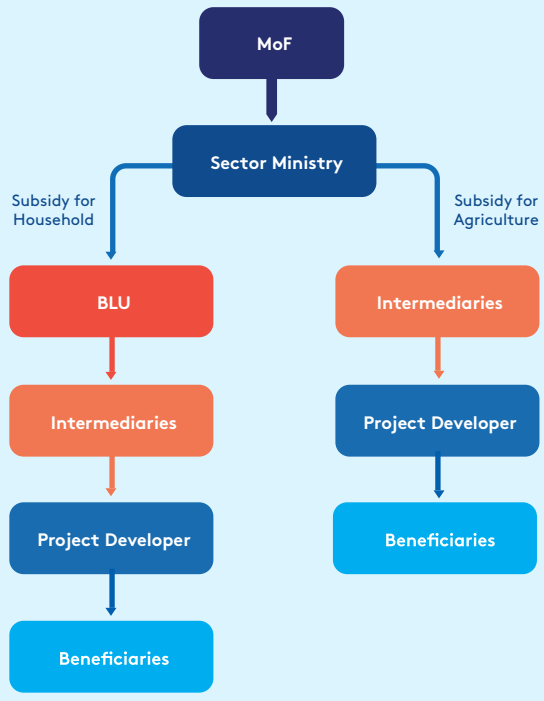


Exhibit ES-16: Institutional arrangements for a subsidy mechanism in off-grid project

Notes: MoF = Ministry of Finance; BLU = public services agency

- Ministry of Public Works and Public Housing: The housing mortgage subsidy programme, Kredit Pemilikan Rumah Sejahtera, works through a liquidity facility for housing financing scheme via a public services agency, the centre for housing financing called as the housing financing fund management centre.
- Ministry of Agriculture: The agricultural subsidy programme under the centre for housing financing offers a lowered interest rate for farmers that is disbursed by national banks as intermediaries.
- Ministry of Transportation: The subsidy for public transport is shared by the national and local government budgets.

The subsidy scheme for off-grid electricity projects can adopt one of the subsidy approaches in agriculture (Ministry of Agriculture) or housing (Ministry of Public Housing) (see Exhibit ES-16).

1. INTRODUCTION

Indonesia has achieved an electrification rate of 98.3 per cent despite being an archipelago of 17,000 islands, spanning over 5,000 kms (DGE, 2018). In the past ten years alone, the national power utility, PLN (Perusahaan Listrik Negara), has managed to connect approximately 30 million new households, representing 110 million people. Over the three-year period from 2016 to 2018, PLN connected an average of 3.2 million new household consumers per year.

The Government of Indonesia recognises that access to electricity is essential for national development and hence has set a target of universal access. Given the multiple benefits for inclusive economic development, community development (such as taking away women's household tasks and improving health and education quality) and household welfare, the country was aiming for near-universal access by 2020. The National Energy Policy adopted in 2014 states that Indonesia should approach 100 per cent electrification by 2020. This ambitious target is also stated in the latest 2020–2024 National Medium-Term Development Plan.

However, roughly 1.2 million Indonesian households (many of which in remote areas with high incidences of poverty) remained without access to electricity by the end of 2018 and nearly 700,000 of these were in eastern Indonesia (MENTARI, 2020).[7] As experience in other countries that have achieved near-universal access demonstrates, the last few per cent of households are the most difficult and costly to supply. The last unelectrified areas often require more time and effort to access. As these more remote communities are expensive to serve through conventional grid extensions, off-grid solutions become increasingly important for cost-effective electrification strategies.

In this study we define off-grid solutions as those that use a distributed approach to ensure electricity supply to the demand area without needing to connect to the PLN grid (20 kV or above)[8] or any similar grid for the next five years[9] since the PLN considers them economically viable (from the central or local perspective). Off-grid solutions can be delivered as individual generators (such as solar rooftops, battery swaps or solar lighting) or as a mini-grid system with a maximum distributing voltage of 380V (for social and residential consumption). All transmission and distribution systems are currently owned and managed by PLN, but we suggest another off-grid solution would be mini-grids with no intervention from PLN that are requested by an independent power provider or other type of entity through power wheeling contracts.

The objectives of this study are to review and analyse the existing off-grid regulatory framework, present new approaches to rural electrification development and lay out suitable

7 Households living in West Nusa Tenggara, East Nusa Tenggara, Maluku, North Maluku, Papua and West Papua (non-PLN off-grid areas in eastern Indonesia)

8 This definition is taken from the following studies: Castlerock (2019:10); Social Impact Inc (2019: 17); Castlerock and ADB (2016)

9 MCAI approach: off-grid is also defined as no PLN integration in the next five years.

off-grid business model options that are feasible within the existing regulatory landscape. The study starts by outlining current regulations, identifying the gaps in the uptake of off-grid projects and describing past programmes implemented in Indonesia. We examine existing and proposed business model options, including their individual characteristics, requirements and performance levels and evaluate them to determine which models need deeper analysis in future updates of this assessment.

Additionally, the study recommends policies to bridge the existing gaps in to promote gender and inclusion in existing regulations and procedures and provides suggestions to improve gender and inclusion impacts in the off-grid business models' implementation. This study is considered the first step towards a more comprehensive analysis of off-grid business models that we will undertake in the upcoming years. As part of future revisions and updates, we will continue to research and examine the proposed business models and different implementation methodologies. This includes, for example, lessons learned from MENTARI's demonstration projects currently under preparation.

2. OFF-GRID REGULATORY FRAMEWORK IN INDONESIA

2.1 REVIEW OF EXISTING OFF-GRID REGULATIONS

The government has enacted a range of laws and regulations to help achieve universal access to electricity and, working together with PLN, it has made good progress towards its goal of universal access. Rural electrification is governed by several laws and regulations and we describe aspects of these laws and regulations relevant to the off-grid power supply in this section.

- Law No 30 of 2007 on Energy: Article 33 of the Indonesian constitution states that energy resources shall be controlled by the state and used for the greatest benefit of the people. The law lays out how government is to implement this obligation, stipulating that one objective of energy management is to improve energy access for the poor and for people living in remote areas. The government shall assist by increasing the availability of energy for the poor and developing the supply infrastructure in remote areas. Energy shall be priced at its fair economic value, but the government will subsidise the supply to the poor. Moreover, the law states that everyone has the right to access energy, as indicated in article 19.

- Law No 30 of 2009 on Electricity: This law defines: the guiding principles in developing the power sector; the various activities that constitute electricity supply; the authorities for licensing, tariff setting and otherwise regulating each of these supply activities; and responsibilities for sector planning. The central and the regional governments are responsible for controlling electricity supply activities and shall appoint state-owned enterprises to implement electrification projects on their behalf. The private sector and other forms of public entities (for example, cooperatives) may also participate in the sector to help fulfil power supply needs.

  Article 4 is particularly relevant as it states that the central and local governments shall provide funds to: supply electricity for indigent communities; construct electricity supply infrastructure in less-developed regions; develop electric power in remote or frontier areas; and ensure rural electrification.

  Government defines the geographical business areas for distribution, retailing or vertically integrated supply that may be undertaken by only one entity in each area. but these areas do not necessarily align with governments' administrative units. State-owned entities have first priority to supply an area. but government shall extend the opportunity to other entities as well. If there is no entity to undertake supply in a given area, government must appoint a state-owned enterprise to do so. The law prioritises the use of new and renewable primary energy sources for electricity generation, and also addresses land access and cross-border electricity trading.

- Government regulation No 14 of 2012 on Electricity Supply Business Licence (IUPTL): This is the principal implementing regulation for Law No 30 of 2009 on Electricity concerning both public supply as well as own (captive) supply. The regulation provides for open access, stipulates the procedures and authorities for defining service territories, licensing, tariff setting, land use, technical regulation and supervision, and also specifies sanctions.

Of particular relevance for electrification, the authority for licensing and pricing the supply to unserved areas rests with either the central government through the Ministry of Energy and Mineral Resources (MEMR), the provincial government or the district or municipal government. This depends on a number of issues: the administrative units within the supplier's service territory; whether the entity is a state-owned company; if the entity will sell bulk power or rent network capacity to another entity; and the level of government that licensed the buying entity. However, these authorities have been reconfigured under Government regulation No 23 of 2014 that includes a revision to detail the process of applying for the electricity supply provision business licence (IUPTL).

- Ministry of Energy and Mineral Resources (MEMR) regulation No 28 of 2012 on Procedure to Request Electricity Business Area and MEMR regulation No 7 of 2016 on its Revision: This regulation defines a business area for electricity as an area without any supply from an existing electricity business supplier or one that was reverted to the minister due to the supplier being unable to provide a reliable infrastructure for electricity services. The ministry stipulates that private companies are permitted to sell electricity to the public or directly to consumers, subject to obtaining an electricity business area (known as a Wilus).

  This regulation defines the application and approval procedures for an electricity business area, as referenced in article 20 of Government regulation No 14 of 2012. Only one entity may serve a given business area. The entity may be an enterprise owned by the national or local government, a private company established in Indonesia, a cooperative or a community initiative through a non-governmental organization (NGO). The Directorate General of Electricity is authorised to define these business areas on behalf of the minister. Detailed requirements and process flows to apply for a business area are also extended in this regulation – and amended later by MEMR regulation No 7 of 2016.

- Law No 23 of 2014 on Regional Government: This replaced Law No 32 of 2004 and it regulates the regional government roles in all sector activities. In electricity, regional governments follow the principles of autonomy and co-administration in accordance with the general system in Indonesia on energy. The law only refers to oil and gas (national authority), and geothermal power (local authority) but does not mention any other renewable sources explicitly.

- MEMR regulation No 38 of 2016 on Rural Electrification Acceleration: This regulation offers new business opportunities for non-PLN entities to participate in rural electrification and allows local governments to authorise them. Under the regulation framework, locally owned enterprises, private companies and cooperatives can manage an electricity business area using subsidy or non-subsidy schemes. Non-PLN entities can thus be actively involved in achieving the universal access target. This framework plays a major role in off-grid electrification and we analyse it more deeply in section 2.3.

- MEMR regulation No 47 of 2018 on Procedure for Setting Electricity Tariffs: Any electricity supply provision business licence holder with a business area to distribute or sell electricity or an integrated electricity supply business shall apply an electricity tariff in selling power to consumers. The MEMR minister sets electricity rates with the support of parliament or the governor after approval from the provincial legislature. The electricity rates set may be adjusted periodically based on the basic costs of providing electric power plus a reasonable business profit margin.

- MEMR Minister's regulation No 143K/20/MEM of 2019 on the National Electricity Plan for Years 2019 to 2038: This regulation in section III.G details rural electrification for the remaining 1.7 per cent of households and prioritise the use of off-grid systems. Developing electricity supplies in the rural areas that do not yet have access aims to encourage development, stimulate economic growth and improve the welfare, particularly of poor people in these areas. This is an ongoing process that needs to be prioritised and combined with relevant capacity-building efforts.

- Presidential regulation No 4 of 2016 on Electricity Infrastructure Acceleration: This stipulates that regional governments may provide incentives and subsidies, issue the required licences and determine the purchase price of the renewable-based electricity to be used in their administrative areas to make the process easier.

- Ministry of Villages regulation No 11 of 2019 on Village Fund Priority: This outlines the priorities for the use of village funds in the 2020 fiscal year. As mandated in Law No 6 of 2014 on Villages, the village funds represent the state budget to cover villages' administration costs and to develop and empower village communities. Article 8 clause (1)a.3 states that the village funds can be used for renewable energy infrastructure. The budget may guarantee investments and cover infrastructure, operations and maintenance costs as well as capital participation in joint venture energy companies and other subsidy components. This was amended by the Ministry of Health regulation No 13 of 2020 that gives three priority areas for village funds: national economic recovery (due to the Covid-19 pandemic); authorised village programmes; and the 'new normal' adaptation awareness programme. Renewable energy for rural electricity is included as part of the national economic recovery programme.

- **Regulations related to Gender and Inclusion**: The Government of Indonesia has clear commitment for gender equality and social inclusion as mentioned in that: (i) Gender equality in the National Medium-Term Development Plan, 2020–2024 (RPJMN) is one of the six aspects that should be mainstreamed into Indonesia's overall development strategy including the energy sector; (ii) The Presidential Instruction (INPRES) Number 9 Year 2000 on Gender Mainstreaming in National Development; (iii) Ministry of Home Affairs Regulation No. 67/2011 on Guideline for Implementation of Gender Mainstreaming at Sub-National Level. Ministry of Women's Empowerment and Child Protection Regulation No. 5/2014 on Guideline for Implementation of Gender and Child Data System; (iv) Article 53 of Law No. 8/2016 concerning People with Disabilities states that the government and state-owned enterprises (BUMN), and private sectors must employ at least 2% and 1% respectively of persons with disabilities of the total number of employees or workers.

  Law No 30 of 2007 on Energy states that energy in Indonesia shall be managed under the principles of beneficial use, rationality, fairness, efficiency, value-added enhancement, sustainability, people's welfare, preserving the environment, national resilience and integration by prioritising the nation's capability. Article 19 also states that everyone has the right to access energy. This policy also acknowledges that the community, both individually and collectively, can participate in developing the master plans on national and regional energy, and developing energy for public interests. This policy confirms the importance of gender equality and social inclusion in implementing energy-related activities.

- There are also various laws and regulations that have supported women's participation and leaderships at village level including the budget provision. The Village Law ensures women's representative in Village Consultative Body (BPD), and Government Regulation No.43/2014 to implement village law obliges that village development should prioritize women's interest. Women and women's groups representative shall be ensured in village development processes. This regulation mentions the village planning and budgeting preparation shall favour, among others, the interests of the poor, people with disabilities, women, children and marginalized groups.

- Besides, the Minister of Home Affairs Regulation Number 114 of 2014 concerning Guidelines for Village Development regulates that women are prioritized to participate in the preparation of the Village RPJM (*Rencana Pembangunan Jangka Menengah* or Mid-term development plan) and Village RKP (*Rencana Kerja Pemerintah*/Government Work Plan) as the Village RPJM (*Rencana Pembangunan Jangka Menengah*/Medium Term Development Plan) Preparation Team and the Village RKP Drafting Team. Similarly, Minister of Villages, Development of Disadvantaged Areas and Transmigration Regulation No.16 of 2018 concerning Priority for the Use of Village Funds in 2019 prioritized Village community empowerment activities include, among others, support for the management of basic social service activities in the fields of education, health, empowerment of the poor, empowerment of women and children, and empowerment of marginalized communities and members of rural communities with disabilities. Finally, the Ministry of Women's Empowerment and Child Protection regulation No 4 of 2014 discusses the Guidelines for Monitoring Gender Responsive Planning and Budgeting at the Regional Level.

2.2 ANALYSING THE GAPS IN THE MINISTRY OF ENERGY AND MINERAL RESOURCES REGULATION NO 38 OF 2016

As part of the off-grid regulatory framework, the Indonesian government has enacted several regulations including Law No 30 of 2009 on Electricity, Law No 23 of 2014 on Regional Government (as amended by Law No 9 of 2015), Government regulation No 14 of 2012 on Electricity Supply Business Activities (as amended by Government Regulation No 23 of 2014), the MEMR regulation No 28 of 2012 on the Procedure for Request of a Business Area for Public Electricity Supply (as amended by MEMR regulation No 7 of 2016) and MEMR regulation No 38 of 2016. Among these regulations, MEMR regulations No 28 of 2012, No 7 of 2016 and No 38 of 2016 provide a framework for off-grid electrification by non-PLN entities. MEMR regulation No 28 of 2012 establishes a process for business enterprises, including private companies, that supply electricity in a vertically integrated manner to areas defined in consultation with PLN. MEMR regulation No 38 of 2016 elaborates on the business framework and tariff determination to accommodate a wide range of off-grid developments but there is still room for improvement according to our gap analysis.

Prior to the licencing process for an electricity business area, a business entity must also obtain an electricity supply business licence (IUPTL) set out under Government regulation No 23 of 2014 (an amendment of regulation No 14 of 2012). If the application for an electricity supply business licence or its renewal is unsuccessful, then any application for a business area will also be discontinued. In one business area, only one small-scale power supplier is allowed to provide the electricity service. In legal terms, the small-scale power supplier

can be an enterprise owned by regional government, a private company or a cooperative. Regardless of the form of the entity, by following MEMR regulations No 35 of 2013 and No 23 of 2014, it is officially and legally established[10] in Indonesia and has a right to do business in the electricity sector.

In regulation No 28 of 2012, a business entity can apply to MEMR through the Directorate General of Electricity for an electricity business area by submitting detailed administrative and technical proposals. This is an area of distribution and/or sales for rural electrification designated by the Minister of MEMR in close consultation with PLN. The current Indonesian law awards all business areas to the PLN. The Directorate General of Electricity will review the applications and approve or reject them within 30 working days of receiving the application. If the proposal is rejected, the Directorate General is obliged to provide a written confirmation detailing the background to the rejection.

A non-PLN entity that holds an electricity supply business licence and a business area has full legal rights to provide an off-grid power supply in its business area. In MEMR regulation No 38 of 2016, off-grid business projects by non-PLN entities may be done with or without subsidies from the state budget.

Without subsidies, the process defaults to Government regulation No 14 of 2012 in which non-subsidy tariffs are defined by the MEMR or the provincial governments. If local governments cannot decide the tariffs, they follow the PLN tariffs. The procedural framework to obtain a subsidy or do without a subsidy in a business area is shown in Exhibit 2-1.

If state subsidies are used, then the processes laid out in the MEMR regulation No 38 of 2016 apply. The subsidy is calculated based on actual power sales using a cost-plus-margin approach, similar to the PLN subsidy under Ministry of Finance Regulation No 170 of 2013. The process of implementing MEMR regulation No 38 of 2016 with subsidy is shown in Exhibit 2-2.

10 Any individual or institution that runs a power supply business for the public is duly obligated to possess a legal document (an electricity supply business licence IUPTL) – referring to Law No 30 of 2009. The technical procedures are outlined under MEMR regulation No 35 of 2013.

Exhibit 2-1: A framework for an off-grid business without a subsidy grid project

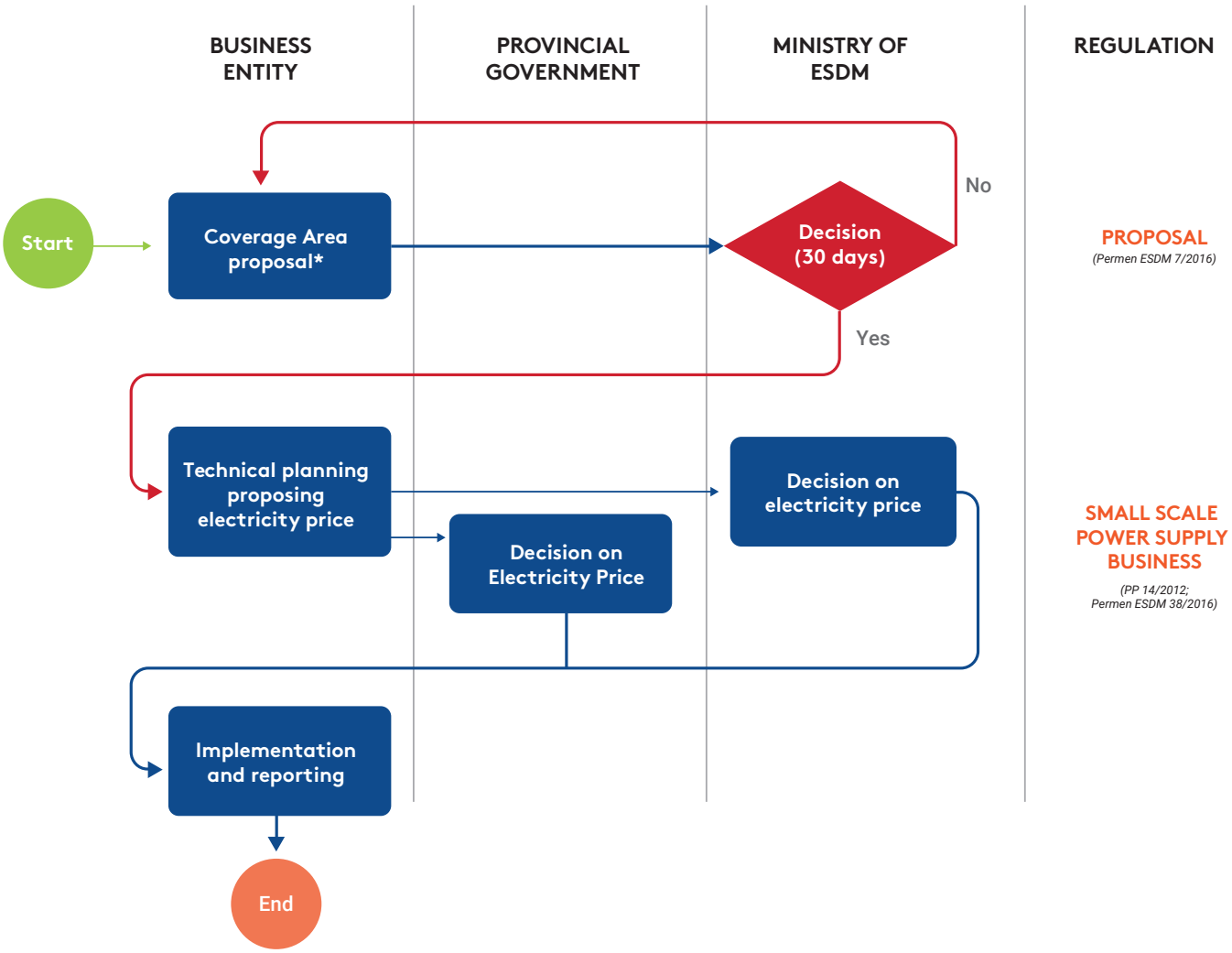
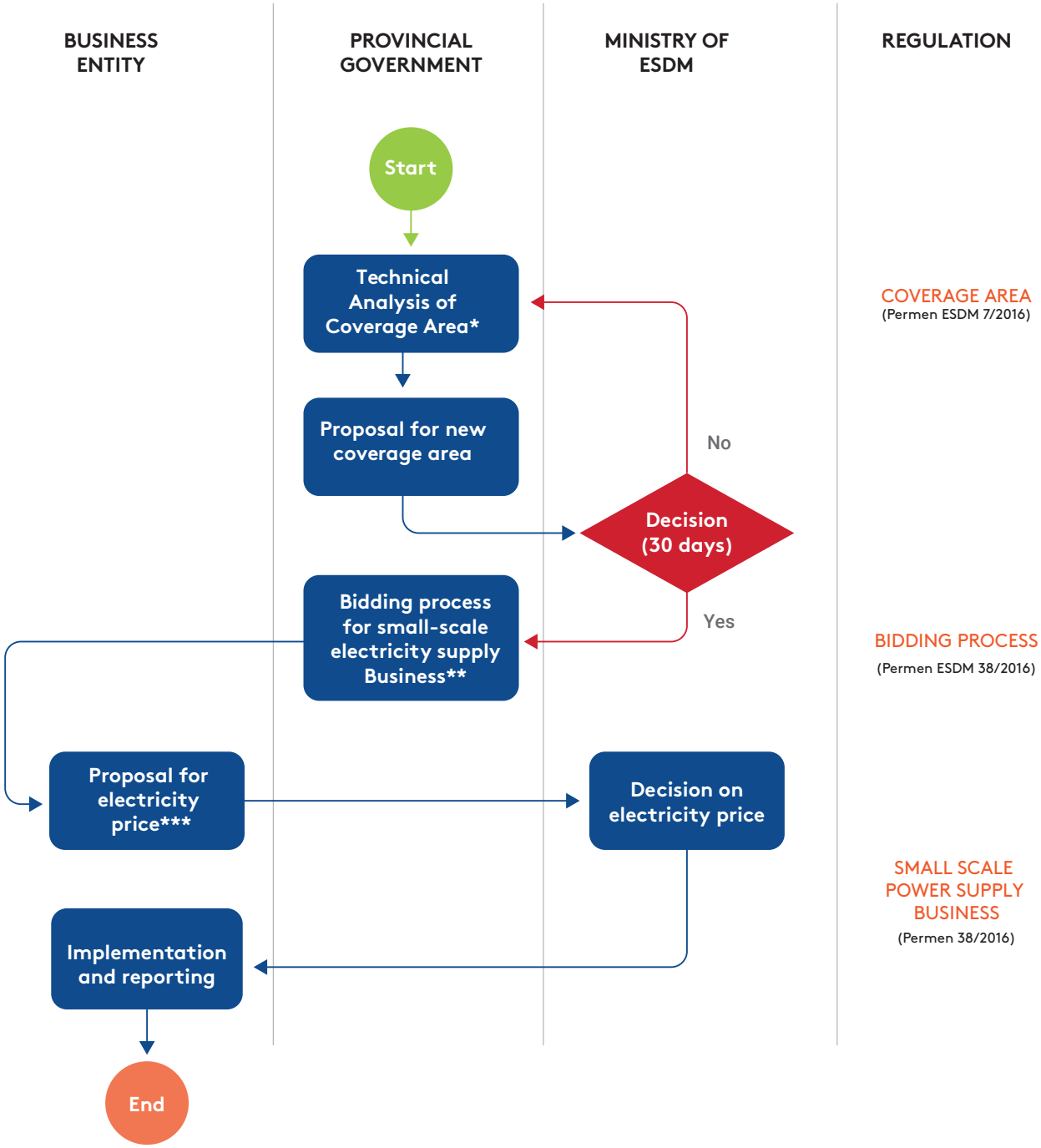


Exhibit 2-2: A framework for an off-grid business with a subsidy



Lessons learned from successful business area applicants

In practice, an electricity provider requests a business area grant in parallel with the electricity supply business licence process. Without this licence, a business area cannot be granted to an applicant. In the no subsidy framework, a business area applicant must comply with the procedures in MEMR regulation No 28 of 2012. In article 5 this stipulates that applicants will be informed on the approval or rejection of their application within a maximum of 30 working days. However, this regulation proved too ambitious as grantees confirmed that the business area application process takes nine months or more. Among the grantees we interviewed, none had succeeded within the subsidy framework and the eligibility criteria for this subsidy framework is unclear. Currently, the MEMR regulation No 38 of 2016 with a subsidy framework has not yet been implemented.

A prolonged bureaucratic process through the local house of representatives presents another issue for successful business area applicants. It takes one to two years for the process of approval on tariffs for the selected area and to issue the electricity supply business licence or complete other administrative requirements with the local representatives.

The last crucial issue is PLN's intervention in MEMR decision making. While coordination between PLN and MEMR is commendable, the ministry's right to veto decisions to approve or reject applications for business areas from other entities should not be overturned by PLN's unprecedented decision to take over the areas concerned. In the field, a successful grantee may be subject to an unplanned decision by PLN. Meanwhile, PLN can also develop the 20kV line near the areas concerned due to their high-level decision-making power. Thus, the lack of coordination between central and local PLN offices does not only affect unsuccessful applicants but also the successful ones. In one case, the local PLN office confirmed that in an area that had had no grid for 20 years, due to a presidential visit, the local office was suddenly tasked with developing the 20kV connection in the predetermined area. Most MEMR decisions are also highly dependent on what the central PLN office decides. Thus, decision making is problematic in the MEMR process and local people have to wait for access to electricity in their areas.

Business area issues

In MEMR regulation No 38 of 2016, a business area is an area of distribution or sales for rural electrification and is issued by the MEMR in close consultation with PLN. This regulation enables non-PLN off-grid power suppliers to be involved in rural electrification development. A small-scale power supplier is a commercial entity with less than 50 MW of total system capacity that supplies electricity for public use in rural areas not served by the electricity grid or otherwise in remote or border areas or on sparsely populated islands. This off-grid power supplier can have a business area licence for one district at minimum and the area can only be managed by one business licence holder, creating the following issues:

1. The minimum coverage size is too large in many parts of eastern Indonesia where remote households have no electricity access at all. The population density is low and scattered throughout a vast area or, in some cases, across many small islands. This creates a difficult task for one entity to accomplish.

2. Even though the economic scale of a business area at the district level may be enough for a business entity to consider, it is not easy to find a district without any electricity coverage from the PLN/MEMR programme. For example, in a district one village might already have access to electricity from a previous electrification programme and this automatically blocks the potential market for private companies since a second electricity supplier is not permitted in one business area. In other words, the approval of the business area is uncertain. Even where private companies have close relations with the local PLN administration, the decision rests with the MEMR and the central PLN office.

3. In a case where a private entity X is willing to cover only one or two villages in one district, the remaining villages (without electricity) cannot be covered by other entities since the area has already been assigned. The villages are locked in by entity X until it can provide access. Therefore, government's target of 100 per cent electrification for all villages will be difficult to achieve unless it can compel the business entities to extend their supply. In conclusion, the business areas granted are too large for a single entity and more businesses need to be able to participate for the rural electrification programme to succeed.

2.3 SUBSIDY GAP AND MECHANISM FOR OFF-GRID INSTALLATION

Subsidy gap in MEMR regulation No 38 of 2016

A subsidy mechanism is critical in developing off-grid installations. In on-grid systems, customers enjoy hidden subsidies from the coal, gas and oil prices that are calculated in the electricity tariff formula. Moreover, some low-income customers are offered direct subsidised tariffs. If on-grid customers with predominantly middle- and high-income levels can access subsidies, it is fundamental to establish a subsidy mechanism for the off-grid programme that is used predominantly by low-income inhabitants in rural areas. TNP2K stated that the poor and vulnerable who fall into the bottom 40% of the economy constitute only 26% electricity subsidy recipients. This is because the regulation on electricity subsidies does not yet recognise female-headed or poor households, and because many of these household rely on off-grid electricity (Medcom.id, 2020). For off-grid customers this is often their first experience of having electricity and if the service is not subsidised, it will be difficult to promote the off-grid programme in Indonesia. Customers do not want to purchase electricity at prices that exceed their willingness and capacity to pay. On the production side, utilities or suppliers will not be interested in building their off-grid installations if there are no subsidies to cover the high production costs, they incur to satisfy a relatively low demand.

MEMR regulation No 38 of 2016 provides the option to use the subsidy mechanism in the small-scale off-grid business model. A business entity that the Minister of Energy and Mineral Resources (via the Directorate General of Electricity) has assigned to provide small-scale electricity with a subsidy can submit a proposal on electricity production costs to the directorate general annually. The directorate general then evaluates the proposal and calculates the level of subsidy based on production costs, the business margin considering the geographical conditions and the PLN tariff for 450 VA customers. The government only provides the subsidy to households with monthly electricity consumption of no more than 84 kWh. The source of the subsidy is solely from the state budget where it can be revised on an

annual basis. Hence, it is difficult to guarantee the continuity of the subsidy given to projects under this regulation.

The regulation states that the line ministries and government agencies will issue a number of related ministerial regulations, procedures and guidelines, for example, on budgeting and paying subsidies and evaluating proposals from business enterprises. This process also requires capacity building for officials at various levels in government. However, this has not materialised to date. In the last four years, this situation has discouraged non-PLN entities from participating in the rural electrification business.

While the process is bottom–up and allows communities at village or district level to request electricity services through their legislative representatives, it is drawn out and involves lobbying which makes the outcome uncertain. Any private company involved will thus also be taking a risk with this process.

The regulation provides further details on procedures to access the subsidy but, apart from the applicant criteria, there is no clear mechanism to deliver the state budget subsidy to households and the Ministry of Finance provides no regulatory framework for subsidising households through private entities. Furthermore, the parameters and processes in evaluating applications (article 6) are not transparent. The subsidy mechanism in this regulation will only work if the Ministry of Finance, as the government budget authority, issues a regulation to support the implementation of the scheme. As it stands, the regulation does not work for ensuring a subsidy.

Various business models are possible and a number of financing arrangements, set under different frameworks, can be used to support the subsidy mechanism in these options with cross-ministerial coordination. Thus, the lack of a subsidy scheme for the off-grid programme is not just about budget limitations but also because the relevant ministries do not coordinate. The long bureaucratic process outlined under MEMR regulation No 38 of 2016 does not help and while the off-grid scheme is implemented on the ground in rural areas, the process is supposed to take place at the ministerial level.

Benchmarking the various existing subsidy mechanisms for off-grid subsidies

In the subsidy framework for an off-grid business (Exhibit 2-2), the state budget is assumed to be the source of the subsidy and so it is processed through ministerial approval. Several other subsidy schemes are provided by the state budget but delivered via local government budgets. Moreover, private companies or other entities can also access other types of subsidy types through grants or other financing systems. All of these are to provide more room for subsidies and a simpler process for proposals. The example of a public transport subsidy is a good benchmark.

A public transport subsidy is possible from both state and provincial budgets with provincial and central governments allocating and sharing the subsidies. In Ministry of Transportation Decree, No 9 of 2020 on Subsidy for Public Transportation, the subsidy is a tariff (per ticket), similar to the arrangement in MEMR decree No 38 of 2016 which is per kWh per customer. Decree No 9 of 2020 outlines a scheme where the inter-provincial transport subsidy can be allocated by the state budget, the inter-city or inter-district transport subsidy can be allocated by the provincial budget and a subsidy on all transport within a municipal boundary can be allocated by the mayor's budget. Where the mayor or governor provide no

allocation or have a limited budget, the subsidy can be sought at the ministerial level. The subsidy is likely to come from the local government budget where there is fiscal capacity. This can be further arranged under Ministry of Internal Affairs regulation No 33 of 2019 on Guidelines for Preparing and Spending the 2020 State Budget. There are dedicated subsidy payments for state-owned and private companies.

Another example of a working government subsidy program is the housing mortgage subsidy program, Kredit Pemilikan Rumah Sejahtera, under the Liquidity Facility for Housing Financing scheme. This scheme consists of a concessional loan from government to lenders who provide housing mortgages at fixed lower interest rates to middle- and low-income households. The intermediaries can be state- or privately-owned national banks or provincial banks as long as they are registered under this scheme.

The scheme, initiated by the Ministry of Public Housing[11], was established in 2010 to increase access to affordable housing through subsidised mortgage rates. The Ministry of Finance approves the financing[12] as well as the modalities and procedures.

In implementing the Liquidity Facility for Housing Financing scheme, the Ministry of Finance also established a housing financing centre (Pusat Pembiayaan Perumahan) [13] as a public services agency to manage the subsidy fund.[14]

The agency comes under the Ministry of Public Works and Public Housing and the subsidy funding is allocated through the ministerial budget disbursement checklist.[15] The public services agency is tasked with disbursing the housing subsidy fund, developing a business strategy and managing the rolling fund. The scheme is sourced from the state budget through the regular ministerial budget disbursement checklist mechanism. Each year the public services agency, via the Ministry of Public Works and Public Housing, submits a budget proposal to the Ministry of Finance.

The Ministry of Public Works and Public Housing established the eligibility criteria for participating intermediaries and the procedure to access the fund.[16] Intermediaries sign a cooperation agreement with the public services agency and submit a payment request based on the amount to be disbursed for the current year. The financing proportions for this scheme are 75 per cent by government and 25 per cent by the lender.[17] The housing financing centre examines the request and later transfers the payment. Intermediaries are charged a provision fee regulated by the Ministry of Finance.[18]

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11 The Ministry of Public Housing merged with the Ministry of Public Works in 2014 becoming the Ministry of Public Works and Public Housing.

12 Ministry of Finance regulation No 130/PMK.05 of 2010

13 The agency is now called Pusat Pengelolaan Dana Pembiayaan Perumahan – the housing finance fund management centre after two changes in name in 2015, 2019 and finally in 2019.

14 Ministry of Finance regulation No 290/KMK.05 of 2010. The decree was later updated by Ministry of Finance decree No 112/KMK.05 of 2016.

15 The first allocation was budgeted at IDR2.6 trillion for 2010 fiscal year

16 As of July 2020, the applicable regulation is the Ministry of Public Works and Public Housing regulation No 20/PRT/M/2019 regarding Housing Assistance for Low-income Households.

17 The provision is currently regulated in Ministry of Public Works and Public Housing decree No 463/KPTS/M/2018.

18 The fee was set at up to 0.5 per cent per annum in the Ministry of Finance regulation No 216/PMK/05/2011.

Intermediaries follow the implementation rules set by the Ministry of Public Works and Public Housing, for example, on the household eligibility criteria, housing type, financing requirements and financing procedures. From 2010 when the Liquidity Facility for Housing Financing was established up to July 2020[19], the subsidy expenditure was IDR 52.1 trillion and the fund reached 732,653 housing units. As of July 2020, 49 banks were participating as the intermediaries.

Another example of a government subsidy program is the Food and Energy Security Credit programme (Kredit Ketahanan Pangan dan Energi) in the agricultural sector that ran between 2007 and 2015. This programme was set up in 2007[20] and aimed to increase agricultural production and productivity levels for food and biofuel. The programme provided the subsidy in the form of lowered interest rates for farmers and cooperatives, and this was disbursed by national banks and managed by the Ministry of Agriculture following implementation rules set by both the Ministry of Finance and Ministry of Agriculture. The beneficiaries (farmers and agricultural cooperatives) can use the loans to buy seeds and farming equipment as well as to cover operational costs. The subsidy was funded through the Ministry of Agriculture's ministerial budget disbursement checklist and between 2008 and 2015 it disbursed IDR 1.374 trillion.

Learning from the transport, housing and agriculture sectors' subsidy schemes, the subsidy referred to in MEMR regulation No 36 of 2016 needs support through regulations from the the Finance, Home Affairs and the Energy and Mineral Resources ministries to provide the details for implementing the subsidy scheme, including: the source of the allocation (state budget, provincial/local budget or others); mechanisms and procedures involved (how to access the subsidy); institutional arrangements (what institutions are involved and what roles they play); and the eligibility criteria (who can access the subsidy, who are the target beneficiaries). Specifically, we suggest that subsidy delivery should undergo a thorough gender and inclusion assessment to identify the challenges for the most vulnerable groups (female-headed and low-wealth households) to access the subsidies, how local institutions can assist these groups, and potential other support from local government.

19 Data as of 17 July 2020 was taken from housing financing centre: https://ppdpp.id/realisasi-dashboard/ on 22 July 2020.

20 Ministry of Finance regulation No 79/PMK.05/2007

3. NEW RURAL ELECTRIFICATION APPROACH

3.1 NEW RURAL ELECTRIFICATION APPROACH

Cultural development, the archipelagic background and geographical conditions are the main obstacles to achieving universal access - energy access for all people regardless their gender, age, education, social and cultural backgrounds- to electricity in Indonesia. In some remote areas, inhabitants live far from each other or on isolated islands. However, each person in Indonesia has the right to access electricity, as access to energy is crucial for inclusive economic development, where it create productive uses of energy and business opportunities to lift women and men out of poverty, as well as enabling improvements to public services such as health and education and helping to freeing up women's time household tasks for productive uses (IRENA, 2019).

Grid extensions and diesel generators are the outdated approach to supplying electricity to these households and PLN allocates an annual budget from the state, provincial or regional budgets for this method through the village electrification programme. PLN offers no other least-cost options to central and local government although grid extensions without a consistent growth in demand represent less cost-effective strategies for households scattered across rural areas.

However, the government can select appropriate technologies, approaches and methodologies to service the remaining unelectrified households effectively by using a least-cost approach. This study proposes a new approach to developing rural electrification in Indonesia where grid extension is not the only option. Rural electrification should be included in the general electrification programme as part of a complete and integrated strategy. This new integrated approach responds to critical issues in rural electrification by proposing an additional step, the national geospatial least-cost plan. The main questions to be answered in a national electrification program are:

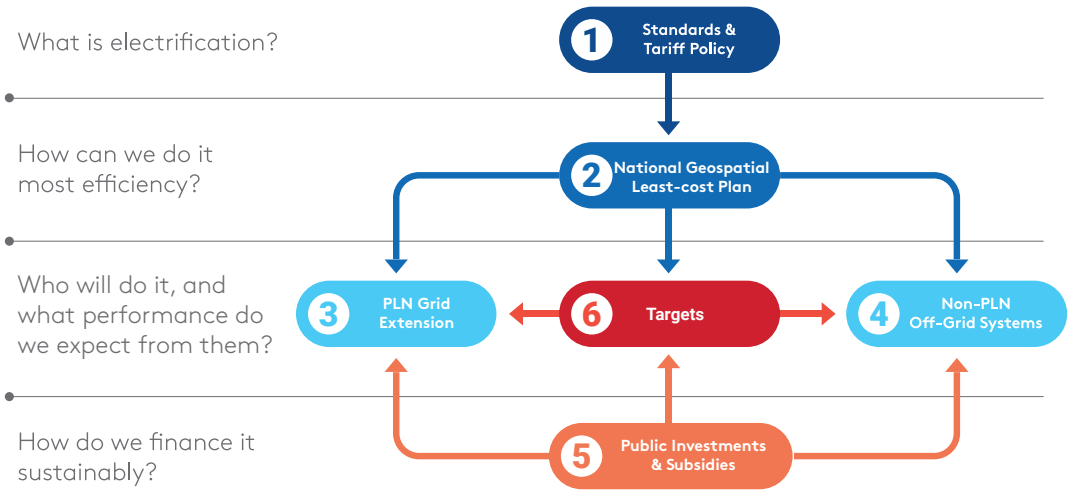
1. What is electrification?
2. How can we do it most efficiently?
3. Who will do it and what performance (including G&I mainstreaming) can we expect from them?
4. How do we finance electrification sustainably?

This new approach may be implemented based on an electrification policy encompassing the following six elements (see Exhibit 3-1).

1. Standards and tariffs – Higher levels of service typically require higher levels of investment, particularly for off-grid systems. Preparing a least-cost electrification plan therefore requires prior definition of the level of service to be provided.

   There is no explicit policy regarding the level of service to be delivered by electrification or the technical standards for off-grid supplies. In practice, publicly-funded programs have delivered services ranging from a constant supply with a modest (450 VA) alternating current power limitation, to enough power supply to run a couple of lights for a few hours per night. Also, although there is a uniform national tariff for the on-grid supply, there is no pricing policy in place for the off-grid power supplies.

Exhibit 3-1: Elements in the advanced rural electrification approach



The existing framework in MEMR regulation No 38 of 2016 does not specify the details of how to calculate the tariffs. This means that households that are least able to pay for electricity could be charged the highest tariffs (with negative impacts on the gender empowerment and social inclusion aims of these projects). Government needs explicit policies regarding service and technical standards and tariffs for off-grid as well as grid-connected supplies to establish systematic financing and roll-out programmes rather than the current ad hoc arrangements for the off-grid supply. Also, a precondition requirement (explained in chapter 6) will stress the definition of sustainable rural electrification.

2. National geospatial least-cost plan – A national least-cost electrification plan will identify the location of all unserved households as well as the optimal technology to serve each rural settlement on a least life-cycle cost basis. It will also determine the overall capital and operating costs of the programme.

   PLN prepares a business plan for its activities, including for its rural electrification programmes, to outline its activities and determine the corresponding funding required from the state budget. However, this plan anticipates PLN services expanding incrementally rather than encompassing a comprehensive drive to achieve universal access to services at least cost. All electrification activities need this comprehensive plan that will reduce their dependence on the state budget. This does not apply only to PLN but also to private and other entities that are granted a business area. Moreover, a geospatial approach that quickly and systematically assesses the technological options for serving each settlement will help ensure consistency across regions, timely preparation and updates of the plan, comprehensive geographical coverage, and disciplined and rigorous least-cost planning.

3. PLN grid extension – Least-cost electrification plans typically identify grid extension opportunities to serve, at least in part, currently unserved settlements that are closest to the grid. PLN has achieved remarkable results with its grid extension activities over the years and this will remain the predominant means of electrification, even as the last 16

per cent of the population is given access. PLN will therefore continue to play a key role in Indonesia's efforts to provide universal access but their activities need to be facilitated and scaled up through improved public funding mechanisms.

4. Non-PLN off-grid systems – As the country approaches universal electricity access, grid extension becomes increasingly costly as only the most remote communities remain to be served. Many households or communities are likely to be supplied more cost-effectively by off-grid systems, such as community mini-grids.

   Although PLN operates thousands of small and isolated diesel systems, it actively aims to eliminate these through interconnections with larger grids. PLN has limited experience with renewable energy technologies, no organizational set-up to expand the installation and management of isolated mini-grids, and numerous competing demands on its human and financial resources. Off-grid supplies will play a significant role in serving the last unelectrified areas and a new approach is needed to engage non-PLN off-grid suppliers in a systematic, efficient, financially viable and sustainable manner in scaling up services across the country. This should include G&I requirements and integration in bidding documents and PPAs to ensure women, low-wealth household and marginalise groups participate in project planning, development, and M&E requirements (EIGE, n.a.).

5. Public investment and subsidies – Experience throughout the world demonstrates that public investment and subsidies are required to achieve the goal of universal access. The existing regulations for public investment through PLN are cumbersome and difficult to scale up while no mechanisms exist for public investment or operational subsidies for non-PLN suppliers. Funding mechanisms for both PLN and non-PLN suppliers must be rationalised or developed to ensure the financial sustainability of their electrification programmes.

6. Targets – In managing a national electrification initiative the government needs to be able to track the progress made by implementing agencies by establishing standards and setting quantified targets that it can use to hold the agencies accountable. If tariffs are set so that government subsidies are required for an electrification project to proceed then how efficiently these subsidies are provided will partly determine the pace and progress of the project.

   The government can use geospatial least-cost planning to establish their targets in terms of the number of households to be connected per year and the corresponding electrification ratio. Government can then assess progress, adjust targets and supervise the entities responsible for implementing the programme. Moreover, it can establish meaningful electrification targets that align with the annual availability of subsidy funds. Finally, G&I performance indicators such as affordability of electricity services to low-wealth households and productive economic opportunities created for women and marginalised groups can be set.

3.2 GENDER AND INCLUSION IN A NEW RURAL ELECTRIFICATION APPROACH

In general, universal energy access and therefore rural electrification is also closely related to gender equality and social inclusion (G&I). As such, in implementing a new rural electrification approach Gender and Inclusion should be mainstreamed throughout, and the above steps have included key G&I recommendations. To give further background to these, this section discusses why a new rural electrification approach should consider G&I and what the key challenges are in doing so.

Why should a new rural electrification approach consider G&I?

Considering G&I in a new rural electrification approach can make rural electrification more cost-effective through increasing electricity demand and ability to pay. Women, low-wealth households, and marginalised groups constitute a large part of the energy consumers, workforce, and drivers of innovation in rural areas in Indonesia, and hence via electrification efforts need to consider their specific needs, skills, and electricity consumption potential to create a viable business case.

The advancement of rural electrification is intrinsically linked with improving the socio-economic situation of women and girls, low-wealth households, and other marginalised groups in remote areas in Indonesia. Women, poor households and marginalised groups are currently disproportionally negatively affected by issues of low quality to no energy supply and high electricity tariffs in rural areas. Improving their access to affordable and reliable electricity can help improve their livelihoods, whilst growing their demand and ability to pay for electricity.

What are the challenges in integrating G&I in a rural electrification approach?

The key challenges to integrate G&I in some of the steps of the proposed new rural electrification approach include:

How does access to electricity benefit women, low-wealth households and marginalised groups?

Access to affordable, reliable, and sustainable modern energy can transform women and men's productivity, incomes, and overall wellbeing. It frees up time for women who usually collect fuelwood and enables people to shift tasks through access to lighting, opening new opportunities for leisure, part-time work, and income-generating activities. These effect link across the public sector where access to electricity can increase inclusive participation, education, health and information (IRENA, 2016b; World Bank, 2011).

More specifically, off-grid energy solutions are vital in achieving universal modern energy access by 2030, one of the targets of Sustainable Development Goal Number 7 on Energy. The decentralised and modular nature of these solutions offer greater opportunities than grid-based systems to engage women and marginalised groups in designing, delivering, and operating these systems and realising co-benefits for gender equality and social inclusion.

Standards and tariffs & subsidies

Electricity subsidies do not specifically target female-headed and low-wealth households. TNP2K states that the poor and vulnerable who fall into the bottom 40% of the economy constitute only 26% of the electricity subsidy recipients (Medcom.id, 2020). The regulation on electricity subsidy (Permen ESDM No.29 Year 2016) applies the Social Ministry integrated data that present the general household data without detailing the specific condition of the household including the low-wealth and female-headed household. At the same time, current tariffs are not always affordable, especially not those by private companies.

PLN grid extension

Power sector procurement policy and procedure lack of gender lens. The current procurement requirements do not appropriately consider and integrate key social and gender dimensions. The current practice of power generation project bidding documents (Request for Proposal) and EPC agreements or contracts mostly consider environmental aspects but barely cover social aspects and gender considerations. As such, procurement procedures for most power projects including rural electrification do not yet require women's labour participation, core labour standard (non-discriminatory principles and SEAH or sexual exploitation, abuse, and harassment), and health and safety (EIGE, n.d.).

Non-PLN off-grid systems

Generally, women's participation in power project planning, implementation, and the overall power project management is low. There is a lack of capacity and knowledge among off-grid stakeholders on G&I concerns, and due to primarily cultural and social norms this limits opportunities for women to benefit from off-grid employment opportunities. As an example, a study by GIZ shows that across the management of 200 off-grid systems in Indonesia, women occupy less than 1% of the key management positions. If they are in management, they often take the role of bookkeeper or secretary, and across the 200 systems only 38 women were involved as manager or operator, compared to a total of 2,460 men (GIZ,2019).

A G&I perspective needs to be integrated from the beginning in designing, implementing, and monitoring rural electrification efforts, which will requiring G&I requirements and integration in bidding documents and PPAs to ensure women, low-wealth household and marginalise groups participate in project planning, development, and M&E requirements (EIGE, n.a.). A holistic approach views women not simply as primary end-users and beneficiaries of such programmes but as actors in delivering rural energy solutions and benefitting from the entrepreneurial opportunities from that come with access to energy. They can take on different roles as well as being end-users, becoming community mobilisers, technicians, part-time and full-time employees or employers and entrepreneurs. Women also bring to the table different social networks from men and tend to have access to hard-to-reach households to deploy modern energy solutions (SEforAll, 2017).

Targets

There are currently no targets set on how affordable rural electrification services are, how many low-wealth and female-headed households are connected, and whether rural electrification provides Productive uses of Energy and income opportunities for women and marginalised groups. Without such data, G&I metrics and the socio-economic advancement of marginalised groups cannot be tracked.

The exhibit below provides a further broad overview of some of the barriers faced by women to participate in the renewable energy sector:

Exhibit 3-2: Main barriers and solutions to women's participation in the renewable energy sector in the access context

Barriers	Solution s
Cultural and social norms	• Mainstreaming gender in energy policies
Inequity in ownership of assets	• Integrating gender perspectives in energy access programmes
Lack of skills	• Enhancing access to financing for women
Lack of gender-sensitive policies	• Access to training and skills development programmes
Lack of gender-specific trainig opportunities	• Awarenes raising
Lack of mentorship opportunities	

4. GEOSPATIAL LEAST-COST PLANNING FOR OFF-GRID SYSTEMS

4.1 PREVIOUS STUDIES

As discussed in chapter 3, geospatial least-cost planning indicates the total level of capital investment required to achieve the universal access target, while the annual public funding determines the rate at which households can be electrified.

PLN carries out the bulk of electrification activities and plans these investments by preparing an electricity supply business plan using a least-cost approach wherever practical. However, the government allocates a significant amount of the electrification funding outside of PLN's planning cycle and whether this funding is efficient or effective in terms of meeting the universal access target is not clear. A comprehensive least-cost plan is required against which all electrification activities may be planned and funded, not just those that PLN carries out. This is vital if non-PLN suppliers are to play a greater role in rural electrification as we propose in this study.

We propose that PLN, as the only organization with the required geographical coverage and technical capability, prepares a single geospatial least-cost electrification plan that explicitly considers both grid extension and off-grid supply with a target of 100 per cent electrification ratio.

To better understand how this planning is developed, we present some recent studies in eastern Indonesia that use the geospatial least-cost planning methodology to identify and provide off-grid rural electrification solutions.

Asian Development Bank Sumba study by Castlerock (2015)

Castlerock Consulting prepared the Sumba study (ADB, 2015) for the Indonesian government and the Asian Development Bank under ADB Technical Assistance Programme No 8287-INO: Scaling-up Renewable Energy Access in Eastern Indonesia. The report focuses on electricity access for all and highlights examples of electrification from eastern Indonesia. These examples encapsulate the ongoing challenges facing electrification efforts in Indonesia, regardless of their location. In particular, the report draws on the experience of the Sumba Iconic Island initiative. The appendix in the Sumba least-cost electrification plan describes a methodology to determine the mix of grid, mini-grid and off-grid systems, including stand-alone systems to achieve the lowest life-cycle cost corresponding to the electrification ratio target. The appendix uses some information from another analysis carried out in Sumba as well (ADB, 2014).

The geospatial planning determines the least-cost means of electrification for each settlement in Sumba, consistent with the electrification ratio target. The planning methodology consists of three main steps.

The first step identifies the technology best suited to serve each settlement in Sumba. A key input to this analysis is the target electrification ratio. Three electrification options are considered: a) off-grid and individual household photovoltaic systems; b) mini-grids:

isolated photovoltaic-powered low voltage grids to supply an entire community; and c) grid extensions: connecting households to PLN's Sumba grid through conventional grid expansion activities. The process starts by characterising the existing settlements and medium voltage (MV) networks and then aggregating the settlements into areas that can be served by a low voltage (LV) supply. The analysis relies on publicly available residential maps from the Geospatial Information Agency and Indonesia's Central Statistics Bureau that provide tables of information on the names of the villages, the number of households and data from key stakeholders, such as PLN and the Sumba district office. This analysis uses the Network Planner model.[21]

The second step is to prepare a least-cost generation expansion plan for the grid. The initial analysis determines the future grid load. In addition, the Deliverable B report (Castlerock and ADB, 2014) prepared under the assignment documents the availability of renewable energy resources in Sumba that are suitable for grid connection. This information is used to determine the least-cost mix of generation options to serve the future network load. This analysis uses the Hybrid Optimisation of Multiple Energy Resources (HOMER) model.[22]

The final main step is to identify the network investment required and this is done in two stages. The first determines the spatial distribution of future electricity load, while the second determines the size, location and nature of generators required to serve that load. Information on transmission and distribution networks is required to connect the future generators with the future loads. The load flow was analysed to determine the network infrastructure required to transmit power throughout the island. This analysis uses the Electrical Transient Analyser Programme model.[23]

Asian Development Bank Papua–Maluku study by Castlerock (2017)

Castlerock Consulting conducted this study report for the Indonesian government and the Asian Development Bank under ADB Technical Assistance Programme No 8826-INO: Sustainable and Inclusive Energy Program. Appendix J of the report describes the preparation of an electrification plan for the provinces of Papua, West Papua, Maluku and North Maluku, and the resulting capital and operating costs of implementing it.

The process starts with rooftop tagging – geolocating households based on satellite imagery. This was done manually using free, publicly available satellite imagery from Google Earth, Bing Maps and HERE Maps. Tagging results are within 10 per cent of the Central Statistics Bureau's population estimates for each of these provinces.

Existing medium-voltage (MV – PLN 20 kV) lines are then geolocated and buffered within certain kilometres to analyse population distribution in relation to grid connection. Next, the performance and unit costs of the three supply options: grid extensions, photovoltaic mini-grids and individual solar home systems (SHS) are compiled, and a demand model is

21 The model takes into account existing geospatial settlement patterns, the location of existing transmission infrastructure, expected load growth as well as the cost and performance of various electrification technologies to determine the least-cost means of electrifying each settlement within a selected region.

22 This software is used to design and evaluate technically and financially the options for on-grid power systems and off-grid systems for remote, stand-alone and distributed generation applications.

23 The Electrical Transient Analyser Programme is an electrical network modelling and simulation software tool used by power systems engineers to create and a nalyse electrical power system dynamics, transients and protection.

developed that calculates a settlement's electricity demand based on population, economic growth and population growth. Only the project's direct costs are counted which excludes programmatic and overhead costs such as licensing, administration, project management and profit.

This information is then entered into Network Planner that uses an optimisation algorithm to determine the least-cost means of serving each settlement that is still without electricity. Settlements within 1.5 kms either side of existing medium voltage lines are excluded from the analysis, since the focus is on new services to unserved areas rather than in-fill of areas with existing supply. The model identifies the least-cost supply technology for each of these settlements and summarises capital and operating costs by technology and administrative unit. Solar home systems are automatically assigned to all isolated households as well as to settlements of 15 or fewer households outside the existing grid buffers. Network Planner has not identified any settlements larger than 15 households where solar home systems would be least-cost. Grid extension (new, not connected to existing grid) represents settlements that would be connected by a 20 kV line, but as new, isolated systems not connected to the existing grid. However, this assumes that the cost of energy at the point of injection to the 20 kV network is the same as for the existing 20 kV systems in each region. This is optimistic since these are remote settlements in Papua and West Papua where fuel transport costs are likely to be higher. These may be candidates for diesel-photovoltaic hybrid generation.

Asian Development Bank Papua-Maluku, Massachusetts Institute of Technology–Institute for Research in Technology (2019)

This study was prepared by the Massachusetts Institute of Technology (MIT) and the Institute for Research in Technology of Comillas Pontifical University (IIT-Comillas) universal energy access lab team for the Indonesian government and the Asian Development Bank under ADB Technical Assistance Programme No 8858-INO: Strengthening Knowledge Sharing in Indonesia. The report details the least-cost plan for Maluku and Papua according to realistic input data, forecasts and assumptions determined jointly by the Asian Development Bank, Ministry of National Planning and PLN.

The consulting team used a planning methodology based on a detailed optimisation model, the Reference Electrification Model (REM)[24] that determines the most cost-effective energy technology for each electricity consumer. The model was specifically designed to address the constraints present in countries with low energy access rates. The model leverages emerging technologies, such as solar home systems, solar kits and mini grids by providing the appropriate technology for the particular environment. It is a central part of a comprehensive approach that includes a set of computer models and methodologies to support decision making towards achieving universal energy access.

Proper planning for on-grid and off-grid systems carefully considers the location of each customer and their anticipated energy consumption. The Reference Electrification Model is a geospatial optimisation tool that depends on the exact location for each customer type as well as the estimated hourly demand over a year. For the analysis in this report, past

24 The Reference Electrification Model (REM) was developed by MIT and IIT Commilas and it determines the most cost-effective energy supply technology for each electricity consumer. It can model isolated electrification with third generation Li-ion direct current solar kits or with fully fledged alternating current solar home systems (or stand-alone systems) custom-designed to the needs and demand profiles of a variety of domestic, productive or community customer types.

geo-tagging data from Castlerock was combined with household identification from the Columbia High Resolution Settlement Layer (HRSL).[25]

The model consists of two major steps: (1) clustering using a bottom-up approach and (2) deciding on the best electrification mode for each cluster. The Reference Electrification Model groups a large number of buildings into potential electrical sub-systems. This step is important because it will condition the spatial distribution of off-grid and on-grid systems. After the clusters are identified, the costs of the electrification options at different layers are calculated for each cluster as follows: grid extension, mini-grid option and single-building option.

The Reference Electrification Model considers three technology options for electrification: alternating current solar home systems or direct current solar kits; mini-grids (hybrid solar photovoltaic-diesel and mini-hydro); and expansions of the existing electricity grid. Each technology option provides specific benefits but is also accompanied by trade-offs in cost, environmental impact and service quality. The model evaluates each technology option with detailed cost calculations before assigning a technology to an end-consumer. Trade-offs in reliability and service quality are incorporated into the decision process by assigning a cost-penalty to less-reliable energy services.

Exhibit 4-1 summarises the differences in each geospatial least-cost planning methodology used in the studies presented.

Exhibit 4-1: Geospatial least-cost planning methodology in previous studies

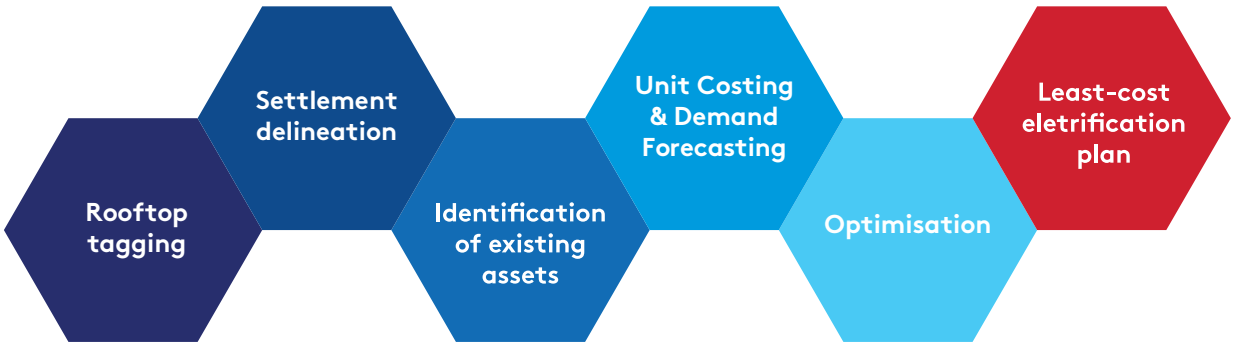
Comparison	ADB Sumba 2015	ADB Papua-Maluku 2017	ADB Papua-Maluku 2019
Data source and processing	Using data and information from Geospatial Information Authority, central statistics office, PLN and local governments (Sumba district)	Using data and information from the Central Statistics Office, Google Earth, Bing Maps and HERE Maps; roof tagging manually done	Using data and information from past ADB Papua-Maluku (2018) study, Columbia High Resolution Settlement Layer, PLN and Ministry of National Planning (for non-household locations data)
Technology options	Using data and information from past ADB Papua-Maluku (2018) study, Columbia High Resolution Settlement Layer, PLN and Ministry of National Planning (for non-household locations data)	Solar home system, isolated solar photovoltaic grid and grid extension	Solar home system, diesel-photovoltaic hybrid generation, isolated mini hydro grid, and grid extension
Tools	Network Planner, HOMER software and the Electrical Transient Analyser Programme	Network Planner model	Reference Electrification Model

25 The High-Resolution Settlement Layer (HRSL) provides estimates of human population distribution for the year 2015 from Digital Globe. The population grids provide detailed delineation of settlements in both urban and rural areas.

4.2 APPLYING GEOSPATIAL LEAST-COST PLANNING FOR OFF-GRID SYSTEMS: A CASE STUDY[26]

This section describes an example of applying geospatial least-cost planning to identify off-grid areas. The method builds on previous Asian Development Bank and World Bank studies on geospatial electricity planning in Indonesia but improves on that earlier work by: a) using rooftop tagging to determine the actual geospatial distribution of population; b) analysing proximity and settlement nodes; c) analysing the medium voltage (MV – PLN 20 kV) grid network buffer to indicate population distribution in relation to how far grid connection could increase electrification; and d) updating inputs based on experience with energy demand, improvements in off-grid technologies and changes in energy costs.

Exhibit 4-2: Analytical approach



Analytical approach: The analytical approach consists of five steps for a Network Planner least-cost electrification plan (Exhibit 4-2). The availability and quality of open access, publicly available geographic information system datasets have improved significantly over the past years. New datasets have emerged conveying useful information regarding resource availability, status of infrastructure and the social and economic characteristics of populations. Population density and distribution maps indicate the location of population and further identify potential residential demand (the geolocation of households based on satellite imagery). These individual tags are then aggregated (tags delineated using proximity analysis criteria) into clusters or settlements that can be served by low-voltage reticulation.

Each settlement is represented by a single point (node) that is characterised by settlement population (number of households) and geolocation. Existing medium-voltage (MV – PLN 20 kV) lines are then geolocated and buffered within a certain number of kilometres to analyse population distribution in relation to grid connection. A detailed engineering design for an electrification project is further prepared based on the demand forecast – calculated according to population density, economic growth, population growth and selected supply combinations of electrification modes (grid, mini-grids and off-grid systems, including stand-alone systems).

Based on the design, a unit cost for those designs is analysed, combining geospatial information with electricity demand and technology costs to estimate and compare the

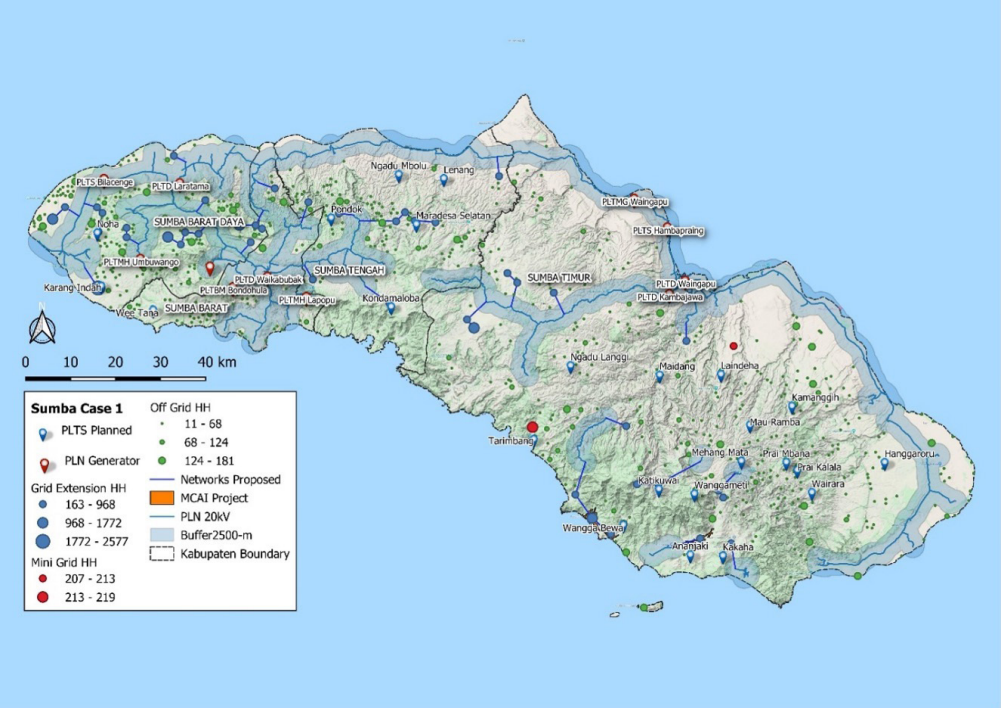
26 Preliminary result

three different options. Its underlying least-cost electrification plan model identifies the optimal electrification technology mix for currently unserved demand centres.

Result: Two base scenarios were developed with different electricity access targets. These examine electrification pathways for Sumba to achieve universal access to electricity by 2025. Furthermore, several additional scenarios could be developed as part of a sensitivity analysis to examine the effect of different development paths. These included a variation of technology costs as well as different levels of electricity access targets. The sensitivity analysis covers grid cost, mini-grids and off-grids, including stand-alone photovoltaic capital costs and electricity demand for basic electricity services. In addition, productivity, health, education and social facilities can be calculated.

Exhibit 4-3 shows a map of distribution for least-cost electricity generation technologies on Sumba island. Network Planner was used to leverage geospatial information and applied to a least-cost approach to identify the most cost-effective electrification solutions in each settlement. This approach considers a case where the urban population would receive the lowest level of electricity compared with the current national average while the rural population would only access sufficient for the most basic electricity services.

Exhibit 4-3: Map of Sumba island in eastern Indonesia showing distribution of the PLN generator and the lowest consumption scenario distribution of least-cost electricity generation technologies



Notes: PLTS = solar power/ stand-alone system; HH = household; MCAI = Millennium Challenge Account Indonesia; *Kabupaten* = district/regency

The map also shows the PLN generator and the spatial distribution of least-cost technologies considering the differentiated costs. The buffer area is 2.5 kms from the existing grid and its planned area. This approach results in on-grid technologies as the least-cost electrification option for most of the population. At the lowest electricity target, most of the population

would be living in areas where the combination of grid-intensification (Tkacik and Smith, 2017:16)[27] and grid-extension is the most cost-effective option.

Off-grid or solar home systems are found across the entire island. Some of these mini-grids are in close proximity to the grid-connected settlements in areas where the population density and therefore demand remains adequately high for these technologies to be deployed. Considering the small distances from these mini-grids to the grid, technical specifications and policies should be put in place to ensure that these settlements can later be connected to the grid, ensuring that there is a viable business case for deploying mini-grids.

27 The deployment of last-mile distribution infrastructure to connect households and other off-takers within rural and peri-urban villages, sometimes called 'intensification'.

5. PAST AND EXISTING OFF-GRID PROJECTS

5.1 SUBSIDY SCHEME

National Programme for Community Empowerment Green programme

The National Programme for Community Empowerment (PNPM) Green programme was a pilot programme under the PNPM rural programme[28] that aimed to improve environmental and natural resources management, and associated governance while increasing household incomes in poor communities and empowering community groups. These community groups prepared and executed the sub-projects and activities at the village level and PNPM Green provided block grants and related technical assistance to promote community investments in natural resource management and renewable energy.

Total funding for the whole programme over the 2008–2013 period was USD30.68 million, and 50 per cent was allocated specifically to finance micro-hydropower (MHP) in selected target locations in Sumatra and Sulawesi. The block grants funded 155 MHP schemes with a total of approximately 1,250 kW of electricity, servicing approximately 40,000 individuals. The individual MHP schemes range was 2–78 kW (average scheme size: 15 kW) and they received an average block grant budget of USD80,000.

Institutional arrangement

The PNPM institutional arrangement took a top–down approach led by the Directorate General of Village Community Empowerment under the Ministry of Home Affairs (Exhibit 5-1). The organizational structure of the programme shows the institutions involved from national to village levels. The right column includes the governance structure from ministry, provincial, district and sub-district levels, the middle column shows the working groups implementing the programme and the left column consists of consultants or facilitators that accompanied and supported implementation.

The Ministry of Economic and People Prosperity was responsible for overseeing the programme and the Directorate General of Village Community Empowerment coordinated with the provincial task force, then on to the district level and finally down to village level. At village level, a sub-district financial management unit helped disburse the project where it was handled by the project implementation team (in coordination with village cadres).

Subsidy mechanism

Regarding the subsidy mechanism, block grants under PNPM Green followed the same procedure as in the PNPM rural programme and were disbursed through the district grants mechanism. The process involved a multi-stakeholder forum at multi-levels (Exhibit 5-2). The communities, assisted by programme facilitators, developed project proposals that detailed the problems identified and the needs or solutions. The proposals were discussed and

28 The PNPM rural programme is a national program aimed at alleviating rural poverty by empowering communities by developing community-based projects. The program was established in 2007 and together with PNPM urban programme is part of the PNPM Mandiri programme. The executing agency for the rural programme is the Ministry of Home Affairs through the Directorate General of Communities and Rural Empowerment.

evaluated based on local priorities in village and sub-district meetings and in consultation with the district forum. On approval, communities implemented their proposals and were often supported by other stakeholders, such as, the private sector, local government and non-governmental organizations.

Exhibit 5-1: Institutional arrangement for the National Programme for Community Empowerment Green programme

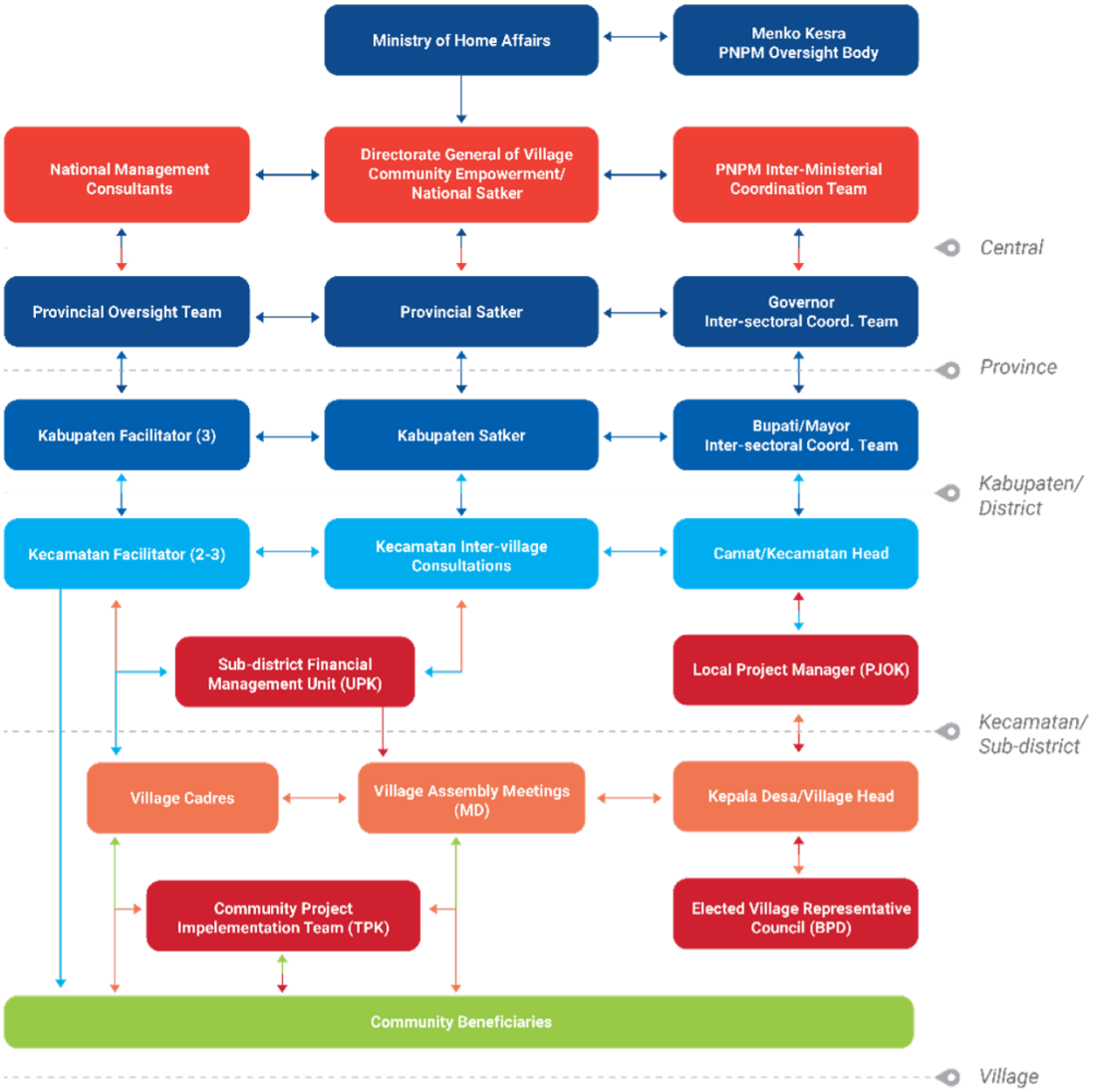
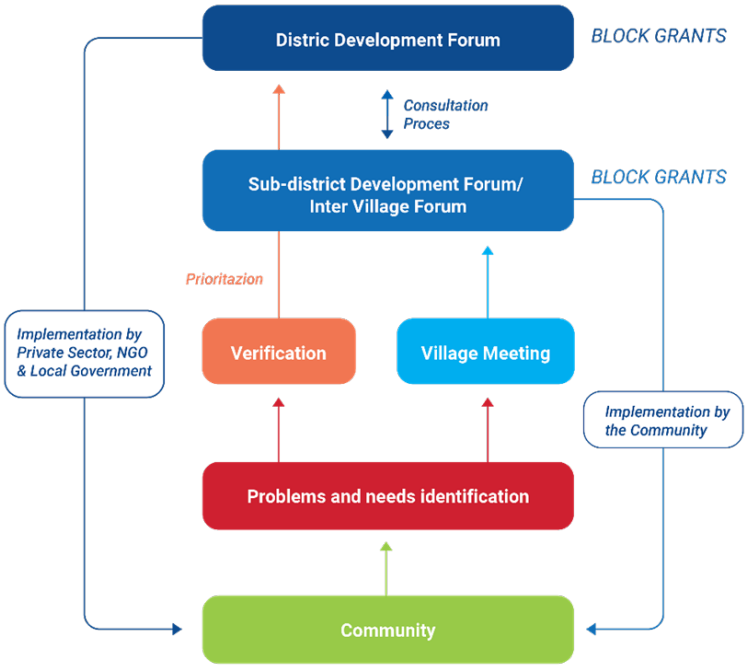


Exhibit 5-2: Block grant cycle at district and village level



Subsidy financing

Local and central government played an important role in the financing scheme. The Ministry of Finance published regulations every year to establish the ministerial budget disbursement checklist while the regent or district head issued regulations to ensure the approved PNPM budget was included. Thus, the ministerial budget disbursement checklist was always controlled on an as-needed basis. This arrangement was to ensure controllable and transparent government financing since in this scheme central and district level co-financing dominated through state budget and local government budget allocations (Exhibit 5-3). A total of USD34 million was used to finance three rounds of block grants for PNPM Green and an additional USD12 million was requested by the government for PNPM Green financing in 2011–2012.

Exhibit 5-3: Project cost and financing scheme for the National Programme for Community Empowerment IV rural programme, USD millions

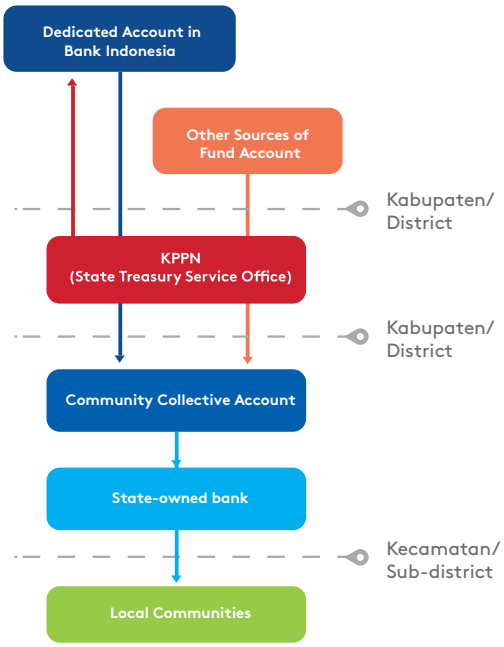
Counterpart Funds							
No	Component	IBRD	APBN*	APBD**	Community	Donor***	Total
1.	Kecamatan Grants	400.00	461.44	178.04	35.34	22.76	**1097.58**
2.	Facilitation Support	99.11	10.66	-	-	0.98	**110.75**
3.	Implementation Support and Technial Assistance	30.98	3.57	-	-	2.22	**36.77**
4.	Project Management Support	1.10	19.65	17.67	-	0.09	**38.51**
		531.19	**495.32**	**195.71**	**35.34**	**26.05**	**1,283.61**

*National **Local ***Donor resources have been received under existing trust fund arrangements.

From the government viewpoint, it shows that central and regional governments allocated funds from their budgets to finance the subsidy. The Ministry of Finance enacted an annual regulation to allocate the state budget for the PNPM programme and the regional government, through the regent or district head, also enacted regulations to allocate funds from the local government budget for the programme.

The fund flow for PNPM Mandiri was set through a dedicated account with Bank Indonesia. Meanwhile other financing resources were saved in another dedicated account that was then operated by a selected bank and the state treasury service office. This office helped to disburse funds to collective accounts for the implementation team that were under state-owned banks. The process diagram is shown in Exhibit 5-4.

Exhibit 5-4: Process diagram for the National Programme for Community Empowerment financing scheme



Sustainability factors

Analysing the financial and economic aspects of the micro-hydropower projects under PNPM Green shows that the subsidy was crucial in developing these off-grid schemes since rural communities are not expected to be profitable investment areas. The study also shows that the revenues can generally cover the regular operational expenses costs but not the costs for major repairs or replacing equipment. Thus, the subsidy can help with capital costs and expenditure as well as any major repair costs.

The study also found that the micro-hydropower projects surveyed had positive outcomes since most appeared to be working well and they provided a valuable service to communities. Some communities reported some operational difficulties, for example: a mismatch in the design and the actual water flow capacity that led to shortfalls in the power output; inadequate monitoring and recording in terms of the technical performance, such as the kWh generated; and the need for regular maintenance of the micro-hydropower infrastructure (power house, weir, access to weir and reservoir).

The projects enhanced economic benefits, for example, by allowing longer working hours for shops, carpentry workshops and new business ventures, such as bakeries and livestock farming. Economic productivity was expected to continue to increase over time.

From a G&I perspective, a review of the 15 year PNPM programme suggests that as a long-term national programme, PNPM had large potential to promote gender equality. Yet, as PNPM was a large-scale programme, it was not always able to capture the different needs and aspirations of each community. A key area for G&I improvements included better internal awareness on G&I mainstreaming, the gender dynamics in decision/policy making, providing affirmative action for women's participation, sexual division of labor in the programme activities, women's ownership over assets and benefits. The programme would have further benefitted of a better gender strategy, strengthening of gender facilitators, and integration of gender indicators in the management information System (MIS).

Millennium Challenge Account Indonesia Compact Green Prosperity project

The Millennium Challenge Account Indonesia (MCAI) Compact Green Prosperity project was implemented over 2013–2018 and aimed to: increase productivity; reduce reliance on fossil fuels by expanding renewable energy; and reduce land-based greenhouse gas (GHG) emissions by improving land-use practices and natural resources management. The Green Prosperity facility provided approximately USD62 million in grant funding for 28 renewable energy projects (solar, hydro and bioenergy) that consisted of 12.73 MW in new generation capacity through four on-grid projects (8 MW) and 24 off-grid projects (4.73 MW).

The project achieved 9,095 electricity connections that included 2,622 households that were provided with a lighting or cooking source fueled by renewable energy. It also managed to leverage almost USD11 million from private sector partners and developers by the end of the project, with another USD2.3 million in commitments to follow after it closed to complete the off-grid community operations components.

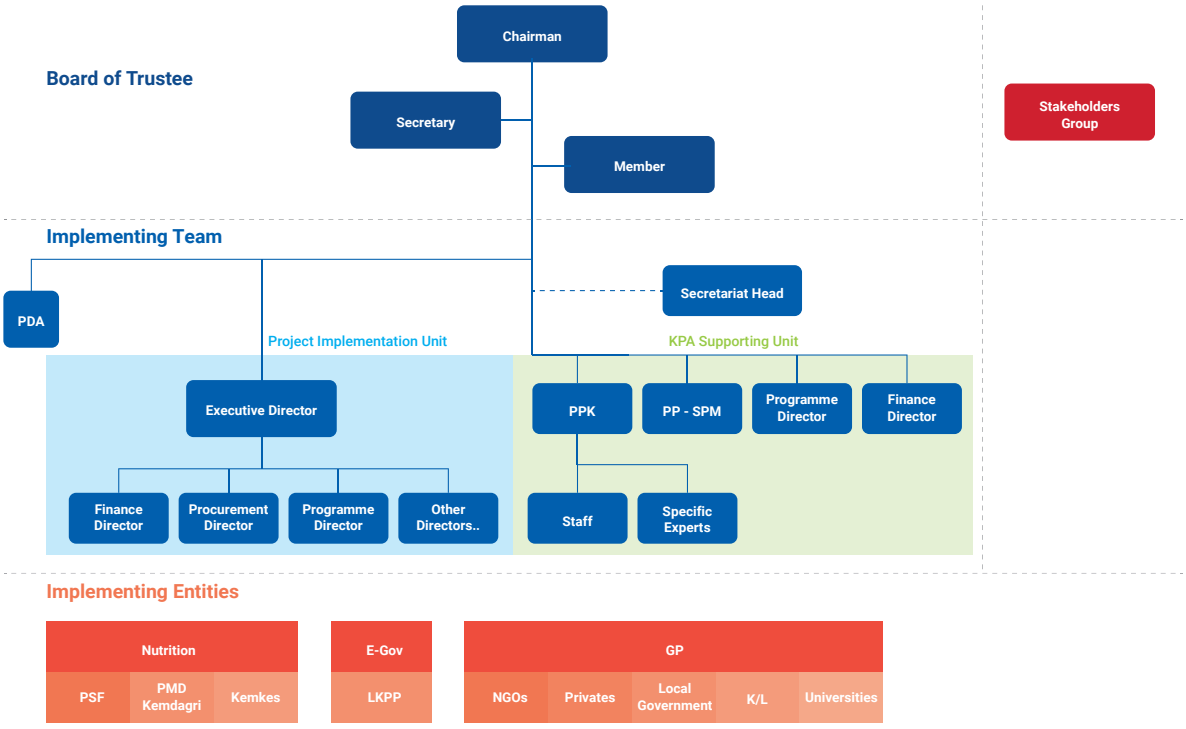
Institutional arrangement

The grant funding was executed through a direct grant approach and used an off budget and off treasury modality whereby MCAI awarded grants directly to recipients without going through the government budget. Regulations or decrees[29] from the Presidential office, Ministry of Finance and the Ministry of National Development regulated the grant allocations, mechanisms, management and other institutional arrangements and created a strong legal framework for operating the grant process. MCAI followed the guidelines laid out in the regulation framework and selected proposals from project developers.

The board of trustees was the key lead in this programme structure. Through the Ministry of National Development, the board worked with a group of stakeholders (horizontally) and the implementing team (vertically), consisting of a project implementation unit and supporting units. This team also worked with implementing entities, such as non-governmental organizations, private companies, local governments, universities and other supporting entities (see Exhibit 5-5). The MCAI organizational structure managed the implementation process as shown in Exhibit 5-6.

29 Examples of these regulations are: Presidential regulation No 80 of 2011 on the Trust Fund (grant), Minister of Finance regulation No 124/PMK.05/2012 on Millennium Challenge Corporation Grant Management Mechanism and Minister of National Planning regulation No 02 of 2012.

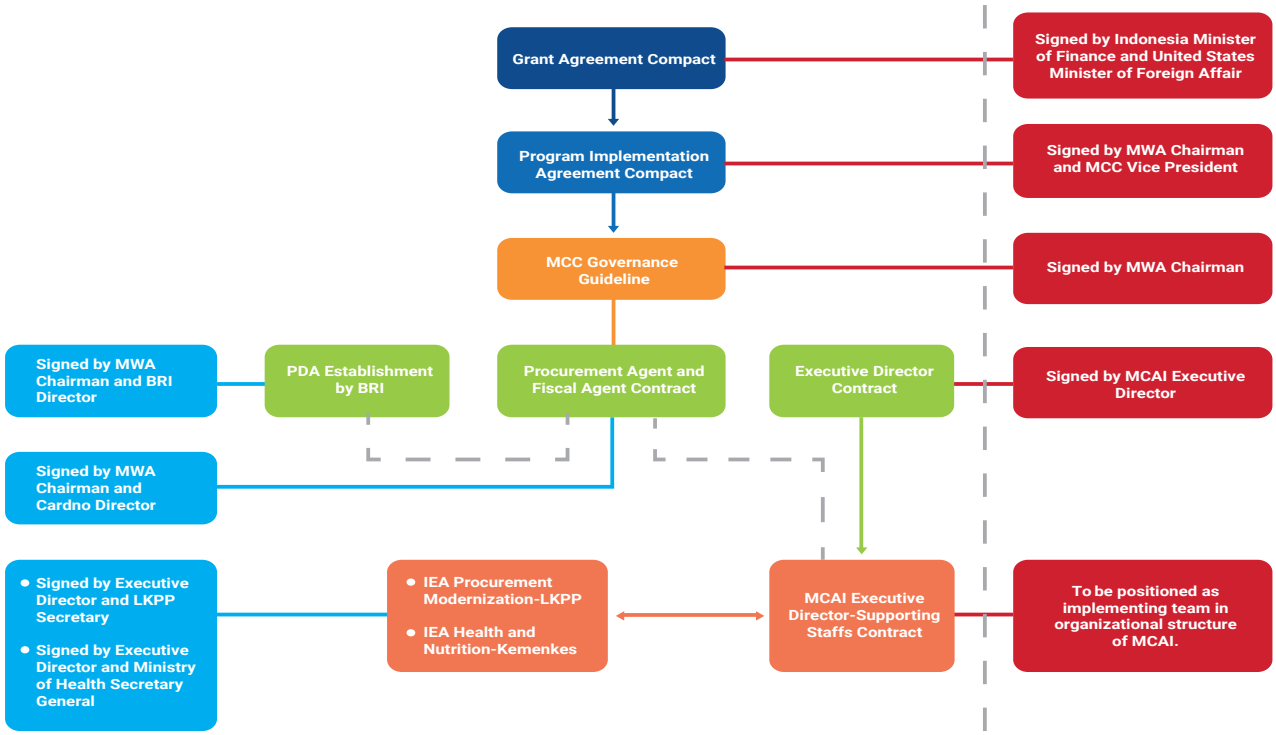
Exhibit 5-5: Organizational structure for the Millennium Account Challenge Indonesia project 2013–2018.



MCAI Organisation Structure

Notes: PDA = trust fund manager; KPA = budget utilisation authority; PPK = authorised person of commitment; PP- SPM = government regulation – minimum service standards; PSF = project support facility; PMD Kemdagri = PMD Ministry of Home Affairs ; Kemkes = Ministry of Health ; E-Gov = electronic government ; LKPP = National Procurement Policy Agency; GP = Green Prosperity project; K/L = ministry/institution

Exhibit 5-6: Implementation process flow diagram for the Millennium Account Challenge Indonesia project



Notes: MWA = Board of Trustees : BRI = *Bank Rakyat Indonesia*; PDA = trust fund manager; LKPP = National Procurement Policy Agency; IEA = Implementing Entity Agreement; *Kemenkes* = Ministry of Health

Sustainability

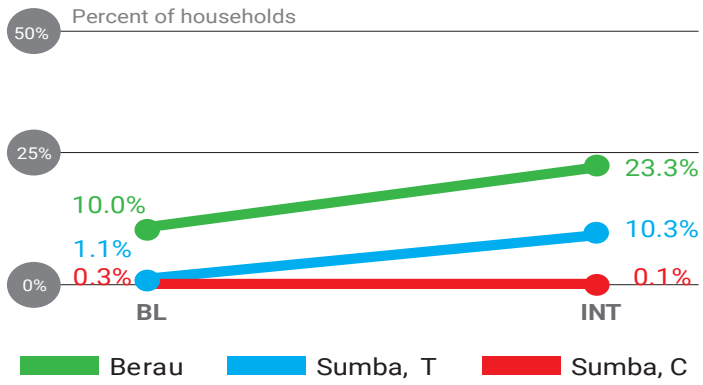
Besides the new generation capacity and connections, other notable achievements of the renewable energy portfolio included:

- Piloting new models in community ownership and management by establishing legal entities in remote rural locations with the community owning a majority share of the power utility to enhance sustainability;
- Investing in three palm oil mills on a cost-share basis to install methane capture systems from palm oil mill effluent to generate electricity, demonstrating the recovery and use of biogas as a potential strategy for the government to meet both their renewable energy targets and reduce greenhouse gas emissions.

An evaluation report on the programme's off-grid project activities shows that in terms of economic productive use, the grants had a relatively small economic impact in the year or so between commissioning the mini-grids and collecting interim data in April 2019. In some cases, as for many villages in East Sumba, the treatment areas were so remote and market access was limited so economic use of the mini-grids might take considerably longer.

Time spent on income-generating activity changed slightly although women spent additional time preparing goods like cakes to sell at local schools or food shops and some invested in mixers. This was at the expense of their leisure time. There was also an increase in households using electrical appliances, like refrigerators (see Exhibit 5-7).

Exhibit 5-7: Electricity appliance use in selected districts



In terms of sustainability, the specific community ownership model was less important than building the capacity within communities so they could manage and operate the facility on a day-to-day basis. A common issue was operating as a business in a familiar environment where people were reluctant to strictly enforce the rules of payment. Establishing a realistic business plan to ensure funding for operating and maintaining the facilities in the long-term was a critical element.

Given the ubiquity of the low demand for electricity relative to initial projections and the regulatory pressure on tariffs, the business plan needs to establish anchor customers for sufficient demand – including PLN through a sufficient feed-in tariff – or secure long-term subsidies to cover the gap between revenue and the operating and maintenance costs.

In terms of Gender & Inclusion, MCAI projects had a clear focus on inclusive economic opportunities and productive uses. The MCAI project has ensured active engagement of women and men in project planning, development, and implementation, as well as in capacity building activities (providing trainings on gender equality, building women's confidence etc). It has also provided clear productive use of energy benefits to communities, ensuring both women and men and the poorest households can benefit from these. This included focusing on creating specific productive economic activities for women, for example running kiosks using energy and renting out lanterns for additional household income, and agro-processing machines and biogas usage that reduces women's burden.

Renewable energy projects by the Directorate General of New, Renewable Energy and Energy Conservation

The Directorate General of New, Renewable Energy and Energy Conservation (DG NREEC) was established in 2010 to promote clean energy development in Indonesia. Since its formation, it has developed infrastructure to expand electricity access, especially for remote areas. Before this development, a specific allocated budget for village electrification was arranged of up to IDR190 billion in 2011 and IDR432.4 billion in 2013. The budget was increased to IDR502.3 billion in 2017 (IESR, 2019) and by 2019, IDR 868.6 billion was disbursed, either directly through the Directiorate General's state budget or through the specific allocation. The funds were mainly used to install solar home systems for households and public offices among other installations (see Exhibit 5-8).

Exhibit 5-8: Infrastructure development programme using the Directorate General of New, Renewable Energy and Energy Conservation budget

Year	Infrastructure type	Capacity or units	Expenditure (in billion IDR)
2019	Solar home systems for village households	107,877 units	311.9
	Solar lighting for public offices	26,254 units	395
	LED bulb retrofitting	68,932 units	8.2
	Solar power for public offices in remote area	28 units	45.8
	Revitalising renewable power plants	26 units	32.1
	Rooftop photovoltaic for public buildings	108 units	48.4
	Biogas installation for school dormitories	20 units	27.2
2018	Solar power plant	46 units with total capacity of 1.5 MW (between 15-65 WP)	
	Micro hydropower plant (MHP)	0.18 MW	Using specific allocated budget (DAK)
	Biogas for non-commercial		Using DAK
2017	Micro hydropower plant	0.209 MW	Using state budget
	Micro hydropower plant	0.11 MW	Using DAK
	Solar power plant	3.22 MW	Using state budget
		0.901 MW	Using DAK

Source: Directorate General of New, Renewable Energy and Energy Conservation (2018, 2019, 2020)

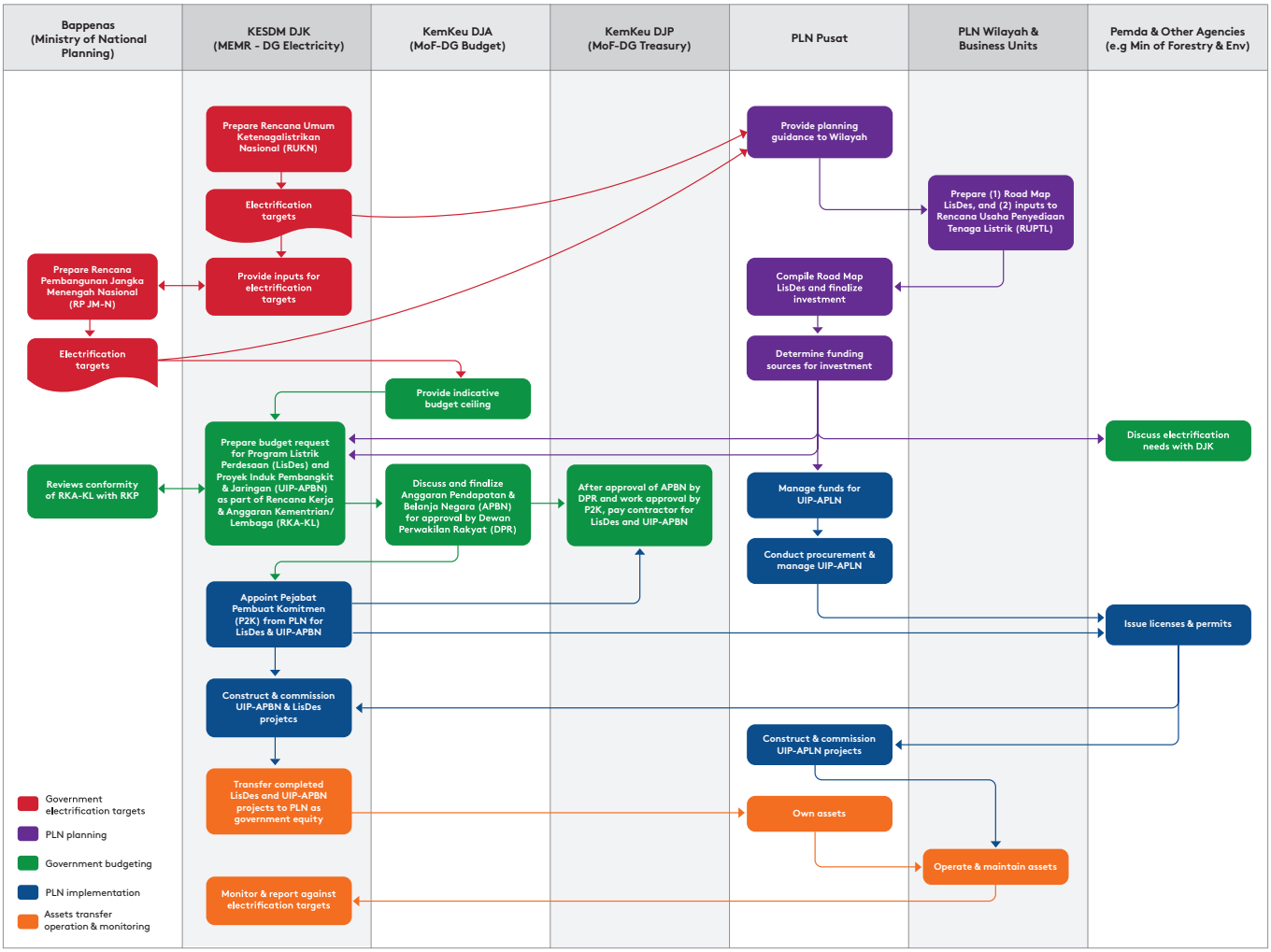
The Directorate General of New, Renewable Energy and Energy Conservation reports how much additional capacity or units it has developed in its annual performance report. Further assessment is needed to analyse the sustainability of these projects.

State electricity company programmes

In the period 1976–2015, PLN executed the largest electrification programmes in the country, accounting for some 97 per cent of all household connections. Historically the PLN programmes are conventional grid extensions except for their Super Extra Energy Saving (SEHEN) program that provided individual household photovoltaic systems with three light points. Their conventional grid extension programmes are integrated with generation and transmission development.

PLN electrification programs are financed from two sources: PLN's own budget and the national budget. The planning and implementation of their programmes depends on the source of funding (see Exhibit 5-9).

Exhibit 5-9: Process flow for electrification projects executed by PLN, the state electricity company



Source: ADB and Castlerock (2015)

Under PLN's budget, the company successfully provided electricity access to 11,323 villages in 2016–2019. This was achieved by installing a regular village electricity supply and Listrik 2510 Desa (IESR, 2019). Most of the PLN electrification programmes are not considered as off-grid unless they are lower than 20 kV or isolated micro-grid and individual systems such as the Super Extra Energy Saving system. In 2020, the total target for the village electricity programme was estimated as up to IDR1.1 trillion for PLN to build its distribution lines and buses units. PLN disbursed IDR735 billion from its own budget while the state budget contributed IDR200 billion with the rest from local budgets (PLN, 2020).30 In this programme, PLN intended to build electricity access through charging stations and battery replacement schemes for 433 villages in Papua, West Papua, Maluku and East Nusa Tenggara.

30 Additional resource: https://economy.okezone.com/read/2020/04/03/320/2193705/pln-rogoh-kocek-rp735-miliar-untuk-alirkan-listrik-ke-433-desa

For projects financed out of its own budget, PLN procures and secures the land and licences, and constructs and commissions the projects. The projects are owned by PLN and operated and maintained by its business units.

The state budget helped fund PLN projects to build 99 MW renewable energy-based power plants, 2,325 kms of transmission lines, 9,320 MVA substations and 404 kms of distribution lines, costing a total of IDR5 trillion.31 This figure is lower than the state budget in 2019 when the allocated amount was up to IDR6.5 trillion. Most of the projects are PLN grid extensions for its distribution lines and substations. However, PLN also considers small-scale renewables (communal), hybrid, diesel generators and solar home systems for off-grid supplies.

For projects financed out of the state budget, the Directorate General for Electricity appoints a PLN employee as the official commitment maker responsible for executing the projects on its behalf. Working with the rural electricity work unit, the commitment maker conducts the same steps as for the projects PLN funds, but the assets remain government assets until the Directorate General for Electricity hands them over to PLN as government equity once they are commissioned.

The PLN projects have no specific focus on Gender and Inclusion.

Summary of the off-grid programmes

Capital expenditure for all the off-grid programmes was subsidised. The project developers all understood the need to conduct feasibility studies but, due to limited project timelines, these studies were not as comprehensive as they should have been, and the projects are at medium to high risk in terms of sustainability. The MCAI funding is typically a full grant while the PNPM funds are a combination of grants and the local or state budget. The Directorate General of New, Renewable Energy and Energy Conservation programme is fully disbursed from the state budget. Details are shown in Exhibit 5-10.

31 See CNBC Indonesia news article on the state funding for electricity services (article in Bahasa): https://www.cnbcindonesia.com/news/20200714211520-4-172728/dapat-pmn-rp5-t-pln-geber-pembangkit-ebt-hingga-listrik-desa

Exhibit 5-10: Summary of off grid programmes in Indonesia

Programme	Period	Pros	Cons	Budget arrangement	Institutional framework	Subsidy presence	Financial sources	Productive economic activity
PNPM	2008–2013	Pioneering and well-structured arrangements	Lack of sustainable projects and programme ceased with Law on Villages No 6 of 2014	Multi-year budget is allocated in advance	Ministry of Home Affairs, regional governments, facilitators, coordinating team, consulting team, village administrations	Capital expenditure (capex) (50% of USD 30.68 million)	International Bank for Reconstruction and Development (IBRD) state budget, regional budget	New business activities: bakery, chicken farming. Longer hours for existing business: shops, carpentry workshops
DG NREEC projects	2011–present	Yearly basis	Small capacity due to budget limitations	Yearly basis	DG NREEC task force members	Capex (various) IDR 868.6 billion (2019).	State budget (specific allocated fund + regional budget)	Electricity for public facilities
MCAI	2013–2018	Massive grant-based development and more project model variants	Uncertain sustainable outlook for the projects	Project basis	Ministry of Finance, Ministry of National Planning, Ministry of Home Affairs, implementing team, board of trustees, supporting team, experts, grantees or partners	Capex (total USD 62 million)	Millennium Challenge Corporation (MCC)	Food stalls, carpentry workshops, fisheries, farming. Specific productive economic activities were created for women, for example running kiosks using energy and renting out lanterns for additional hh income, and agro-processing machines and biogas usage that reduce women's burden has timesaving benefits.
PLN	1976–present	Sustainable due to PLN's longstanding experience and capacity Strong supports and buy-in from many stakeholders longstanding experience and capacity	Most projects are grid extensions or hybrid and diesel generators for off-grid systems.	Yearly basis	Ministry of Finance, Ministry of National Planning, Ministry of Energy and Mineral Resources and local governments	Capex + subsidised tariff (various)	State budget, regional budget, PLN budget	Electricity for public facilities

Based on the existing off-grid projects, this study concludes:

- The PNPM programme was perceived as a successful even before MEMR regulation No 38 of 2016. It started before the electricity business area provision was enacted in MEMR regulation No 28 of 2012. At that time, while the business area was required, it was not enforced for micro-scale projects and those run by non-governmental organizations – PNPM projects were considered as micro-scale projects. Therefore, this study may identify that prevailing business area determination is considerable for small projects or off-grid, instead of in a district level, which somehow helps to accelerate electrification programme.

- The experience from the Directorate General of New, Renewable Energy and Energy Conservation projects does not show evidence of the productive economic activity it generated. Key performance indicators for these projects only measure whether the project was built or not and how many households were covered. Regarding the MCAI project, the interim evaluation reports that many projects would face uncertainty (rated poor–fair) in terms of sustainability (Social Impact Inc., 2019). This is due to various issues in each project, ranging from limited demand and lack of a comprehensive feasibility study to the erratic supply of off-grid feedstock.

- From a G&I perspective, MCAI showed the strongest results. Projects mainstreamed G&I considerations from project design to implementation, and women and marginalised groups received capacity-building support and Productive use of Energy and business opportunities were designed to benefit them. Besides, policy-makers endorsed G&I. Some of the more negative framing of how women were able to take on new income-generating opportunities but had to give up leisure time for these have not been proven to defer women from stopping the activities, and other livelihood activities such as running energy kiosks have provided sustained G&I benefits.

5.2 COMMERCIAL SCHEMES

This study also encapsulates some best practices from Indonesia's peers in Southeast Asia, to understand on what level private companies drive the off-grid business models and what lessons we can learn in encouraging private entities that are willing to explore Indonesia's off-grid requirements (ARE, 2019).

Myanmar projects – Yoma Micro Power: 31.2 kWp solar-powered mini-grid in Sagaing region

Yoma Micro Power (YMP) builds, owns, operates and maintains small-scale power plants and mini-grids for off-grid customers and rooftop grid-tied solar systems. To avoid overlap with the government's national electrification plan, YMP also coordinates with the regional governments and the government-operated electricity supply enterprises in choosing its locations. For this project, YMP first communicated with the village head and conducted an initial survey of the village to determine the current status of its energy needs and the villagers' future plans. After a preliminary survey, YMP performed a more detailed survey to determine each household's needs and their desire to connect to a mini grid. Then, with sufficient interest from the villagers, they built the solar hybrid mini-grid and it started to deliver reliable electricity at the beginning of 2018.

The project in Sagaing region consists of a solar-powered hybrid mini-grid with batteries and diesel back-up. YMP offers electricity to rural businesses and communities. Based on the telecom load and household loads, YMP decided on a solar photovoltaic power plant with battery and diesel generator for backup and designed the power plant and mini grid to be unmanned and remotely monitored to reduce operational expenditure costs. The mini-grid is grid-ready and meets or exceeds the national grid code.

The project is 100 per cent equity funded32 and the shareholders are Yoma Group, the International Finance Corporation (World Bank Group) and the Norwegian Investment Fund. YMP used the anchor–businesses–communities business model for this project and worked with three different types of customers, starting with off-grid telecom towers as an anchor customer and surrounding rural businesses and communities. YMP demonstrated the viability of building commercially sustainable mini grids with this project while delivering 100 per cent uptime to its telecom customers, rural businesses and households. As a result, the telecom customer signed a long-term power purchase agreement with YMP to receive similar services at hundreds of their off-grid towers. The tariffs YMP charges are based on time of use, at MMK300 (equivalent to USD0.20) per kWh in daytime and MMK900 (equivalent to USD0.60) per kWh at night-time.

The off-grid systems provide electricity to telecommunication towers and the surrounding communities, including households, schools, monasteries, clinics and businesses. The grid-tied rooftop systems reduce commercial and industrial customers' electricity bills with sustainable and green electricity from solar. The system provides power to a telecom tower that uses a diesel generator for the power supply, to rural households that were using solar home systems and to a monastery that was running a diesel mini grid but wanted to move up to a higher tier service and run productive appliances in addition to lighting. By providing solar-generated power to the tower, YMP resolved complaints from neighbours about noise from diesel generators running 16–18 hours per day. At the same time, YMP reduced the operational costs for the tower company.

For fixed load and fixed hours service packages, YMP used smart load limiters while for non-stop service packages it used pre-paid meters. Rural businesses and households are able to pay for their electricity services through Wave Money – a leading digital money platform in Myanmar. YMP provides power to households with various kinds of fixed and metered packages. They can choose from multiple fixed amount packages based on the number of lights, television and mobile charging usage. Small businesses like mills, shops and other households can opt for a non-stop power supply at a kWh rate that varies for daytime and night-time.

Thailand project – InnoEnergy School, Blue Solar and Symbior Solar: 60 kWp solar powered mini grid on Koh Jik island

The project team from the InnoEnergy Masters school (including members from KTH Royal Institute of Technology in Stockholm, Eindhoven University of Technology, Polytechnic University of Catalonia Barcelona and Instituto Superior Técnico Lisbon) regrouped as the Koh Jik ReCharge team and played a key role in optimising an existing mini grid. The ReCharge team facilitated negotiations between the community, the government and the

32 Includes a 60 per cent subsidy program for community-based renewable energy mini-grids that involve the private sector. The subsidy comes from the World Bank Group funding and is allocated to the government for selected projects.

investors, and disseminated information to the scientific community. Two private sector developers from Thailand, Blue Solar and Symbior Solar, were also involved in the project as funders.

The ReCharge project aimed to restore and improve the system on Koh by adding more power capacity and replacing existing lead acid batteries with lithium-ion batteries. For easier management and monitoring, the project implemented an automatic control system, a flexible hybrid alternating current–direct current configuration and network-connected digital meters. The island has no connection to Thailand's main electricity grid. The community is still in charge of operating and maintaining the system but costs are covered by the investors. This means that if a component breaks down within the duration of the contract, the investors are responsible for fixing or replacing the components.

Project financing for the major system upgrade was secured from a joint venture between Symbior Solar and Blue Solar. The community energy company owns the assets that existed on the island before the mini-grid upgrade and was responsible for operations, maintenance, billing and collecting the electricity revenue. However, the investors are currently responsible for managing all these aspects until the end of the build–operate–transfer process. The investors agreed to invest in equipment upgraded under the conditions of the power purchase agreement with the community energy company. The agreement is for a contract duration of ten years with the option of extending to 15 years with the provision of a battery upgrade in year 11. The electricity tariff is 13 THB/kWh (equivalent to USD0.42 /kWh), subject to fuel price volatility.

The mini-grid gives the community access to electricity at affordable prices while providing more reliable and higher quality power than other means of electrification. The population is relatively stable and so are its energy needs and, furthermore, the community's past experience has ensured their trust in and acceptance of the new project. Community consultations allowed the project to benchmark new tariffs against the old ones, assess the customers' eventual reaction to the price change and their willingness to pay. The project allows the inhabitants to conserve access to clean, reliable energy at the same tariff while they benefit from a new, more efficient system that allows continuous use of their energy-intensive utilities, from washing machines, refrigerators and rice cookers to power tools and high-pressure water pumps.

The community energy company is still responsible for metering, billing and collecting the tariffs. It uses a pre-payment billing and metering system through a split three-phase prepaid meter that enables metering and vending point of sales. Digital payments through online money transfers are also possible and these reduce cash transactions. The summary of the Myanmar and Thailand projects are tabulated in Exhibit 5-11.

Exhibit 5-11: Examples of off-grid commercial schemes in Myanmar and Thailand

Project	Key Stakeholder	Financing	Tariff (per kWh)	Revenue Model	Productive Uses of Electricity	Billing and Metering
Myanmar	Regional government, state-owned utility company and village community	100% equity	USD cents 20-60	Power purchase agreement with telecom tower, service package for households	Telecommunication tower, productive appliances	Mobile money with prepaid smart meters
Thailand	Government and village community	100% equity	USD cent 42	Power purchase agreement with local community	High-pressure water pumps for agricultural purposes	Online payment and cash collection with prepaid smart meters

Source: ARE (2019)

5.3 LESSONS LEARNED

For subsidy schemes, a clear institutional arrangement supported by the necessary regulations and rules is essential in establishing a mechanism that runs smoothly. In all three subsidy cases examined, related government authorities created the legal framework required and defined clear roles and divisions of responsibility between institutions involved.

Micro-hydropower projects under the PNPM Green programme were considered successful for several reasons, for example: the subsidy was accessible through a clear and transparent district grants mechanism; the projects were developed with sound technical support from the programme; and the projects were driven by community needs and involved communities in the decision-making processes.

Developing projects driven by community needs is a key factor in determining project success. Assessing demand needs to cover a forecast of ongoing demand and communities' willingness to pay so project developers can make well-informed decisions. Learning from the MCAI case, low demand could detract from the sustainability of a project.

Projects from PLN and the Directorate General of New, Renewable Energy and Energy Conservation are more sustainable than the National Programme for Community Empowerment projects. Involving government bodies will encourage local engagement and that quality standard checks will generally ensure the system works longer. The MCAI's evaluation also highlights this issue of sustainability.

However, assessing the risk levels for sustainability is also crucial at the project preparation stage and this needs to be repeated continuously as the project evolves. This process is

still lacking in the Directorate General of New, Renewable Energy and Energy Conservation projects as the performance indicators mainly record whether the project is built or not rather than assess its sustainability.

Learning from the commercial projects in Myanmar and Thailand, getting the right customer base with the ability to pay is critical for a project's financial sustainability. In the case of Myanmar, having the telecommunication business as the main customer ensured it generated regular income for the developer, increasing project sustainability. In the case from Thailand, consulting with the community to assess tariffs, tolerance for price changes and willingness to pay helped the project developer make the right decisions for the project's longer term financial sustainability. The productive use of the telecommunication tower and high-powered pumps in the Myanmar and Thailand cases respectively also strengthened economic sustainability. Including the future system upgrade in the Thailand case also increased the technical sustainability of the project.

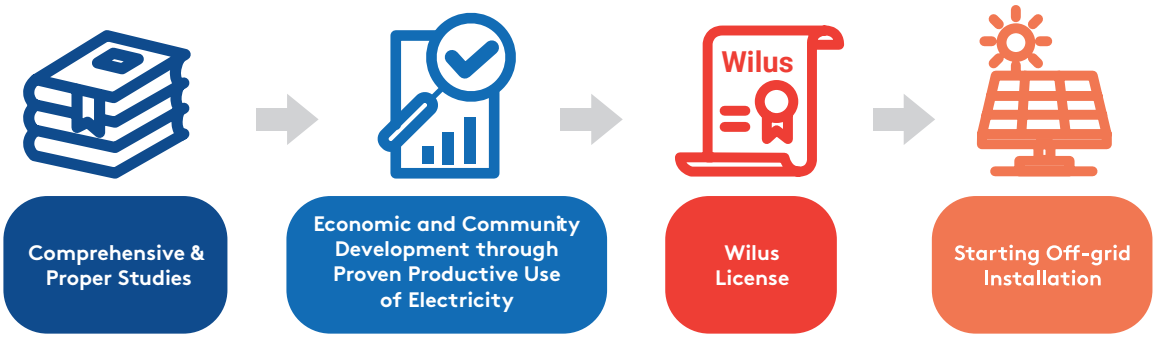
6. OFF-GRID BUSINESS MODELS OPTIONS

6.1 PRECONDITION REQUIREMENTS

Over the past decade, the off-grid electrification projects in Indonesia have faced enormous challenges to reach 100 per cent universal access across the country. The Indonesian government initiated the process by spending a considerable amount of the state budget on multi-year programmes, particularly in frontier, outermost and least developed areas. The programmes span line ministries, local governments and state-owned enterprises. Various international and national donor-funded projects also constructed off-grid projects that use renewables as the primary source for generating electricity (several examples are given in chapter 5). These projects encountered a number of obstacles in their efforts that may affect their sustainability.

This study outlines three main requirements as a complete consecutive-step that a private entity needs to complete before it implements the off-grid project (Exhibit 6-1).

Exhibit 6-1: Precondition requirements for an off-grid installation in Indonesia



Comprehensive and high-quality studies

An off-grid power supply company must conduct a sequence of studies in the earlier processes to ensure it is making a sound investment and that the project is sustainable. Several key milestones in the project rely on the quality and accuracy of these studies. Instead of outlining the ideal number or processes required, we identify three types of study that companies need to conduct prior to implementation:

- *Prefeasibility study and feasibility study with integrated geospatial least-cost planning and development, including gender and inclusion issues*: Various forms of prefeasibility and feasibility studies have been developed and applied in off-grid projects across the globe. In this study we emphasises that geospatial least-cost planning and development analyses need to be part of such studies. This planning ensures the company finds the best off-grid solution. Furthermore, the plan anticipates increased demand by adding more appropriate sources without compromising the reliability of the long-term electricity supply. Proper planning can minimise these technical risks. Prefeasibility studies should explicitly address G&I through mapping female-headed and low-wealth households (potential) energy demand, and specific productive uses of energy that women and marginalised groups can benefit from and help grow electricity demand.

- *Willingness-to-pay study*: This study should capture not only whether people are willing to pay for electricity per kWh but also whether they are willing to spend their income on accessing electricity. With this premise, the willingness-to-pay study should explore the trade-offs of household expenses, for example, electricity against food or electricity versus leisure. Different levels of priorities can convey a message about how much of people's income they will spend on the utility bill. In some failed projects, people's willingness to pay for electricity declined when costs for other priorities increased. In other cases, their willingness to compensate the tariff per kWh declined as their electricity consumption rose.

- *Demand forecast study:* Overestimated demand projections are found in many temporary off-grid projects. This happens in the early stages of a project when the expected revenue cannot be generated due to the lack of income from bill payments. Consequently, the project cannot operate and be maintained as planned. This is a classic problem in rural electrification projects. In some projects, underestimated demand is also a fundamental issue when people turn out to be more interested in using electricity than expected. The project may only cover basic uses in households, such as lighting, but once people access the service, they begin to understand all the other uses of electricity such as stocking food (refrigerators), entertainment (television, radio) and communication (telephone, internet). This unexpected rise in demand will be unmet by the supply and thus limit people's access to electricity once more. Therefore, a proper demand forecast must be based on realistic and reasonable assumptions. Over optimistic assumptions, for example, projecting appliance use and productive use of energy, are frequently the main issue in poor demand forecasting. However, pessimistic demand forecasting is equally problematic. When people first have access to electricity, they can feel euphoric. Companies need to be prepared for demand to rise or sink and be able to make realistic short- and long-term assumptions within this context in developing off-grid projects.

The studies described here may be combined in one or more studies or conducted as several separate studies, but the key issue is the quality and accuracy of the studies and their findings that must be set to a high standard. Comprehensive and high-quality studies can improve the success rate of off-grid projects.

Economic and community development through a proven productive use of electricity

A particular characteristic of rural demand is that it is low but also sensitive so it can grow or sink depending on how interested people are in using electricity at any one time. This sensitivity may be affected by the questions of why they should need electricity, what benefits electricity will give them in their present lives (especially if they are currently without any electricity), how much electricity will cost and whether they have the funds to purchase it. If communities are being offered electricity for the first time, the project could begin with community development activities. These activities are designed to build people's awareness of how electricity can improve their lives and livelihoods and support their activities (women's empowerment and specific productive use of energy opportunities for women, poor household and other marginalised groups can also be promoted in these sessions). Electrification needs to be seen as part of an inclusive development drive and be integrated with health, education, government administration and entrepreneurial initiatives to yield the full benefits and fulfil people's aspirations. This community development will

boost the local economy, generate livelihoods and increase the local demand for electricity, thus making the project sustainable.

In community and economic development, identifying and capitalising on opportunities for productive uses of electricity is critical to maximise the impact for both individuals and communities. Community-level impacts fulfil various needs (clean water, fresh food, medical facilities) while there are also myriad impacts on individuals related to household electrification (educational opportunities for children and adults, business opportunities, better security, easier food preparation, entertainment and information). Both levels can initiate a new productive culture where people can generate income and change their old ways (before the off-grid system established). Thus, productive uses mean additional economic opportunities for all.

For example, solar water pumps and mills can reduce the time spent fetching water for homes and farms. An integrated irrigation system can work mechanically rather than manually, and machinery electrified by solar power can process a harvest automatically. This frees up time for women and men to do other productive activities such as, cooking or baking, farming and enterpreneurial activities like running kiosks. These activities will also improve sales of electricity. Households can also preserve and prepare food and thus help improve the health of the community.

Productive uses of electricity increase the assurance that households and communities will make their payments to the off-grid companies. The electricity uses generate more income and jobs that may create multiplier effects and trigger more opportunities in the market to be exploited. Moreover, this can result in greater electricity consumption and contribute to the financial viability of the private company involved. Nevertheless, the impact of these productive uses in triggering economic activities needs to be proven. Electrification is necessary but not sufficient to be the main driver of economic growth.

Improved and reliable access to electricity or new electricity connections enhance the established economic activities too. Its productive uses can thus guarantee long-term revenue for off-grid power suppliers.

Business area licences

Besides the financial and technical limitations that PLN faces in its efforts to electrify all households in the country via grid extensions (see chapter 2), it also faces the greater challenge to power the remaining unelectrified areas through off-grid solutions. To boost the electrification ratio, the Indonesian government set out a framework that allows the private sector to join in this effort. In November 2016, MEMR regulation No 38 of 2016 on Acceleration of Electrification for Villages and Underdeveloped Areas established a framework for private provision of off-grid electricity supply, building on Law No 30 of 2009 on Electricity and Government regulation No 14 of 2012 on Electricity Business Activities.

The regulation stipulates that an off-grid electricity supply for areas that PLN cannot electrify can be provided with or without subsidies from the state budget. Any entity in either scheme must obtain an electricity business area licence from the government to deliver the service. The ministry issues this licence after a series of consultations with PLN. Several grant-funded and government-funded projects have successfully obtained business area licences and implemented their projects. In 2018, dozens of private sector companies

were granted these licences to cater for industrial purposes. MCAI-funded projects over 2013–2018 also successfully obtained licences for off-grid electrification. However, it has been extremely difficult for private players to secure a licence.

Obtaining the licence is a critical step since off-grid electricity generation suppliers cannot start their projects without it. The licence not only provides certainty for the business but also generates revenue. However, because of the impediments of getting the licence, some off-grid companies have decided to provide their services through independent power producer contracts or joint partnerships with PLN.

6.2 OFF-GRID BUSINESS MODEL TAXONOMY AND CRITERIA

Business model options discussed in this study are compiled from all the off-grid projects implemented in Indonesia. To allow mutually exclusive but collectively exhaustive business model options, the off-grid business models are assessed using the following levels: Level 1 – how businesses obtain the business area licence; Level 2 – who the customer pays for the electricity service; and Level 3 – who owns and operates the off-grid infrastructure (see Exhibit 6-2). We then evaluate the business model options against criteria to determine the replicability, durability, effectiveness, and timeliness possible in implementing the models.

Business model taxonomy and options

Level 1 in the taxonomy includes three scenarios with regard to Ministry of Energy and Mineral Resources business area licences. In the first type, the ministry will not issue a licence in any area where PLN is already operating. However, where the PLN directly handles and supervises the service, businesses do not need a business area licence as they are responsible only for supplying electricity generation services.

In the second scenario, the ministry grants business area licences if an enterprise submits a request through a pre-determined procedure and fulfils certain requirements under MEMR regulation No 38 of 2012 (amended by MEMR regulation No 7 of 2016). This licence is issued based on an applicant's request.

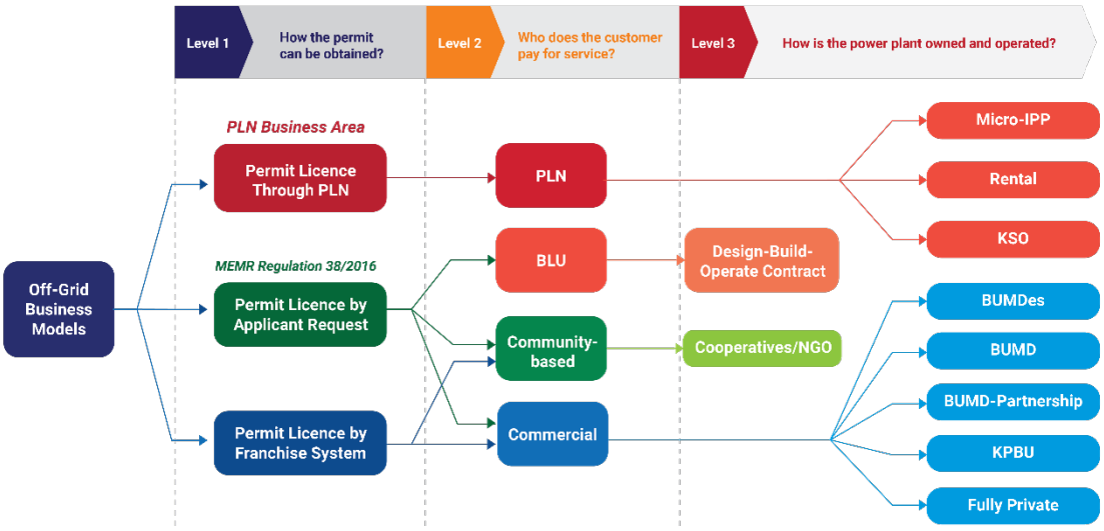
By contrast, in the third scenario, the ministry can issue a business area licence without receiving any proposal. In this case, the ministry invites all eligible legal business entities to help accelerate electrification in the remaining unserved areas through a franchise system. The ministry acts as the franchisor and opens remaining business areas that have no reliable electricity systems either to existing businesses or to new applicants. The business area licence allows private entities to operate in an area for 30 years but in the franchise model, the ministry draws up a long-term contract (20–30 years as relevant to most renewable plants' lifetime) for the franchisee. Once business holders have established all the assets within the given business area, they transfer these assets to PLN if they are in a PLN business area or to local government if not. In terms of subsidy, central government will most likely provide a capital subsidy for all projects under the franchise system or offer other fiscal incentives, whereas local government is likely to provide an operational subsidy or other non-fiscal incentives or concessions. The subsidies guarantee that the project developers will comply with the regulated tariff for electricity. However, this business area subcontracting model needs to be investigated further in relation to the legal system in Indonesia.

Level 2 includes four possible off-grid scenarios where customers pay: a) the PLN and the service are operated and/or owned by PLN; b) the public services agency that owns and operates the service; c) the community-based organization that runs the service; and d) the commercial company that owns the business.

Level 3 covers all the business model options classified under the different types of institution (Exhibit 6-2).

These business model options apply to businesses of all sizes. Therefore, institutions involved in each business model option can build or develop whatever size plant they think feasible to deliver satisfactory services and fulfil the demand. For example, village-owned businesses can build large power plants as long as the demand is there but plant size is also affected by the capital required and we do not consider this aspect in this initial study. This study assumes that capital requirements are met by the off-grid project through investors or private means.

Exhibit 6-2: Business models options



Notes: PLN = the state electricity supply company; BLU = the Public Service Agency; NGO = non-governmental organization; Micro-IPP = small-scale independent power producer; KSO = joint operational cooperation; BUMDes = village-owned enterprise; BUMD = local-government-owned enterprise; KPBU = public–private partnership

Licences through the state electricity company

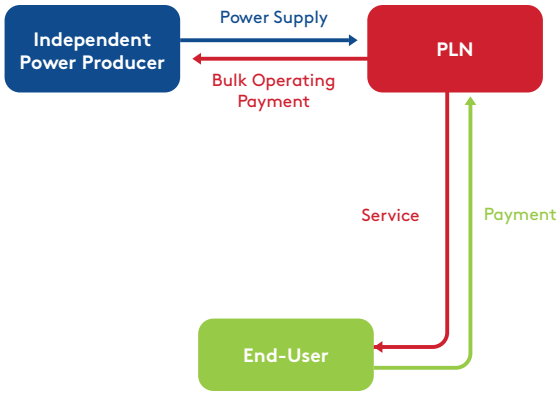
In this business model type, the state company, PLN, has an active role in the following four options and all end-users of the off-grid power supply pay the tariff directly to PLN.

Small independent power producer model

The small independent power producer model (shortened to micro-IPP) uses the independent power producer framework commonly followed in Indonesia. Project investors or developers build power plants and any required grid extensions as well as operate and maintain the plant. Under a power purchase agreement contract, the developer sells the electricity to PLN and is paid for each kWh transferred. PLN uses its own grid to distribute the service to the customers and collects payment from them.

The regulatory framework in this business model follows MEMR regulation No 4 of 2020. Any private companies interested in investing as an independent power producer must use the build–operate–own scheme. The government subsidy goes straight to PLN and the end-users enjoy a subsidised PLN tariff. Exhibit 6-3 presents the schematic model.

Exhibit 6-3: PLN business model: small independent power producers[33]



Model description	Independent power producer
Tariff collection	PLN
Asset ownership	Project investor/developer
Operation and maintenance	Project Investor/Developer
Subsidy delivered	PLN tariff
Business area permit	No Need (under PLN's Wilus)
Example	Clean Power Indonesia Biomass Project on Mentawai island

Rental

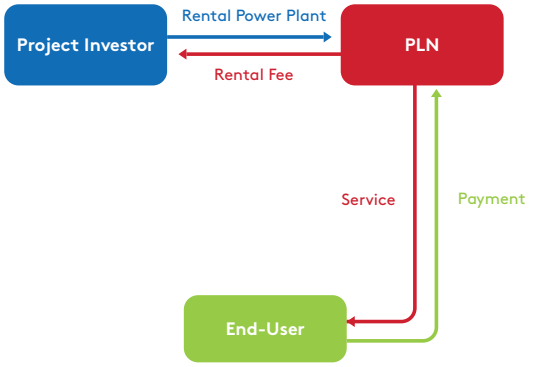
In the rental model[34], PLN uses the power plant owned by project investors who receive rental payments from PLN through an annual contract. PLN delivers generated power directly to the customers who pay their service fees to PLN.

PLN has a more active role in this model that complies entirely with its procurement regulations and procedures and does not require a business area licence. PLN's customers receive the subsidised tariff as government transfers the state budget to PLN. Exhibit 6-4 presents the schematic model for the rental scheme.

33 More information about the project can be found at http://cleanpowerindonesia.com/

34 In Indonesia, there is no direct legal statement for rental in electricity business. However, rental business are supported by operation permit and business permit under Electricity Law 30 2009, general rental business through Civil Law article 1548, Ministry of Finance's Regulation No 634/KMK.013/1990 (on procurement via rental) and No 1169/KMK.01/1991 In jurisdiction review, this business is legally accepted in electricity sector. To date, PLN's rental framework is also practised widely across Indonesia although it is generally used for small diesel power plants.

Exhibit 6-4: PLN business model: rental[35]



Model description	Rental
Tariff collection	PLN
Asset ownership	Project investor
Operation and maintenance	PLN
Subsidy delivered	PLN tariff
Business area licence	No need (under PLN's area)
Example	None

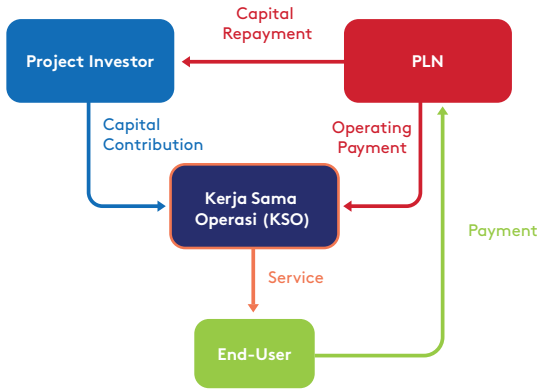
Joint operational cooperation (*Kerja Sama Operasi* or KSO)

In this model, any private company can be a project investor, developer or operator and establish a joint operational cooperation with PLN for rural electrification in one or more specific areas. This cooperation framework works under a business-to-business agreement between PLN and the private company and the joint cooperation provides the electricity service to customers and also operates and maintains the power plant. PLN compensates the company for its operating costs and the end-users pay PLN for the service. Unlike with rentals, distribution lines and substations can be built by investors and operated based on a contract period, as long as PLN includes these costs in its capital repayments to investors.

The joint operational cooperation closely coordinates with PLN and local governments, including village administrations and communities. This business option delivers the electricity service in the PLN business area and households that use the service pay a subsidised PLN tariff. The end-users retain the same government support as others enjoy across the country. Exhibit 6-5 presents the schematic model for joint operational cooperations. PLN considers cooperations with local government involvement as a sustained and long-term solution for rural electrification (PLN, 2019: 72). An example of a successful joint operational cooperation was initiated by the Directorate General of New, Renewable Energy and Energy Conservation and PLN. In this study, we propose that the directorate general can be replaced by other project investors in this model.

35 No commercial development recorded to date. In the PLN and MEMR's Super Extra Energy Saving programme (Sambodo, 2015), the total monthly payment is IDR35,000 consistsing of a monthly fee (subscription IDR14,800 per month) and rental cost of equipment (IDR20,200 per month) (Source: PLN Letter No 1227.K/DIR/2011).

Exhibit 6-5: PLN business model: joint operational cooperation



Model description	Joint operational cooperation
Tariff collection	PLN
Asset ownership	Project investor/developer
Operation and maintenance	PLN
Subsidy delivered	PLN tariff
Business area licence	Not required (under PLN's area)
Example	Biogas and Biomass Power Plant in West Sumba (DG NREEC and PLN) (DG NREEC, 2018)

Licences based on applicant requests

According to MEMR Regulation No 28 of 2012 (amended by MEMR Regulation No 7 of 2016) private companies or any other institutions can sell electricity to the public or directly to consumers by obtaining an electricity business area licence. The enterprise requests the licence from the ministry by following the official procedures. There are three groups of institutions that can collect the tariffs: public services agencies, community-based enterprises and commercial enterprises. The following off-grid business models are possible.

Public services agency business model: design–build–operate contract

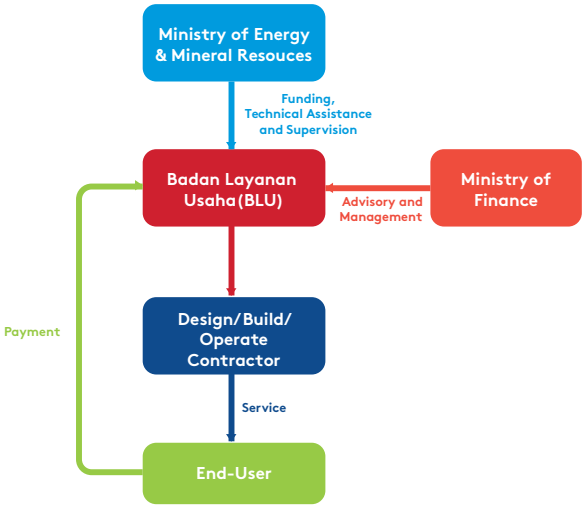
In this classification the public services agency that manages, operates and maintains the power plant is also the focal point in delivering the off-grid power supply and it has only one business option – a design–build–operate contract.

The concept of public services agencies is not new in Indonesia, but it has largely been implemented in the health and education sectors. It is defined and updated under Government regulation No 74 of 2012.

The Ministry of Finance establishes a public services agency under supervision from the Ministry of Energy and Mineral Resources. The agency then opens up contracts to design, build and operate off-grid service projects, allowing the private sector to participate in supplying off-grid electrification. The agency owns all the assets in the off-grid projects and collects payments from the customers. The contractor company receives an income from the agency on a fee-for-services basis. Exhibit 6-6 presents the schematic for the public services agency model.

The Ministry of Finance also allocates funding to the public services agency to finance initial investments and operating expenses. This is under supervision from the Ministry of Energy and Mineral Resources that also provides technical assistance to the agency. This central government participation plays a substantial role in this option while PLN is also involved in coordinating any projects. The public services agency uses the framework in Government regulation No 38 of 2016 to supply off-grid electricity services in remote settlements. The BLU model is possible to be integrated with subsidy scheme under BLU (proposed in section 7.2).

Exhibit 6-6: Public services agency business model: design–build–operate contract



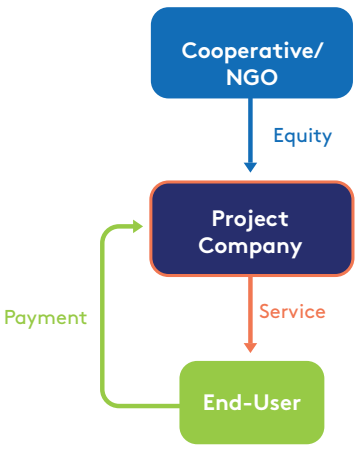
Model description	Design-Build-Operate Contract
Tariff collection	Public services agency
Asset ownership	Public services agency
Operation and maintenance	Contractor
Subsidy delivered	Capital and operating expenses
Business area licence	Required by application
Example	None

Community-based enterprise business models: cooperatives or non-governmental organizations

This off-grid business option is initiated by cooperatives or non-governmental organizations focusing on economic development at the village level. These entities work closely with village communities to set up a project company that will deliver access to electricity. Assets in the project may be fully owned by the organization or shared with the community but the project company is responsible for building, operating and maintaining the off-grid power plant. The cooperative or non-governmental organization also owns the assets and collects payment from the end-users. Exhibit 6-7 presents a schematic model of this community-based company option.

The organization also requires a business area licence to implement the project, but it can operate with or without a subsidy under MEMR regulation No 38 of 2016. Many organizations use grants to finance the initial investments and this non-government support can help reduce operating costs. Moreover, cooperative institutions can use the subsidy scheme in MEMR regulation No 38 of 2016 to alleviate the burden of expensive maintenance and operating expenses.

Exhibit 6-7: Community-based business model: cooperatives and non- governmental organizations[36]



Model description	Cooperative/non-governmental organization
Tariff collection	Project company
Asset ownership	Cooperative/NGO
Operation and maintenance	Project company
Subsidy delivered	Capital and operating expenses
Business area licence	Required by application
Example	Ibeka project in West Java

36 More information on the project can be found at: http://3.ibeka.or.id/wp/index.php/en/home/

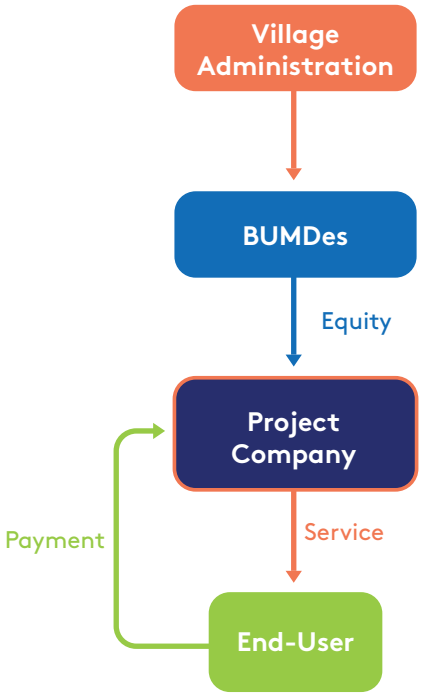
Commercial business models

Village-owned organizations (BumDes)

In this model, the village administration, with consensus from the community, creates a village-owned enterprise to manage the off-grid power supply. The enterprise forms a specific supervisory body to act as the project company, supervise the project and provide the electricity service. The project company builds the power plant, delivers the electricity service and is responsible for operating and maintaining the project on a daily basis, including collecting tariffs. Exhibit 6-8 presents a schematic of this model.

The village-owned enterprise model needs a business area licence to run the off-grid project, but it can run with or without a subsidy under the framework in MEMR regulation No 38 of 2016. The village administration needs to coordinate closely with the provincial and district governments and with central government, especially with the Ministry of Villages and the Ministry of Energy and Mineral Resources. These village-owned enterprises can investigate different forms of subsidy in accordance with MEMR regulation No 38 of 2016 and Ministry of Villages regulation No 11 of 2019. Under the latter, the village administration can disburse village funds to subsidise the installation of a power plant and/or the electricity fees charged.

Exhibit 6-8: Village-owned business model[37]



Model description	Village-owned enterprise
Tariff collection	Project company
Asset ownership	Project company
Operation and maintenance	Project company
Subsidy delivered	Capital and operating expenses
Business area licence	Required by application
Example	None to date

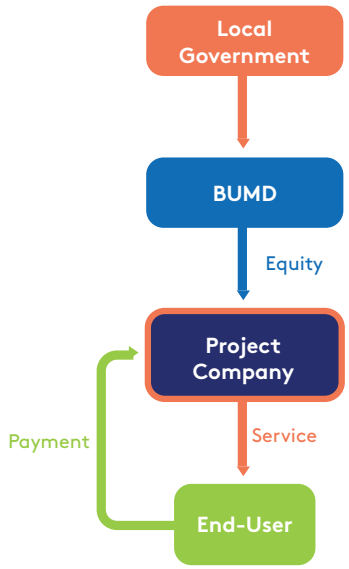
37 There is no example of a village-owned entity that has created a project company to deliver the off-grid power supply on commercial basis. However, there are some examples, of village-owned enterprises cooperating with private or non-governmental organizations for grant purposes.

Local government-owned enterprises (BUMD)

Provincial and/or district governments can create local enterprises to manage the off-grid power supply. The enterprise then forms a supervisory body to manage the service company. Shares in the company belong to the local government company itself and it manages the project, from planning and preparing through to implementing and maintaining the services. The project company owns the power plant assets and collects the service fees from the customers. Exhibit 6-9 presents the schematic for the local government owned enterprise model.

Local governments play a major role in this business model option. The model works under the framework of MEMR regulation No 38 of 2016 whereby the project company needs a business area licence to operate the power plant and offer the electricity supply. While the model is based on having no central government subsidy, subsidies from the local government budget can support any initial investment as well as operating costs. Using this scheme, the electricity tariff is regulated by the local government and parliament.

Exhibit 6-9: Commercial business model: local government-owned enterprise



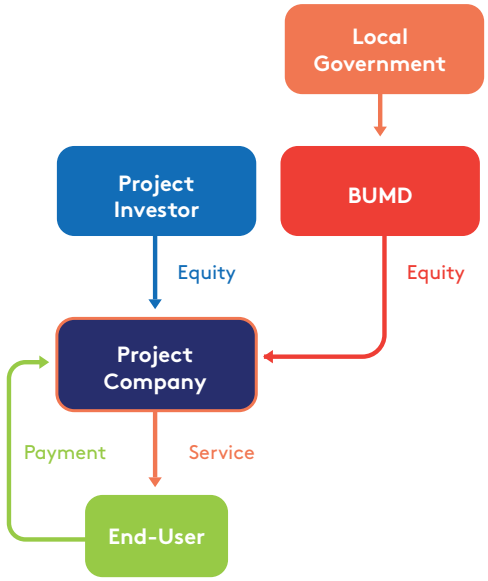
Model description	Local government- owned enterprise
Tariff collection	Project company
Asset ownership	Project company
Operation and maintenance	Project company
Subsidy delivered	Capital and operating expenses
Business area licence	Required by application
Example	None

Local government-owned and private enterprise partnerships

Under this model, local governments still play a major role in administering the rural electrification project and once again the provincial or district government creates a local government-owned enterprise to provide the off-grid power supply. The difference in this model is that the government-owned enterprise collaborates with one or more private entities to establish a supervisory body as the project company. The partnership aims not only to increase equity and share risks but also to improve institutional capacity in delivering reliable electricity access. The local government-owned enterprises and private companies share the project company's assets. The joint venture company operates and maintains the service and collects the fees.

Exhibit 6-10 shows the schematic for this partnership model.

Exhibit 6-10: Commercial business model: local government-owned and private enterprise partnerships[38]



Model description	Local government- owned enterprise
Tariff collection	Project company
Asset ownership	Project company
Operation and maintenance	Project company
Subsidy delivered	Capital and operating expenses
Business area licence	Required by application
Example	None

The partnership works under the framework of MEMR regulation No 38 of 2016 so the project company requires a business area licence from the ministry. In terms of the subsidy, this model is similar to the local government-owned business model with an option to access local government budget funds as equity in the project company. The government support can offset capital expenditure and operating costs but not tariffs. Equity injections from the private companies enhance the modalities in establishing the off-grid projects.

Public–private partnerships with availability payments (KPBU in Bahasa)

Generally, the public–private partnership model uses the framework under Presidential regulation No 38 of 2015 and its subsidiary regulations, including Minister of Home Affairs regulation No 96 of 2016. In general, the model has two schemes: the availability payment[39] and the viability gap fund.[40] Availability payments conform with Minister of Finance regulation No 190.PMK08 of 2015. The public–private partnership availability payment is defined and applied under supervision of the Directorate General of Budget Financing and Risk Management in the Ministry of Finance.

Even with no support for capital costs at the outset (such as in the viability gap fund model), investors can meet the capital costs for village or district level off-grid projects

38 There is no example of a village-owned entity that has created a project company to deliver the off-grid power supply on commercial basis. However, there are some examples, of village-owned enterprises cooperating with private or non-governmental organizations for grant purposes.

39 The minister, chairperson or regional head makes periodic availability payments to an enterprise for providing infrastructure services that conform to the quality and/ or criteria specified in the power purchase agreement.

40 Government provides viability gap funds for public–private projects to improve their financial feasibility by reducing the capital needed for infrastructure and ensuring higher returns on investment. Many infrastructure projects are economically viable but not financially feasible without this assistance.

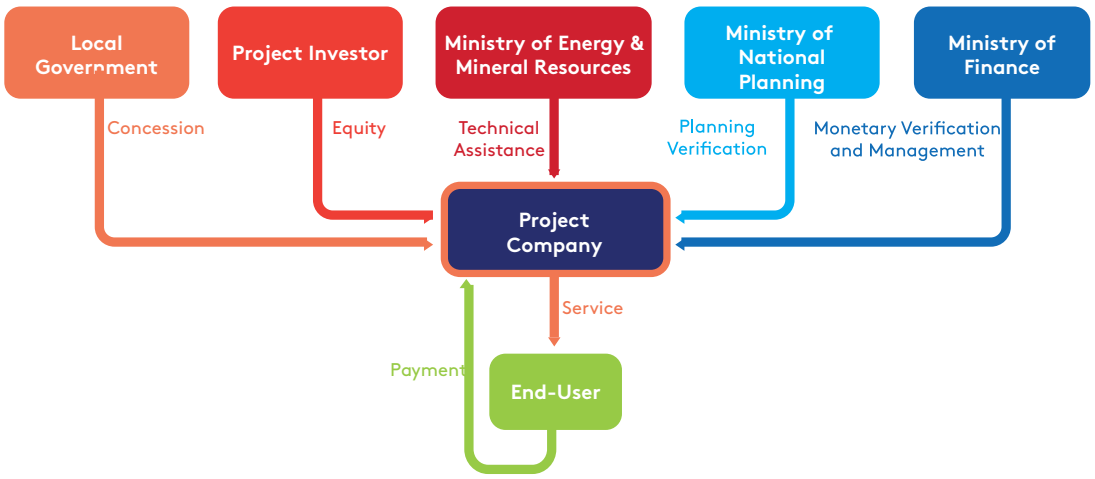
by ensuring they receive availability payments on the infrastructure to cover their capital repayments and operational subsidies. The viability gap fund provides capital rather than operational support. Therefore, this study evaluates the availability payment model that was also initiated in the residential gas pipeline project.

Local governments and private investors establish a specific public–private partnership contract for an off-grid project. The agreement is implemented by a project company and the company builds the power plant, collects the tariffs, and operates and maintains services on a daily basis. The assets of the project company are owned by the parties in the contract based on the shared equity. The line ministries, such as Ministry of Energy and Mineral Resources and Ministry of Home Affairs, can provide technical assistance to the project company under this partnership. Exhibit 6-11 presents a schematic for this public–private partnership model.

The project company needs a business area licence to offer its services, working under Government regulation No 38 of 2016 and using a non-subsidy scheme. The government subsidy is paid however through the local government budget and can go to initial investments and operating costs as in the local government-owned enterprise model and the local government-owned enterprise partnership model. Furthermore, the public–private partnership model can optimise Minister of Home Affairs regulation No 96 of 2016 on Availability Payments. This regulation allows this facility as a periodic payment from the local government to business entities that deliver infrastructure services conforming to the criteria specified in the partnership contract.

Model description	Public–private partnership
Tariff collection	Project company
Asset ownership	Project company
Operation and maintenance	Project company
Subsidy delivered	Capital and operating expenses
Business area licence	Required by application
Example	None

Exhibit 6-11: Commercial business model: public–private partnership[41]



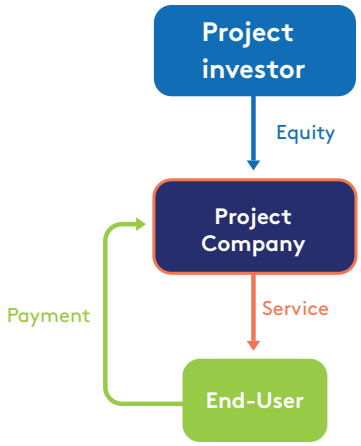
41 The MEMR-Perusahaan Gas Negara is an example of a public–private partnership at the municipal level for a residential gas pipeline: https://www.esdm.go.id/id/media-center/arsip-berita/pemerintah-daerah-dukung-skema-kpbu-untuk-jargas

Fully private projects

Of all the eleven models, this option has the least interaction with the government and PLN. Project investors establish a project company to focus on rural electrification and it carries out all the activities related to providing the service. The company builds the power plant, operates and maintains it, delivers the service and collects the fees from the end-users. As a fully owned private company, the assets belong to the project company although they may be shared among a number of project investors. Exhibit 6-12 shows a schematic of this fully private model.

As mentioned in the previous models, companies not operating through PLN must have a business area licence to run an off-grid power supply. In applying for the licence, the project company needs to coordinate with the government at all levels – central, provincial and district. The company also needs to coordinate closely with the village administration and communities. These steps are time consuming and can take years. Under MEMR regulation No 38 of 2016, businesses using this model can only request a subsidy for the electricity tariff. The company follows the PLN tariff and the government pays it the difference between the regulated tariff and the generation costs plus its margin. However, the detailed mechanism for this subsidy scheme is not yet in place. If the company pursues the non-subsidy scheme, it is a major task to agree with the local governments on a tariff.

Exhibit 6-12: Commercial business model: fully private companies[42]



Model description	Fully private company
Tariff collection	Project company
Asset ownership	Project company
Operation and maintenance	Project company
Subsidy delivered	Subsidised tariff
Business area licence	Required by application
Example	ElectricVine project in Papua

Licence granted through a franchise system

SUN and ElectricVine are two companies that have shown that obtaining a business area licence is challenging. In some cases, even if the local PLN office agreed to grant the licence, the central PLN office had already planned its future electrification projects for the areas concerned. Therefore, this study proposes that MEMR offers a franchise system –that does not involve applying for a business area licence – as a solution to accelerate universal access to electricity.

42 ElectricVine completed the preparation phase of an off-grid project in Papua but did not obtain a business licence.

In this model, presented in Exhibit 6-13, MEMR acts as a franchisor (franchise owner) and offers its business area either to existing business holders or to new applicants (franchisees). The PLN service franchise is similar to a food franchise system for a secret recipe but in this context the 'secret' is how to supply electricity reliably and maintain a high quality of service. In compliance with the PLN recipe for success, the franchisees will follow the guidance and package prepared and determined by PLN (as owner) to supply electricity to the selected area. This system is similar to that described in article 9 of MEMR regulation No 38 of 2016, whereby local government can appoint a local government-owned company to be granted a business area licence directly. However, this is only possible for non-PLN business areas. The franchise system will not be limited to local government-owned enterprises and non-PLN business areas but also apply to community or other commercial entities (private companies) that can offer support even in business areas already allocated to PLN.

As new applicants, all the community and commercial entities described in the previous section (cooperatives, non-governmental organizations, village-owned enterprises, local government-owned enterprises, local government-owned enterprise partnerships, public–private partnerships and fully private companies) can participate as franchisees in this system. However, public services agencies cannot participate in the franchise due to the tariff payment it receives directly that makes it more complicated under the existing laws and regulations on public services agencies.

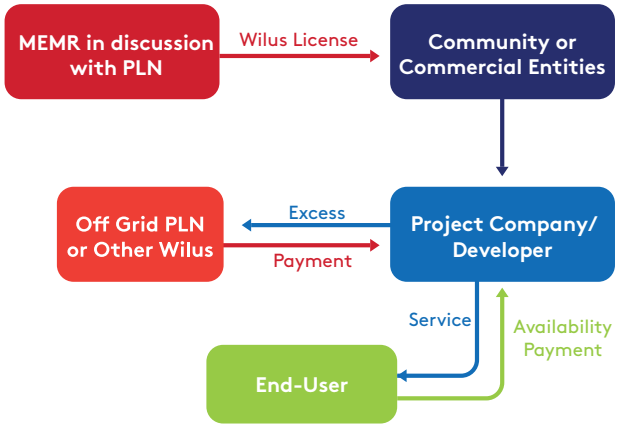
All the other company types collect the tariffs through the project company that also builds the power plant or grid point extension to provide electricity services directly to the end-users following PLN guidelines and licence requirements. The guidance guarantees that franchisees use the standardised technology, meet PLN's service quality standards and fulfil their reliability criteria. This will extend the technical sustainability achieved in all previous models.

Franchisee selection would normally involve competitive bidding so that PLN obtains the lowest price for electricity but with high quality services. For consumer tariffs, the electricity supplied within a PLN business area can be regulated to follow the PLN tariff (with adjustments over the operational time). The franchisee can then obtain two types of subsidies to compensate for any shortfall – a capital subsidy and an operational subsidy. The franchise model also encourages the use of blended finance (if any viability issues arise).

Projecting demand is an issue in off-grid electrification plans. Companies faced with an unexpected drop or surge in demand may not have done adequate initial market studies. Therefore, to maintain demand, it is possible for a business area licence owner to sell excess electricity either to the PLN off-grid system or to another business area owner. MEMR will need to issue a new regulation to clarify the situation in these cases. This will change each off-grid system into a mini-grid. However, this is an idea to be explored further in a later study.

In a franchise system, the process of build–operate–own–transfer ensures that all the assets will be transferred to PLN or local government. This creates a win–win solution for PLN that obtains assets freely while fulfilling its responsibility to electrify whole country.

Exhibit 6-13: New approach to business area licences: franchises



Model description	Franchise
Tariff collection	Project company
Asset ownership	Cooperative/NGO or project company
Operation and maintenance	Project company
Subsidy delivered	Capital and operating expenses
Business area licence	Licence granted by MEMR to community/commercial entities
Example	None

A summary of all the proposed business models is outlined in Exhibit 6-14.

Exhibit 6-14: A summary of off-grid business model options

Licence Model	Business area licence to PLN			Business area licence by applicant request							Licence by franchise system
Models	**Small independent power producer**	**Rental**	**Joint operational cooperation**	**Public services agency**	**Village-owned company**	**Cooperative/ non-governmental organization**	**Local government owned company**	**Local government owned company–partnership**	**Public–private partnership**	**Fully private**	**Franchise**
Tariff collection	PLN	PLN	PLN	Public services agency	Project company	Project company	Project company	Project company	Project company	Project company	Project company
Asset ownership	Project investor/ developer	Project Investor	Project investor/ developer	Public services agency	Project company	Cooperative/ NGO	Project company	Project company	Project company	Project company	Communities or project company
Operation and maintenance	Project investor/ developer	PLN (operation only)	PLN (both operation and maintenance)	Contractor	Project company	Project company	Project company	Project company	Project company	Project company	Project company
Subsidy delivered	PLN tariff	PLN tariff	PLN tariff	Capital and operating expenses	Capital and operating expenses	Capital and operating expenses	Capital and operating expenses	Capital and operating expenses	Capital and operating expenses	Subsidised tariff	Tariff, capital and operating expenses
Business area licence	No need	No need	No need	Apply	Apply	Apply	Apply	Apply	Apply	Apply	Granted
Commercial example	Clean Power Indonesia Biomass project on Mentawai island	None for renewable energy but some for diesel generators	Biogas and biomass power plant in West Sumba (cooperation between directorate general and PLN)	None	Grants only, no commercial entity yet	Ibeka project in West Java	None	Jambi province and the SUN cooperation (business area application turned down)	PGN-MEMR public–private partnership for residential gas pipeline	Electric Vine project in Papua	None

Business model evaluation criteria

The criteria listed in this section answer questions about the replicability, durability, effectiveness and timeliness of the off-grid business models. Replicability is defined as the ability to roll out and scale up the model in remote regions. Reliability of the electricity service to customers and whether it will last over the project's lifetime reflect the durability of the model option. Effectiveness and timeliness are paired as key factors in implementing the business models. The business model should be executed effectively using the current framework without needing radical changes and must be in place in good time. New business models may take longer than expected but if they take too long, they will not be considered.

Criteria 1: Institutional setting

Off-grid electrification planning and implementation that involves multiple parties and stakeholders requires a cohesive institutional framework. This study identifies at least five groups of key stakeholders concerned: central government, PLN, local governments, village administrations and informal leadership figures who are involved and coordinate directly with off-grid projects. As the only utility supplier in the country, PLN is involved in all aspects of the power supply business, including off-grid electrification. Local governments in this framework include the provincial and district governments who also have the power to disburse the state budget at the local level. As all off-grid electrification takes place in villages across the nation, the village administration and its informal leadership have a direct relationship with the projects.

The business area licence is the first sub-criterion we analyse for all the business models. We thus discuss the interactions of the main actors under the current policies and regulations particularly in dealing with the business area licence. To evaluate institutional capability, we examine each party's capacity and competency in setting up an off-grid electricity business.

Criteria 2: Subsidy presence

Achieving universal access by providing electricity to the remaining unelectrified households in off-grid regions is technically and financially more difficult than it was for those households situated within reach of the grid or the grid extensions. Any off-grid power supply needs subsidies to cover large investments and high operating and maintenance costs for the sake of reliable and flexible systems. Communities living in rural and remote areas also have limited access to economic and commercial activities. Against this background, every business model choice requires the subsidy from the government to offer these services. The government needs to be present to deliver these basic needs for all its people. Each off-grid business model elaborated in this chapter explores various government subsidies. The subsidy may secure capital and/or operational expenditure for the off-grid project. We analyse the model options and explore particular subsidy forms and mechanisms.

Subsidies can have clear Gender and Inclusion (G&I) benefits when low-wealth and female-headed households can access electricity subsidies or benefit from lower electricity tariffs.

Criteria 3: Sustainability

An off-grid project needs to sustain the following four aspects of the business: technical, financial, economic and social. Technical sustainability is demonstrated by the company being able to offer a reliable electricity service. This involves delivering the electricity as planned and maintaining the equipment for optimum performance. A healthy cash flow, either from tariff revenue or other indirect incomes, is a gauge of the financial sustainability of a project and ensures the service is continuous and without financial issues. In a broader sense, economic sustainability can be measured by the community's ability to keep paying the electricity bill and the customers' willingness to pay these bills. This dimension is closely connected to how much electricity the community uses and how productively. Thus promoting productive activity needs to be embedded in the business model. Without economic sustainability an off-grid service provider will only generate income from the service on a temporary basis. Social sustainability is evident in the community's sense of ownership of the off-grid project, their level of social engagement and whether the price or model is acceptable. This aspect may rely on community involvement, the presence of a subsidy and interlinks among the other three sustainability factors that occur in any business model. In one option, this may be one factor that supports other sustainability aspects. In another option, one or more aspects cannot be separated due to its model characteristics. We analyse four dimensions of sustainability in each off-grid business model.

Using these criteria, we assessed each business model through a risk analysis process that covered three stages: identification, assessment and risk appetite or tolerance.

The first stage involved identifying the facts and experiences from relevant stakeholders. The MENTARI team collected data from both past and ongoing off-grid programmes, publications, webinars and interviews. Through this process we found, for instance, that only a few village-owned businesses have adequate technical capacity in the electricity business.

In the next stage the team verified the data and assessed what level of potential risk was within the parameters through an internal review within the team and in consultation with local experts. The discussion included research experts from the Climate Policy Initiative and the Institute for Essential Services Reform. Each model was evaluated based on the inherent risk that was brought to the project under each criterion and sub-criteria. Each was scored from 1 (high risk) to 3 (low risk) and all were equally weighted before the final score was summed up to compare the different models. We went through the following process for each criterion:

From an institutional aspect, we evaluated a low risk (3 points) when models scored well on the following: the ease of obtaining the business area licence; the party's capacity to run the business model; the simplicity of the institutional process; and high participation from relevant stakeholders. Divergence from these scenarios was regarded as medium risk (2 points) or high risk (1 point).

On the subsidy, a high certainty of obtaining a subsidy was considered as 3 points while uncertainty commanded a higher risk and fewer points. The total absence of subsidies for licence holders was assigned as high risk (1 point).

Finally, from a sustainability perspective, we considered a low-risk profile as having high

technical capability within the organization with healthy cashflows, relevant local economic impact and close engagement with the local community.

The third stage to assess the risk appetite and tolerance is not yet completed and not part of this initial study. This will be included in the next update of the business models study when we discuss the models more comprehensively and from a holistic perspective. At this later stage we will also consider some business models that MEMR has requested we examine to assess the risks and their potential to be replicated nationally.

6.3 BUSINESS MODEL EVALUATIONS

The evaluations of each business model against the criteria are presented in this section.

State electricity company – PLN business models

Small independent power producer

The small independent power producer (Micro PPP) model does not require a business area licence. PLN holds the electricity concession and plays the central role in providing rural electrification while any private involvement is through a power purchase agreement. Thus, this regulatory sub-criterion poses a low risk. PLN also has extensive experience with independent power producers through their large-scale on-grid services therefore it easy to set up the institutional arrangements. Guaranteed government support using the power purchase agreement framework puts the subsidy presence in the low risk level too.

All four aspects of sustainability have low risk in this business model. From the technical point of view, PLN supports and ensures a steady power supply for the end-users. The independent power producer is also assumed to be in compliance with all the PLN quality standards. From the financial and economic perspectives, it is in the project developer's own interests to keep communities' business and productive uses of electricity going well and growing. Long-standing experience will ensure the power producers' financial flows and ensure they can collaborate with PLN to ensure positive economic impacts for inhabitants. The subsidised PLN tariff maintains the households' willingness to pay, assuring a low risk. PLN's involvement and the simplicity of the model for local communities are advantages and mean that social acceptance is at low risk.

Rental

Similar to the small independent power producer model, the rental model optimises close cooperation with PLN. With this premise, the regulatory framework and institutional capacity poses a low risk. A low risk also applies to subsidy allocation because the government supports the PLN tariff.

A central role of PLN in this model is to ensure minimum risk to any private entity interested in the rural electrification business. This study assumes that PLN involvement and its quality standards guarantee the technical aspects of the project. Compared to the previous model, this business option has a medium risk for the financial and economic aspect. Renewing the agreement with PLN annually creates some uncertainty for the private entity concerned and

may affect financial activities in the long run. Rental may incur a risk, for example, if the machines are not running well due to low maintenance by PLN or the local community.

For economic sustainability, rental has a medium risk where the rental mode has a direct impact on productive use. Rental models are generally only for electrifying individual households and are more complicated when they relate to mini grids, for example. If the electricity is for domestic purposes, less productive use is possible, and the economic impact is not perceived as community development. From the social perspective, if the rental model is targeted at individual households (not through a mini grid), PLN needs to ensure the model is socially acceptable. This may be challenging initially since the rental model can be interpreted as having local ownership of the power plants. However, the long-standing experience of the local PLN offices can ensure as low risk as possible.

Joint operational cooperation

The example of the joint operation cooperation between the Directorate General of New, Renewable Energy and Energy Conservation and PLN is a special case since the assets were built before the cooperation was signed. Nevertheless, we consider the joint operation model replicable with the prospect of being extended through a well-thought-out management set-up from the outset.

In this cooperation model, PLN still owns the business area licence which means a low risk for the regulatory setting. However, PLN has more responsibilities than in the independent power producer model as it operates and maintains the project. Unlike in the rental model, this model is based on a lifetime contract and private investors or developers are not obliged to maintain and deliver the service successfully to the end-users. The investors provide the capital and develop the plant. Thus, a joint operational cooperation with a long-established and experienced private company poses a low risk for institutional capability. However, a transition of the concept to include private companies or investors who might be new to government and lacking in experience may pose a medium risk at the beginning of the project. The joint operational cooperation will be easier to implement if investors accept the model and are ready to invest. Government support is also secure and in the form of subsidised tariffs putting the subsidy allocation risk also at a low level.

The technical aspect of this model poses a low risk with an experienced project investor or developer and support from PLN. Financial and economic sustainability is also at the low risk level since the secure partnership with PLN and its commitment to promote productive uses of electricity will ensure these dimensions. Nevertheless, the private company's efforts to stimulate economic activities must be included in the business-to-business agreement. As long as the government and PLN support are assured, the social sustainability will be at the low risk level.

Public services agency business model: design–build–operate contract

Although public services agencies are set up in many sectors, such as development, health and education, they are yet to be established for off-grid electrification. However, the process of creating new public services agencies within this specific sector may take some years in discussing the options and building the necessary institutions. These issues may challenge the process and create high risk in the sense of institutional fit. Furthermore,

public services agencies still have to apply for a business area licence to deliver their services. In terms of the subsidy, government support would come through capital investment and regulated tariffs. Public services agencies need internal mechanisms controlled by regulations to fix their tariffs, but they also need to engage with the local communities in this process.

Out of the four sustainability aspects, financial and economic elements are key in sustaining this off-grid business model. Contractors are thus obliged to promote productive uses of electricity as part of their procurement agreement to ensure economic sustainability throughout the lifetime of the project. Using a competitive tender system will ensure government selects experienced contractors with the technical capabilities to provide reliable services. The model will also ensure the financial and economic aspects. Thus, the technical, financial and economic sustainability dimensions are all considered at low risk in this model. However, the social aspect may be at higher risk in the public services agency model if the local community struggle to accept it. If the process is well organised and follows the example of the National Programme for Community Empowerment it could work but replicating this approach will be challenging at the outset, leaving social sustainability at the medium risk level.

Community-based business models

Cooperative and other non-governmental organizations: through business area licences and franchises

Obtaining a business area licence with limited support from central and local governments could prove challenging in these models but in terms of institutional capacity, cooperatives and non-governmental organizations generally have the experience and capacity to run an off-grid service company. Many established cooperatives in Indonesia have the entrepreneurial spirit needed to become service providers. Also, national and international non-governmental organizations are generally familiar with rural electrification projects and the processes involved, from preparing the project and mobilising the community through to implementing it and promoting productive uses of electricity. Nevertheless, the limited sources of government support in this model puts the subsidy criterion at medium risk.

If MEMR applies a franchise system, it will relax the business area licence procedures and grant licences more easily to cooperatives or non-governmental organizations that qualify after competing for the franchise. The subsidy will also be part of the package when the licence is granted and local or national banks can become intermediaries for the organizations concerned, depending on their scale and experience (see chapter 7).

The organizations' expertise in rural electrification increases the projects' technical sustainability and reduces the risk of any operational and maintenance failure. Furthermore, the strong role that non-governmental organizations and cooperatives have played in community empowerment will help promote productive uses of electricity and ensure economic sustainability. The financial aspect in this model may be at medium risk if the organizations cannot raise the capital investment but on the operational side, they are likely to have the necessary capability. This also means the economic impacts will be guaranteed. Cooperatives and non-governmental organizations usually have long-standing experience of engaging with their local communities and this will have a positive impact on the social sustainability of the project.

Commercial business models

Village-owned enterprises through business area licences

Under the framework of MEMR regulation No 38 of 2016, the provincial government can nominate any business entity, including village-owned enterprises, to be granted a business area licence. The enterprise has to create a legal unit, such as a cooperative, company or limited partnership to run its activity of selling electricity.[43] This is in line with the Law of Villages No 6 of 2014.[44] Institutions need to be capable and experienced to prepare for and successfully navigate the long bureaucratic process involved and village-owned enterprises tend to have limited human resources available to manage the process. This low–medium capability of village administrations will also affect disbursement of the subsidy, particularly from village funds, so that subsidy allocations may be at medium risk.

Once again, if MEMR applies a franchise system, it will relax the business area licence procedures and grant licences more easily to village-owned enterprises and their project companies that qualify after competing for the franchise. The subsidy will also be part of the package when the licence is granted through a suggested subsidy option (see chapter 7), village-owned enterprises can become the intermediaries for their project companies so the subsidy is easier to access.

The sustainability factors, particularly for the technical and financial aspects, depend on the quality and accuracy of the studies conducted before the off-grid project starts. This may compromise inexperienced village-owned enterprises that cannot supervise this process and put these two aspects at high risk. However, these enterprises have an in-depth understanding of the livelihood needs in their communities and know how best to promote productive electricity uses. These productive activities can be embedded in the process of establishing the project company and are likely to have a positive economic impact on the community. Financial sustainability will be at high risk if the village-owned enterprise depends on the government subsidy, has limited allocations from the village funds and no alternative source of finance. From the social perspective, village-owned enterprises tend to be close to their communities and social engagement and support will be at low risk.

Local government-owned enterprise

Although provincial and district governments are actively involved in awarding business area licences, this model still has medium risk in the regulatory framework because the main mandate to achieve the universal access target is still with PLN. In practice, local governments have limited roles and responsibilities in this effort. Established public institutions and experienced local government-owned enterprises can support the project company executing the rural electrification project. Local budget disbursement for the initial investment can be a crucial milestone. In addition, the non-subsidy business area licence scheme as a preferred option under this business model may take some time since local interests and parties need to agree on the electricity tariff. These processes will put the subsidy criterion at medium risk.

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43 This is relevant to village-owned enterprises where it is defined in Ministerial regulation No 39 of 2010.

44 Available at: http://www.dpr.go.id/dokjdih/document/uu/UU_2014_6.pdf

Again, if MEMR applies a franchise system, it will relax the business area licence procedures and grant licences more easily to local government-owned enterprises and their project companies that qualify after competing for the franchise. The subsidy will also be part of the package when the licence is granted. Through a suggested subsidy option (in chapter 7), the local government-owned enterprise or regional banks can be intermediaries for its project companies, reducing the risk in accessing the subsidy.

Local government-owned enterprises can only support their project companies in terms of budget and administration but not in dealing with technical problems. This can put the technical sustainability aspect of the project at medium risk. With back-up finance from the local governments or local banks, local government-owned enterprises still need to carefully assess the financial and economic sustainability of their business. Comprehensive studies conducted at the beginning of the project can help detect any issues in advance and provide long-term solutions. In a non-subsidised tariff scheme, boosting productive uses of electricity is fundamental in maintaining demand and ensuring customers can pay the unavoidable higher tariffs. The financial aspect is at medium risk because of the enterprises' dependence on the local budget to compensate for its non-competitive tariff. Local banks may provide support to lower the risk. However, against this background, the financial and economic sustainability of the project are both at medium risk in the local government-owned enterprise model. With regard to social sustainability, an approach from the local government may be accepted by local communities and encourage their engagement.

Local government-owned enterprise partnership

Partnerships between local government-owned enterprises and private companies may speed up the process of securing a business area licence. However, the process needs coordination and with the final decision coming from outside the partnership, this may still impede implementation. By optimising the different expertise brought to the partnership by the two parties, the model can be strengthened, becoming low risk for institutional capability. In the subsidy criterion, this model option has a similar risk to the local government-owned enterprise model. Although the private sector can play a bigger role in making the initial investments, they still depend on tariffs being regulated by the local government. This situation puts the project at medium financial risk.

If a franchise system is applied, while the challenges are the same as for the local government-owned enterprise on its own, these partnerships have a higher success rate in bidding for a business area licence.

Technical support from capable private institutions can reduce the risk of operational failure and thus result in low risk for technical sustainability. An integrated approach to promoting productive uses needs to be part of the partnership agreement to reduce the financial risk as much as possible since the private company must ensure financial sustainability as their main interest. Similar to local government-owned enterprises, the social aspect of the partnership may benefit from the local government input to ensure the project is accepted by local communities and encourage their engagement.

Public–private partnerships

In terms of institutional setting and subsidy criteria, the public–private partnership model faces similar risks to the local government-owned enterprise partnership model. Public–private partnerships pose a medium risk in terms of regulatory fit due to the difficulties in securing a business area licence. These partnerships may also be at high risk in terms of acceptance and institutional capacity if a number of entities participate and the bureaucratic requirements multiply. Evaluating access to subsidy, this model has more options for funding, for example, through the periodic availability payment from the local budget. In practice, this scheme has never been used for a rural electrification project. This condition puts these businesses at medium risk in terms of government support or subsidies.

As with the other models, if MEMR applies a franchise system, it will relax the business area licence procedures and grant licences more easily to the public–private partnerships and their project companies that qualify after competing for the franchise. The subsidy will also be part of the package when the licence is granted. Through a suggested subsidy option (see chapter 7), project investors or national banks can be intermediaries for the project companies. The chances of accessing a subsidy and being selected through the bidding system are higher for these public–private partnerships.

A project company in this model is owned by the local government and the private sector and they have experienced and qualified institutions to deliver the electricity service. This results in a strong technical foundation and financial sustainability. Furthermore, technical assistance from MEMR improves the project's technical sustainability. Direct participation from the private companies and their collaboration with local government can guarantee activities to promote productive uses of electricity. Local governments may also drive communication with local entities to ensure the project is well accepted and supports the off-grid project.

Fully private companies

The fully private model carries a high risk for the the business area licence criterion. While many other entities have some connection with government at different levels or with the PLN office, private companies are likely to struggle to join the government effort to achieve universal electricity access. Equally, under the current rural electrification framework, private companies cannot access government support from either the subsidy or non-subsidy systems. Overcoming these two issues will be a major challenge. In contrast, the fully private model shows low risk for capability since established companies can support the project company through their experience and their financial back-up.

If MEMR applies a franchise system and offers business area licences through a simplified procedure, the private project company may obtain the licence by making a competitive bid. The subsidy too will be included in the licence package. Through a suggested subsidy option (in chapter 7), project investors or national banks can become intermediaries for the project companies helping to circumvent current procedures and access the subsidy.

A project company in this option may have the solid technical know-how to prevent any operational failure so the model poses a low risk for technical sustainability. Financial and economic aspects have low risk in this case too. Furthermore, any private company is used to encouraging growing economic activities in their service areas. However, the absence of subsidies and support from government entities or utilities may also put the social aspect at high risk.

Franchise system

As discussed under the various business entities, the franchise system means that MEMR releases the remaining business areas to be handled by franchisees (cooperatives, non-governmental organizations, village-owned enterprises, local government-owned enterprises, local government-owned enterprise partnerships, public–private partnerships or fully private companies). Institutional capacity in this concept is easy to build and implement while PLN's procurement procedures and contracts are key factors in this model. The Directorate General of Electricity and Directorate General of New, Renewable Energy and Energy Conservation have long-standing experience in bidding contests for renewable energy projects. If PLN and the directorate generals establish effective procurement criteria, technical standards (from their own or other independent power producer experiences), comprehensive guidance and competitive procurement processes, this franchise model can boost access to reliable electricity services in rural areas.

The franchise system will also ensure that all franchisees have access to the subsidies. This will lower the risk by at least one level for the stand-alone fully private model. The remaining parameters for each community and for commercial entities remain similar to those under the applicant licence request system. Nevertheless, the legal perspective and implications need to be investigated if this franchise system is to open all the business areas up for development and issue long-term contracts to accelerate the electricity programme. MEMR will need to check the requirements for a successful franchise system and establish the appropriate regulations. Therefore, this study will not evaluate the franchise system as an option until the Directorate General of New, Renewable Energy and Energy Conservation and MEMR are ready to proceed.

A summary of the evaluation criteria e for each model is shown in Exhibit 6-15. Any criteria or aspect that we considered low risk was given 3 points, medium risk elements were given 2 points while any high risk criteria were given 1 point. In this evaluation, the 'regulatory' category refers to the business area licence. Each of the criteria has the same weighting at this point due to the subjectivity in establishing an agreed weighting system. The points are given only to select the best three models, without any subjectivity.

Exhibit 6-15: Evaluation of off-grid business models against institutional, subsidy and sustainability criteria

Payment to & operated and/or owned by	Business models	Institutional		Subsidy	Sustainability				Gross Total
		Wilus Permit	Intitutional Capability		TechnicalF	inancial	Economic	Social	
PLN	Micro-IPP	3	3	3	3	3	3	3	21
	Rental	3	3	3	3	2	2	3	19
	KSO	3	2	3	3	3	3	3	20
BLU	Design-built-operate-Contract	2	1	3	3	3	3	2	17
Community-Based	Cooperatives/ NGO	2	3	2	3	2	3	3	18
Commercial	BUMDes	2	2	2	1	1	3	3	14
	BUMD	2	3	2	2	2	2	3	16
	BUMD-Partnership	2	3	2	3	3	3	3	19
	KPBU	2	1	2	3	3	3	3	17
	Fully Private	1	3	1	3	3	3	1	15

Each model is analysed against the criteria and is defined into three levels of risk: Low risk Medium riskH igh risk

Highlights of the business model options against the evaluation criteria

Of the eleven business models, only the small independent power producer (Micro-IPP) (full points) emerges as an ideal business model under the current rural electrification framework.

Small independent power producer: In this model the producer cooperates closely with PLN through a long-term power purchase agreement to secure a reliable electricity service in the long term. No business area licence is required in this model as PLN still has the concession and plays the central role in providing rural electrification. MEMR and the Ministry of National Planning also agreed that this business model is the most feasible for off-grid projects. This also enables the subsidies for off-grid services (via the PLN tariff). All four aspects of the sustainability criteria are in the lowest risk category in this model. PLN will ensure a steady power supply to end-users and ensure the independent power producer complies with all quality standards. The project developer is also interested in maintaining local community businesses and promoting productive uses of electricity to increase uptake and future demand. PLN's involvement with local communities and better social acceptance is perceived as low risk.

From a G&I perspective, the low risk assigned to access to subsidies benefits low-wealth and female-headed households to an extent (although electricity subsidies do not recognise these two groups as requiring subsidies specifically). Potential improvements to ensure project developers specifically integrate G&I are adjusting PLN's bidding documents and PPAs to integrate G&I requirements. This can include requiring IPPs to include G&I considerations during project design (e.g. inclusive meaningful participation of women and marginalised

group in project consultation and FS, developing G&I action plans), project implementation (e.g. hiring female employees), and monitoring and evaluation (e.g. collecting gender- and wealth-disaggregated data). For more information see section 6.4.

However, this model is conventional and may not offer a creative enough solution to the rural electrification problem. Looking at the other models, however, each has its own merits or problems in certain criteria.

This study identifies two other promising business models that are low risk, the joint operational cooperation model (20 points) and the local government-owned enterprise partnership model (19 points). Promising means the model is easy to implement under the current regulations and can be set up quickly. The models also have the lowest risk for the three main criteria compared to the other models.

Working with PLN support, the joint operational cooperation is a primary alternative for off-grid projects. Meanwhile, without direct cooperation with PLN, the local government-owned enterprise partnership model is also a good solution under the current framework.

Joint operational cooperation: PLN still owns the business area licence but retains more responsibilities than in the independent power producer model since it operates and maintains the project. Working with an established and experienced private company poses a low risk. We assigned a medium risk to the institutional capability sub-criteria since adapting this model to private investors might prove difficult in the short term. The sustainability aspects are in the low risk level as well. As long as government or PLN support is assured, the social risk is also low.

The G&I impact will be similar to described under the micro-IPP section.

Local government-owned enterprise partnership: Although provincial and regional governments are involved in defining the business area and licence, we assigned this model as medium risk in the regulatory framework since the main mandate to achieve universal access is from PLN. The subsidy is medium risk as it may take some time to agree on the electricity tariff among local interests and parties.

From a G&I perspective, the medium risk assigned to subsidy means G&I risks might be higher than for micro-IPP and KSO as BUMD models tend to have higher electricity tariffs, reducing the inclusivity of the energy service for low-wealth households. The higher tariffs result from the fact that the BUMD model is regulated by the local government, and not based on standard subsidised electricity tariffs from government to PLN. Yet, on the social criteria there is clear G&I potential where 1) the process of establishing the supervisory board and legal entity for the BUMD ensures women participation and representation in meaningful manners, and 2) when electricity beneficiaries mapping and tariff setting identifies the most vulnerable households and ensures they can afford the electricity services. However, previous programmes have shown that these G&I benefits do not materialise automatically, primarily due to cultural and social gender stereotyping, and hence require specific external involvement and capacity-building.

These two models will be discussed further with the Directorate General of New, Renewable Energy and Energy Conservation to understand ministerial preferences and seek feedback. Any models selected between MENTARI and the Directorate General of New, Renewable

Energy and Energy Conservation will be comprehensively analysed in a further study that will address the limitations of the current scope of work and expand the discussions on financing mechanisms, institutional building and detailed phases of preparing and implementing the projects. Details of how gender equality and social inclusion activities can be integrated with these models' options will also be included in the upcoming study.

6.4 INTEGRATING GENDER EQUALITY AND SOCIAL INCLUSION IN OFF-GRID BUSINESS MODELS

Building on the G&I chapter in the new rural electrification approach which outlines the reasons to integrate G&I considerations in a new rural electrification approach and defined the key challenges in doing so, this sub-chapter further analysis where G&I entry points can be established in the precondition requirements for an off-grid installation (see exhibit 6-1) and the discussed off-grid business models. We focus on the three preferred business models – Micro-IPP, KSO and BUMD – as well as BUMDes as in the MENTARI Demonstration Project the model used will be a BUMDes / KSO model.

Key G&I precondition requirements for an off-grid installation

Exhibit 6-1 showed an overview of the key precondition requirements for off-grid installations. This includes 1) Comprehensive studies, 2) Economic and Community Development through proven Productive uses of Energy (PuE), 3) Wilus License and 4) starting the off-grid installation. In these requirements, there are various G&I considerations that are discussed below:

Comprehensive (pre-feasibility, demand & WRP studies) studies should specifically assess the needs, livelihood activities, incomes, businesses and skills of women, low-wealth and marginalised groups. This is crucial to both make an accurate demand forecast, and ensure all groups are able to pay for electricity services.

Economic and Community Development through proven PuE assessment should analyse gender- and wealth- specific opportunities to provide livelihood, job, income, productive use of energy and business opportunities for women and marginalised groups. Not only to ensure access is inclusive, but also to address the issue of underestimated energy demand. Growing these groups' energy demand will help address sustainability issues of off-grid systems due to low demand. Women and marginalised groups involvement should start at planning stage, and continue through construction, management phases and evaluation (ESMAP, 2018).

In conducting consultations, women and vulnerable groups' participation should be meaningful and not only be about the number of female attendants in the local/village meetings. Women and marginalised groups feel confident to speak, are heard, and they have influence over decision-making. Meaningful participation of both women and vulnerable groups will ensure they receive concrete benefits from the project, either by being employed for construction, operation and maintenance, or management, or as the project beneficiaries.

Private sector participation in power generation projects is a good window for opportunity for women's entrepreneurs to get involved in renewable energy projects. Most women and other vulnerable groups in remote areas are mostly working for the informal sector and have micro and small businesses. An exercise or pilot of gender sensitive business models, which analyses in which sectors women mostly receive an income and providing target capacity building and access to finance services can create a format of women's benefit from productive uses of energy, income and employment opportunities in the renewable energy sector.

7. POLICY RECOMMENDATIONS

Recommendations for the rural electrification policy focus on the current framework of MEMR regulation No 38 of 2016 which, as discussed earlier, has hindered development of off-grid electrification in Indonesia since it was adopted. While the regulation opens participation to local governments and private entities in efforts to achieve universal access, in practice the procedures required have blocked their contributions. To address these issues, this study recommends policy under two main sections: the business processes of off-grid power supply, including licences and implementation, and the subsidy procedures.

7.1 BUSINESS PROCESSES AND THE BUSINESS AREA LICENCE

For the business process of implementing a small-scale power supply in rural areas, the study identifies three main points in reducing risks for the business models with regard to the institutional setting.

Clarity in business area criteria and processing steps

Whether it involves a subsidy or non-subsidy arrangement, the process to apply for and obtain a business area licence is complicated and time consuming. The delay between applying for approval or permission from the regional government and its representatives to being granted a licence is nine months or more with high levels of uncertainty[45] and this discourages non-PLN entities from investing in rural electrification projects. In practice, a private entity has to complete so many steps even in the initial phase, including for example, submitting a coverage area proposal (see Exhibit 2-1 and Exhibit 2-2). Internal processes in the ministry involving close coordination with PLN need to be more transparent. Business area licence applicants have the right to know, for example, why PLN is taking over the business area concerned, why MEMR rejected their application and when PLN will be able to build the electricity access. If PLN is likely to take longer than non-PLN entities, MEMR needs to use a fair principle of first come, first served. Alternatively, MEMR can create a business area map showing PLN and non-PLN areas and provide special regulatory frameworks to promote the non-PLN areas for private investment.

Business area applicants want to be able to monitor the status and location of their proposals at any time, but we also suggest that the bureaucratic processes involved in getting the business area licence can be tightened up and simplified. The Directorate General of Energy needs to play a more central role in granting the licences and this will require capacity building for officers on how to review and evaluate business proposals, as stipulated in article 6 of MEMR regulation No 38 of 2016.

Identifying selected business areas to accelerate off-grid power solutions

To speed up the business area licence process, government needs to revisit the minimum size requirement for an off-grid power business area. A district in the context of rural electrification is still a relatively large area. Moreover, according to the official explanation in the Law on Energy of 2009, article 10, paragraph 5, business areas should not be defined

45 Based on interviews with business area licence applicants.

in terms of government administrative units. Based on the communication pipeline that the National Programme for Community Empowerment successfully implemented at village level, villages or smaller administrative units can work for the rural electrification programme. This programme was implemented before the Ministry of Energy and Mineral Resources established the business area system and it shows that off-grid electrification can be supported and work successfully without these business areas.

Furthermore, finding a district completely without PLN access is a challenge whereas unelectrified areas at the village level are easily evident in the PLN studies. According to the current regulations, if one village is unelectrified while other villages have full access to PLN electricity, an off-grid supplier cannot apply to fill that gap.

Therefore, this study suggests village or other small administrative units as the new business areas for off-grid suppliers. The village or small administrative units (or no definitive government units) will mean that off-grid suppliers can take on more areas (more villages in different districts). Thus, determining business areas by following administrative boundaries can replaced by packages of non-electrified areas or villages (listed by MEMR) or through a contract service to PLN. This will boost the rural electrification programme.

Competitive selection and applying the geospatial least-cost plan

Article 8 in MEMR regulation No 38 of 2016 states that the process of selecting companies to supply electrification in a particular business area is to be conducted on the basis of a competitive tender. However, there are no detailed guidelines for this procurement procedure and this lack of clarity is a major obstacle in efforts to increase private participation in the off-grid business. Guidelines for the competitive selection process are therefore a priority since using this tendering approach helps to ensure the best value for money. Nevertheless, to ensure efficient services the competitive bidder must comply with the standards and quality of electricity services laid down under existing regulations and in the PLN standards.

Competitive selection is suitable only for a few business models (for example, independent power producers, franchises, rentals and public services agencies). Other business models will continue to submit their applications through the existing channels. Furthermore, the study highlights the need to integrate geospatial least-cost planning into the procurement process. Implementing MEMR regulation No 38 of 2016 requires that PLN delineates the areas it wants to retain for its own operations and identifies areas that can be released to the private sector. Coordination between PLN and local governments, as suggested in article 5, should refer to the least-cost plan prepared by PLN. Both PLN and non-PLN entities can then use the geospatial planning files from this analysis to define the respective areas. The competitive tendering process thus also allows government to implement the geospatial least-cost approach.

The current procurement requirements tend to mostly consider environmental aspects but but do not extensively cover social and gender aspects. Requirements should include encouragement of women-owned businesses, women's labour participation, gender-sensitive labour standards, health and safety guidelines, and gender and social safeguarding standards.

Clarity on roles and responsibilities of local governments

In every unelectrified area in Indonesia, PLN has the first mandate to provide electricity services. At the same time, local governments, as mandated in some regulations, must proactively pursue rural electrification projects for their areas that are still unconnected. This shows that each party's roles and responsibilities in this effort need to be clarified through subsidiary regulations and guidelines. There are still no clear guidelines that local governments can follow in pursuing a business area licence, for example, on preparing a rural electrification proposal or nominating a business entity for a licence. Other line ministries, such as Ministry of Home Affairs and Ministry of Villages also need to be involved in formulating these guidelines to ensure everyone's interests are taken into account. However, the guidelines will need to be accompanied by capacity building for local governments on how to use them.

In addition, if local governments fund the subsidy mechanism for rural electrification projects from their own budgets, this will raise awareness and promote a sense of local ownership for these projects. Many projects established using the state budget lack input and maintenance from local governments. However, if local governments use their own budgets for the rural programmes they are likely to give them priority. This should have a domino effect and encourage local companies to participate in the projects or offer other kind of support.

Advanced key performance indicators

In this study the key performance indicators for off-grid business models incorporate the following factors: productive economic uses; gender equality and social inclusion impacts; and sustainability. We measure sustainability under four categories: technical, financial, economic and social. The Directorate General of Electricity and Directorate General of New, Renewable Energy and Energy Conservation can use these sustainability and gender gap indexes to ensure sustainability and inclusivity in their efforts to achieve 100 per cent electrification. Applying the performance indicators also responds to the criticism that some off-grid projects offer unreliable and unsustainable services for rural areas. The selected business models can be adopted or adapted in practice and streamlined by adjusting the ministerial key performance indicators to consider inclusive productive economic uses, gender equality and social inclusion impacts, and project sustainability.

7.2 SUBSIDY MECHANISMS

General recommendations

Reliable legal and institutional framework

Stable and reliable legislation is crucial for the private sector to participate in the off-grid rural electrification sector. Project developers and private financing institutions will only be interested if their investments and the expected returns can be ensured. With a reliable legal framework, private developers as well as public power utilities seeking to develop an off-grid project will be more likely to secure long-term commercial or soft loans.

Most lending institutions have little experience with the off-grid electrification business and may need to be encouraged to finance such projects through credit enhancements to reduce the perceived risks. Credit enhancement is a strategy to reduce the credit risk of a business and an example in this context would be providing a government-based interest-free loan to the commercial finance institutions that then finance the rural electrification projects at low interest rates.

Subsidy budget allocation

Budget allocations for off-grid subsidies need to be earmarked in advance and the portions sourced from different government budgets should be integrated so that off-grid projects are sustainable and economically viable. For example, the state budget and the specific allocated budget (managed by the Ministry of Finance) combined to fund the transmission network, the local government budget (managed by Ministry of Home Affairs) funded the distribution line to community houses and village funds (managed by Ministry of Villages) funded the operations and maintenance costs.

Subsidies for connection costs and electricity tariffs can have clear G&I benefits, where it can improve affordability of low-wealth households. However, we suggest that subsidy delivery should undergo a thorough gender and inclusion assessment to identify the challenges for the most vulnerable groups (female-headed and low-wealth households) to access the subsidies, how local institutions can assist these groups, and potential other support from local government.

Involving micro-finance and cooperative institutions

Local banks and especially microfinance institutions can offer preferential micro-credits for rural villagers to pay for electricity services (for example, down payments on a solar home system) and to initiate or expand their productive activities. This increases the number of customers and the volume of plant use for the off-grid power system, improving the financial viability of the project. The Ministry of Cooperatives will play a role largely by stimulating savings and loans for productive or income-generating activities and ensuring that these efforts target women and marginal groups.

A G&I opportunity under this recommendation is to providing loans or credit for productive and income-generating activities for women-owned businesses and cooperatives.

The subsidy mechanism needs to balance short-term and long-term needs and interests. For example, in the short term, the subsidies may respond to political interests or government budget mode limitations and, in the long term, they may be used to attract private sector involvement.

Transparent procedures are key in attracting the private sector and its know-how to participate in off-grid rural electrification projects. Unclear criteria and/or complex application procedures prolong the development process and increase costs unnecessarily, discouraging the private sector from investing in off-grid rural electrification projects.

Involving institutions

The Ministry of Energy and Mineral Resources needs to work with representative institutions to assess project risks, and manage and disburse the subsidies. These institutions can be: cross-ministerial task forces; public services agencies; special authorities or institutions with the specific function of managing the subsidy; or financial intermediaries.

Choosing the right type of subsidy

Subsidies are a burden on government budgets and as such are best kept to a minimum. Investment or connection-based subsidies are recommended choices since these are relatively predictable and are bound to physical implementation – whether they are used to finance capital expenses, operational expenses or both. Subsidies in each area will be different as they are set based on the gap between the capital and operational costs, and the tariff that people pay for each kWh of electricity. MEMR can also include geographical factors in assessing how many subsidies and what size of subsidy it should give in a particular area. For instance, the subsidy factor for rural areas on Java island may be set at 1.0 but in Papua it could be 5.0 or higher. Alternatively, subsidies in each area can be tendered if there is sufficient interest in the area.

Subsidy deliveries should be provided by a thorough gender assessment to identify different needs between men and women in relation to the subsidy objective. The gender assessment should also identify the challenges of the most vulnerable groups in accessing the electricity subsidies, the local institutions that might be able to assist these groups, and the potential support from the local government. A beneficiary mapping should include the most vulnerable women's groups such as poor female-headed households or other most vulnerable groups in the areas.

Model-based recommendations

The subsidy schemes implemented in the housing and agriculture sector (described in chapter 2) suggest several key components are required to implement a subsidy scheme successfully.

A clear legal and regulatory framework laying down the modalities and procedures involved needs to be established by both the sectoral ministry (in this case MEMR) and the Ministry of Finance as the government budget authority. In the three examples explained in section 2.3, the sectoral ministries are the Ministry of Transportation, Ministry of Public Works and Public Housing and the Ministry of Agriculture. Thus, the first recommendation is to establish a clear legal and regulatory framework for the ten off-grid business models (listed in chapter 6) and for the franchise system model with the aim of accelerating universal access to electricity in Indonesia. This framework will be an extension of MEMR regulation No 38 of 2016.

Intermediaries play a key role in assessing the project risk and running or managing the subsidy payments. Since both the housing and agriculture subsidies are based on lowered interest rates, having intermediaries who can assess the project credit risk is crucial. These skills are not among the required capacity or skills within the sector ministry. Thus, having eligible institutions (such as banks) involved and acting as financial intermediaries eases

the pressure on the sector ministry. MEMR can contribute to the process of establishing intermediaries by offering the institutions capacity building and training and visiting the project to monitor progress.

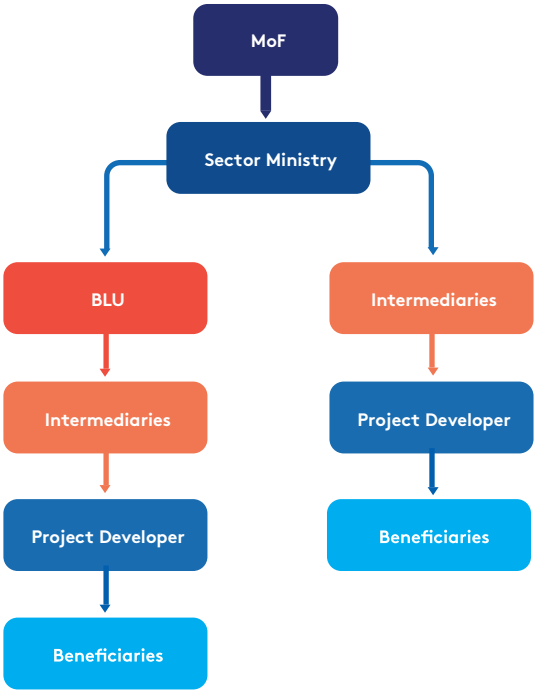
Learning from the Liquidity Facility for Housing Financing scheme, we recommend having an option to establish a public services agency to assist the sectoral ministry (MEMR) in disbursing the funds or subsidies and managing the daily operations.

The housing sector established a centre for housing financing as the public services agency to manage the funds and ease the burden on the Directorate General of Housing Financing under the Ministry of Public Works and Public Housing. The housing directorate was then able to focus on supervising the housing scheme and, from a wider perspective, making affordable housing available by developing appropriate regulations. One of the off-grid business models involves a public service agency and once MEMR has established a public services agency for this business model, it can use it to manage the funds or subsidies for nine other off-grid business models. Therefore, this recommendation applies to all business model types.

The final recommendation relates to the availability of the funds allocated by the Ministry of Finance. In the case of the non-energy sector and also the National Programme for Community Empowerment Green, having the subsidy allocated by the Ministry of Finance through legal regulations was key to ensuring that the funds were there and could be used. Also, the Ministry of Transportation example showed the value of having several alternative sources of funding, such as provincial or local budgets. Some of the off-grid business models involving private companies, village-owned enterprises and local government-owned enterprises, may benefit from having more options for alternative sources of funds. Thus, for private companies we recommend seeking capital subsidies or any concessional loans or grants from international or domestic parties. For village-owned enterprises, a dedicated portion of the village funds needs to be allocated with agreement between the enterprise and village administrators. This will mean that a subsidy for capital costs or operating expenses is always available from the village funds. For local government-owned enterprises, an allocated budget from local government may also encourage these enterprises to extend their services and electrify the unconnected villages through the subsidy.

A schematic of the subsidy scheme for off-grid electricity shows the possibility of adopting one of the subsidy cases either from the agriculture sector (Ministry of Agriculture) or from the housing sector (Ministry of Public Housing) (see Exhibit 7-1).

Exhibit 7-1: Two options for Institutional arrangements in off-grid subsidy schemes



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