



The Government of Nepal
Ministry of Energy, Water Resources and Irrigation
Alternative Energy Promotion Centre (AEPIC)
Making Renewable Energy Mainstream Supply in Nepal

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Zusammenarbeit (GIZ) GmbH

IMPLEMENTATION PROCESS GUIDELINE FOR SOLAR MINI-GRID SYSTEMS

*Implementation of subsidy-supported systems under Nepal's
Subsidy Delivery Mechanism, 2079 B.S.*

For use by units of the Local Government, Provincial Government, and
Federal Government

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Acronyms

AC	Alternating current
AEPC	Alternative Energy Promotion Centre
B.S.	Bikram Sambat
CREF	Central Renewable Energy Fund
DC	Direct current
DFS	Detailed feasibility study
EPC	Engineering, procurement, and construction contract
ESCO	Energy service company
FY	Fiscal year
kW	Kilowatt
LG	Local Government
NEA	Nepal Electricity Authority
O&M	Operation and maintenance
PFS	Pre-feasibility study
PPMO	Public Procurement Monitoring Office
RfP	Request for proposal
SMG	Solar mini-grid
SRC	Subsidy Review Committee
TRC	Technical Review Committee

1. ABOUT

This document provides comprehensive up-to-date guidance on AEPC's implementation procedures for subsidy-supported solar PV systems in Nepal. It outlines briefly the system design and related policies while referencing all relevant templates.

The processes presented here have been evolved over the years. They offer the best available fit between simplicity, transparency and clarity of roles apart from maintaining consistency with the prevailing federal rules and regulations concerning the implementation of renewable energy projects.

Representing a good practice approach, it is hoped that these processes may serve Local Governments, Provincial Governments and private developers as reference in the implementation of projects and as benchmark for formulating their own processes. Wider adoption of these procedures would foster a unified approach across the different levels of governance, which is what AEPC seeks to inspire with this publication.

2. USERS OF THIS GUIDELINE

The process chart that has been mapped is for projects supported by the Government of Nepal and in alignment with the Renewable Energy Subsidy Policy, 2078 B.S.

Note: Projects entirely developed and implemented by the private sector have not been mapped. However, various stages of the process map are relevant to the private sector for project execution.

The users that will benefit from project implementation process documents are described in the table below.

Table 1: Target audiences

Government	<ul style="list-style-type: none">▪ Aligned with the processes defined by the Alternative Energy Promotion Centre (AEPC) under the Subsidy Delivery Mechanism, 2079 B.S., the federal, provincial, and local governments can and should follow this guideline to implement solar mini-grid projects.▪ The responsible entity for each stage and document is defined in Figure 4.
Private companies	<p>Private companies who bid on and construct solar mini-grid projects can and should follow this guideline to align with requirements and improve service delivery.</p> <p>The responsible entity for each stage and document is defined in Figure 4.</p>

3. INTRODUCTION OF SOLAR MINI-GRIDS

The cumulative installed capacity of solar mini-grids including wind mini-grids reached 2,929 kW in FY 2021/2022¹. Almost all solar mini-grids are subsidy-driven. In the Renewable Energy Subsidy Policy, 2078 B.S., 90% subsidy of solar mini-grid cost (up to 250 kW_p capacity) is channelled by AEPC whereas, the remaining 10% is subsidized by the respective local government.

However, assessing the current landscape of involvement of private companies in solar mini-grids, the companies implement solar mini-grid projects mostly under engineering, procurement, and construction (EPC) contracts.

Solar mini-grids are promoted in remote regions with no power grid access and may be a viable solution for last-mile electrification where power grid access is not foreseen to be connected soon or construction of transmission and distribution may be uneconomical.

Analysing the recent trend in cumulative installed capacity of solar and wind mini-grids reported by AEPC shows that it has been rapidly deploying solar and wind mini-grid systems². The year-wise rate of increased installed capacity has been 32%, 70%, and 132% from FY 2018/2019 to FY 2021/2022³.

4. BRIEF ON SYSTEM ARCHITECTURE

This section briefly describes the general architecture of solar mini-grid systems.

Note: The samples shown in this section are illustrative only and not to advise of a specific system design. In every case, the appropriate architecture must be determined through a feasibility study specific to a given project site. The information given in this section is to provide only a general overview of solar mini-grid architecture.

Figure 1 shows the typical architecture of a pure off-grid solar mini-grid. The term 'pure' here means that solar PV is the only source of energy generation in these systems with no means of diesel generator back or grid-interactive option. This is equivalent to a community-scale off-grid solar PV system.

¹ AEPC (2022), "Progress at a Glance: Year in Review", Kathmandu

² Data on solar mini-grids and wind mini-grids are reported together

³ Cumulative installed capacity: 563kW in FY 2018/2019, 741kW in FY 2019/2020, 1,262kW in FY 2020/2021 and 2,929kW in FY 2021/2022; obtained from AEPC's progress reports

In general practice, this architecture is adopted in the following site conditions,

- i) Where the grid access is not foreseen for the duration of the design life of the solar mini-grid.
- ii) Critical loads having significant economic loss are not foreseen for the design life of the solar mini-grid.

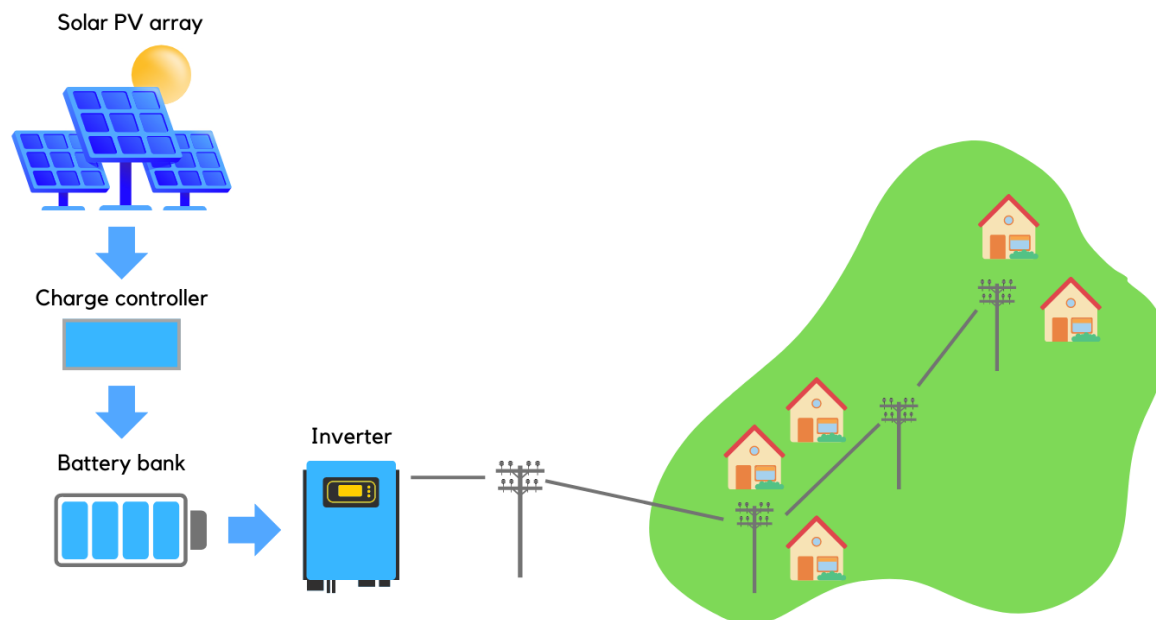


Figure 1: Purely off-grid solar mini-grid architecture

An example of a more advanced¹ solar mini-grid architecture is shown in Figure 2. A major differentiating aspect of this architecture compared to the purely off-grid architecture is that it allows for the connection of other sources of electricity such as diesel generators² and the national grid³. This gives the mini-grid more flexibility in its management of electricity sources. For example, when the national grid reaches the community several years after the installation of the solar mini-grid system, it can interconnect with the mini-grid system utilizing the existing transmission and distribution infrastructure. Solar mini-grid can then prioritize solar PV energy generation and utilize the national grid when energy generation from solar PV is inadequate.

An example architecture is shown in Figure 2 for an AC-coupled solar mini-grid system. In this architecture, the main bus carries alternating current (AC) to which different components of the system are synchronised. Similarly, DC-coupled solar mini-grid systems are also available, where the main bus carries direct current (DC).

In general practice, this architecture is adopted in the following site conditions,

- i) Where the grid access is foreseen within the duration of the design life of the solar mini-grid.
- ii) Critical loads having significant economic loss are foreseen during the operation of the solar mini-grid.

¹ The word advanced is used to communicate higher complexity compared to purely off-grid architecture

² Diesel generators can serve as backup electricity for load and battery charging when poor weather conditions result in inadequate solar PV generation and when the battery bank charge is low

³ National grid can be connected when it reaches the community several years after the installation of the solar mini-grid

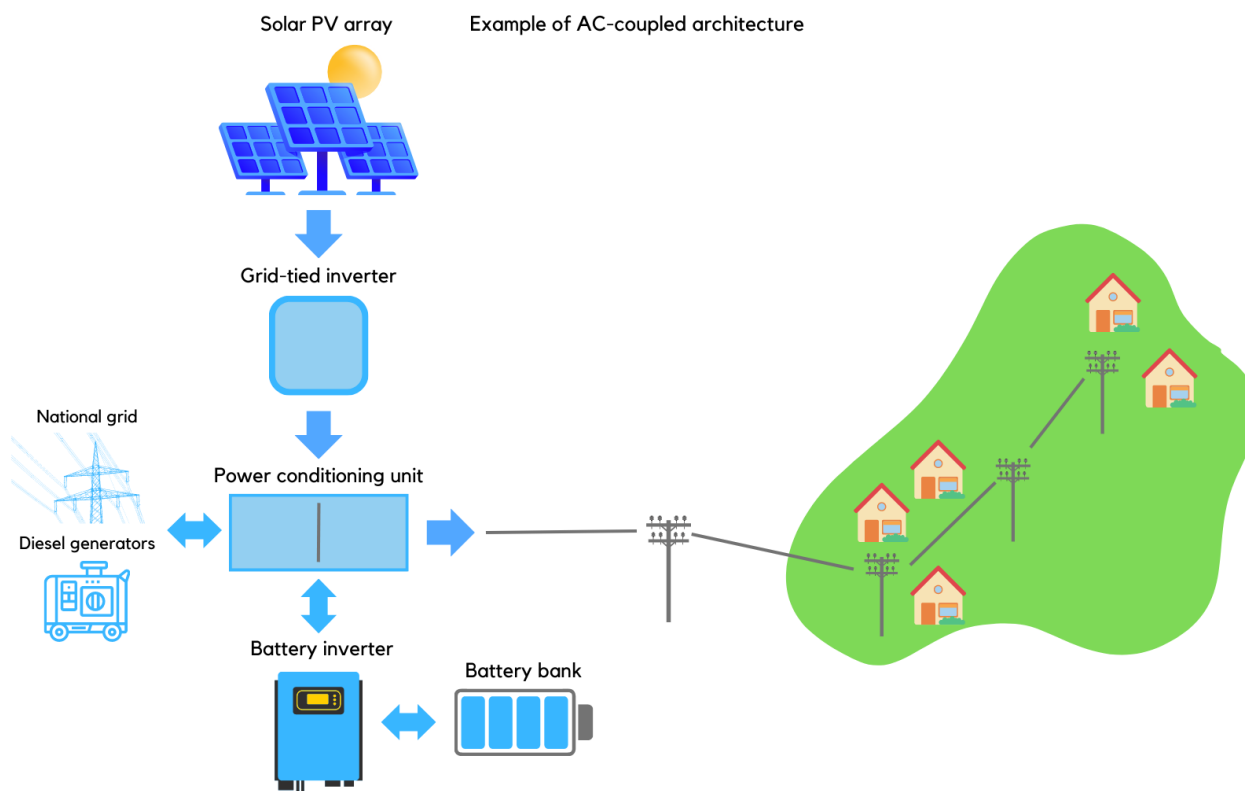


Figure 2: Advanced solar mini-grid architecture

5. PROJECT MODALITIES

Within the subsidy modalities defined in the Renewable Energy Subsidy Policy, 2078 B.S., Figure 3 describes the two modalities of implementation. It defines conditions, ownership, capacity, and subsidies for both models. This process guideline covers both models.

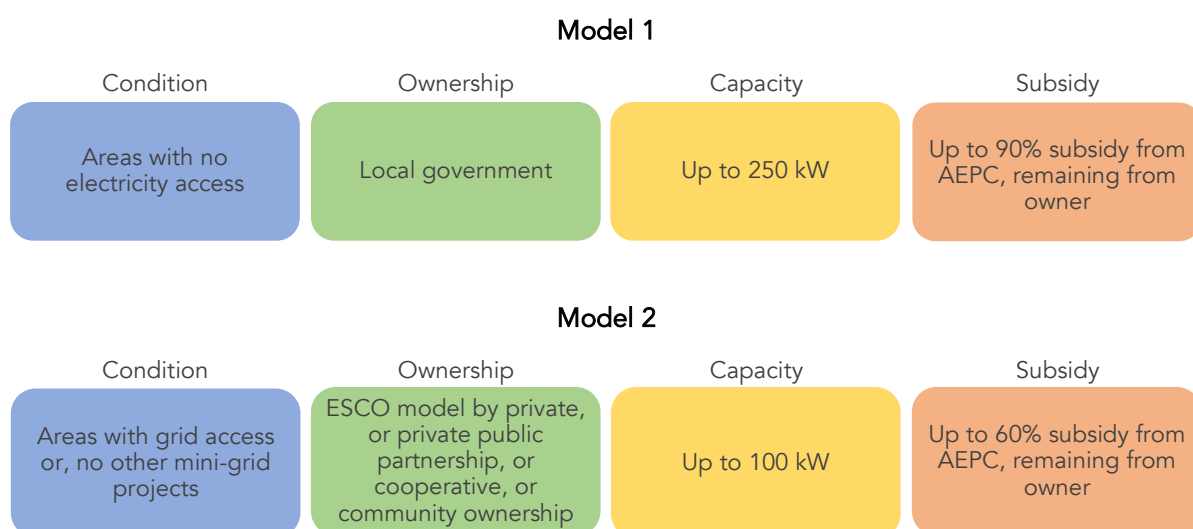


Figure 3: Subsidy modalities: Renewable Energy Subsidy Policy, 2078 B.S.

6. SUBSIDY DELIVERY MECHANISM

The subsidy delivery mechanism is summarized from the Renewable Energy Subsidy Delivery Mechanism, 2079 B.S.

6.1 Projects with local government ownership

The demand will be collected after issuing a public notice. The local government can on its own apply or apply through a cooperative or company through which it intends to implement the project. The demand application along with a pre-feasibility report should commit to contributing at least 10% of the project costs and make adequate land available for the construction. The project location should not have electricity access from the national grid or other mini-grid systems.

The demand will be assessed by a committee based on factors such as

- i) Current lack of electricity access and probability of future electricity access,
- ii) Financial contribution from local government or provincial government,
- iii) Topography of project location,
- iv) Disadvantaged groups and community location, and
- v) Possibility of productive end-uses.

After the demand assessment, the Technical Review Committee (TRC) will estimate the system capacity based on beneficiary households and potential productive end uses. A detailed feasibility study will be carried out by AEPC. Upon completion of the detailed feasibility study, the committee will review the study based on various technical, financial, economic, social, and environmental factors. It then submits its recommendations to AEPC for the decision on the technical and financial due diligence. If the project is approved, AEPC will commit to 90% of the project costs and the remaining 10% has to be committed by the local government or from the agreement between the local and provincial government. Before tendering the project, the project promoter (which can be a local government or community-owned entity with a major shareholder from the local government) will have to open a project bank account and deposit its financial contribution. On behalf of the local government, AEPC will then issue a tender based on the approved technical requirements and evaluate and select the installer.

The project promoter must sign an agreement with the installer company, or upon request from the local government, however, AEPC can sign an agreement with the installer company. All procurement activities will have to comply with the Public Procurement Act of Nepal. AEPC will disburse the subsidy based on project milestones upon verification by the local government. The final instalment will be disbursed after project completion.

Upon completion of the construction, AEPC will inspect the construction and carry out testing and commissioning. During the commissioning phase, the installer company and project promoter will appoint an operator in the presence of an AEPC representative. The installer company has to submit a project completion report to AEPC and the local government.

The installer company will be responsible for the project's operation and maintenance (O&M) for 5 years. During the O&M period, the installer company will submit site visit reports quarterly. After the O&M period, the handover process will happen.

6.2 Projects deploying the ESCO model with private, public-private, cooperative, or community ownership

Similar to the project implementation with local government, the first step is demand collection that follows the same procedure as described in 6.1. However, in this case, the applicant also has to submit a pre-feasibility report. The demand application will be reviewed as described in 6.1 and if selected, the energy service company (ESCO) has to submit a detailed feasibility report. The technical review committee (TRC) will review the project based on factors such as

- i) A current lack of electricity access,
- ii) A recommendation letter from the local government,
- iii) A registration certificate of the installer,
- iv) A financial contribution/cost-sharing letter,
- v) Commitment of land availability for construction.

Upon approval of the project, AEPC will mobilize the subsidy based on conditions that

- i) All equipment used in the project has to meet the AEPC standards,
- ii) All sources of funds apart from the subsidy have to be disclosed and committed,
- iii) If a loan is taken, a loan agreement proof shall be submitted, or if other funds are accessed, the respective documents proving the source of funds shall be submitted,
- iv) The committee has to approve the project,
- v) All procurement activities will have to comply with the Public Procurement Act of Nepal or as per the procurement policy of the developer, or procurement guidelines specific to the project,
- vi) The ESCO has to submit a letter confirming the completion of construction to AEPC along with a project completion report,
- vii) AEPC will inspect the construction and handover upon approval, and finally,
- viii) AEPC will recommend the Central Renewable Energy Fund (CREF) to disburse subsidy as per the agreement either to the developer or the installer.

7. STEP-BY-STEP PROCESS

Figure 4 shows the flowchart of the solar mini-grid project implementation process. The process begins with a demand call and follows through until the project is constructed and operational – ending with monitoring and follow-up visits. In Figure 4, in addition, on the right side of the flowchart, the documents related to each stage are shown.

Complementary to the flowchart in Figure 4, Table 2 gives a more detailed overview of the documents which are required for each of the government-supported SMG projects.

Legend

- AEPC responsible for the accomplishment of the stage
- User/Installer responsible for the accomplishment of the stage

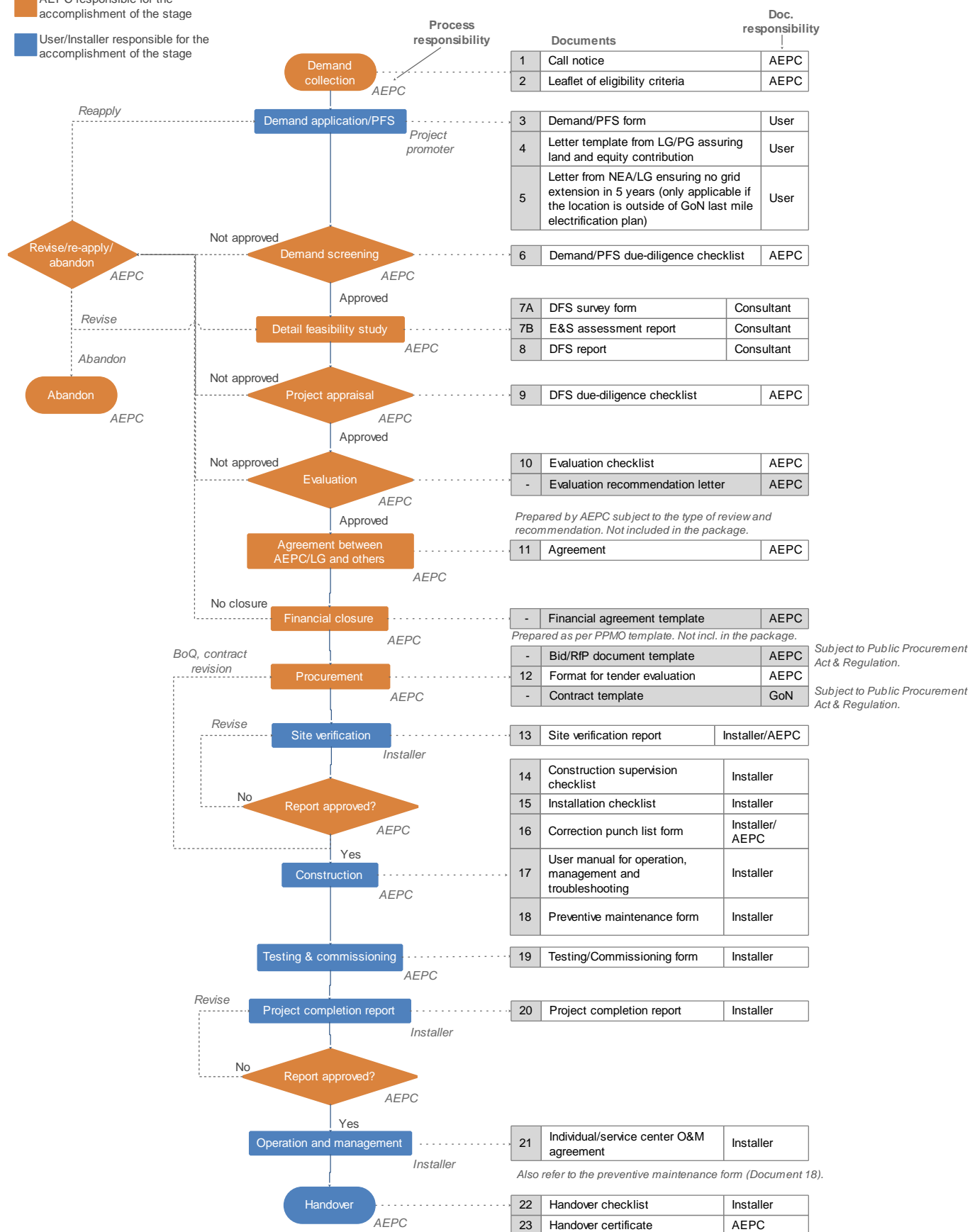


Figure 4: Process flowchart for government-supported solar mini-grids

Table 2: Detailed process description


Process name	Doc. no.	Document	Description
Demand collection	1	Call notice	Template for demand call by the government.
	2	Leaflet of eligibility criteria	Leaflet to be used by the government for simplified guidance to the applicants.
Demand application/PFS	3	Demand/PFS form	Demand form to be filled by the applicant.
	4	Recommendation from LG/PG assuring land and equity contribution	Letter confirming financial contribution and land availability for construction.
	5	Letter from NEA/LG ensuring no grid extension in future (only applicable if the location is outside of GoN last mile electrification plan)	Letter confirming that the project site does not have grid access and no foreseen grid expansion in the near future.
Demand screening	6	Demand/PFS due-diligence checklist	Due diligence checklist used by AEPC to verify the quality and outcome of the PFS.
Detail feasibility study	7A	DFS survey form	DFS survey format to be used by private companies (usually consulting firms) contracted by AEPC.
	7B	E&S survey form	E&S survey format to be used by private companies (usually consulting firms) contracted by AEPC.
	8	DFS report template (incl. E&S assessment report template)	DFS report format to be used by private companies (usually consulting firms) as a report submission to AEPC.
Project appraisal	9	DFS due-diligence checklist	Due diligence checklist used by AEPC to verify the quality and outcome of the DFS.
Evaluation	10	Evaluation checklist	A checklist is to be used by the evaluation team for evaluating the project before recommendation.
		Evaluation recommendation letter template	Prepared by AEPC, subject to the type of review and recommendation. Not included in the package.
Agreement between AEPC/LG and others	11	Agreement template	A project agreement between AEPC and the local government confirming the implementation of the project.

Financial closure		Financial agreement template	Prepared as per PPMO template. Not included in the package.
Procurement		Bid/RfP document template	Subject to Public Procurement Act & Regulation. Not included in the package.
	12	Format for tender evaluation	A tender evaluation format is to be used by the local government or AEPC for evaluating the bid proposals.
		Contract template	Subject to Public Procurement Act & Regulation. Not included in the package.
Site verification	13	Site verification survey report template	A site verification report template is to be used by the private company to verify the specifications provided in the bidding document against site conditions. The report will be submitted to AEPC to validate the design, and site conditions and bring attention to any deviations.
Construction	14	Construction supervision checklist	A construction supervision checklist is to be used by the private company
	15	Installation checklist	An installation checklist is to be used by the private company to ensure systematic and quality workmanship.
	16	Correction punch list form	A correction punch list is to be used by engineers of the private company, local government, or AEPC to give a list of items to be rectified during installation supervision.
	17	User manual template for operation, management and troubleshooting	The template on the user manual for operation and troubleshooting is to be prepared by the private company specific to the project site and handed over to the operator to ensure adequate knowledge of the operator for system operation and basic troubleshooting.
	18	Preventive maintenance form	A preventive maintenance checklist is to be used by the installer (subject to agreement on after-sales service) or the local government (upon handover) to ensure that the system is operating smoothly.
Testing and commissioning	19	Testing and commissioning template	A testing and commissioning template is to be used by the private company and AEPC for the installation.
Project completion report	20	Project completion report template	A project completion report template is to be used by the private company for submission to the local government and AEPC.
Operation and management	21	Individual/service centre O&M agreement template	A contract agreement template to be used by the private company (subject to agreement on after-sales service) or local government (upon handover) to ensure adequate technical service available locally in or near the project location.

Handover	22	Handover checklist	A handover template is to be used by the installer to hand over the responsibility of system operation and maintenance upon fulfilling its contractual obligations.
	23	Handover certificate	A handover certificate is to be used by AEPC as a final document that certifies that the project has been handed over to the project promoter and that all obligations of AEPC are fulfilled.

8. ANNEXES

Annex 1	Call of notice for installation of solar mini-grid systems
Annex 2	Leaflet of eligibility criteria
Annex 3	Demand/Pre-feasibility study form– Nepali and English versions (AEPC)
Annex 4	Recommendation from LG/PG assuring land and equity contribution • Template
Annex 5	Letter from NEA/LG ensuring no grid extension in future • Template
Annex 6	Demand/Pre-feasibility study due-diligence checklist
Annex 7A	Detailed feasibility study survey form
Annex 7B	E&S assessment report • Template
Annex 8	Detailed feasibility study report • Template
Annex 9	Detailed feasibility study due diligence
Annex 10	Evaluation checklist (AEPC) • Template
Annex 11	Agreement • Template
Annex 12	Format for tender evaluation (AEPC) • Template
Annex 13	Site verification survey report • Template
Annex 14	Construction supervision checklist
Annex 15	Installation checklist
Annex 16	Correction punch list form
Annex 17	User manual for operation, management, and troubleshooting • Template
Annex 18	Preventive maintenance form
Annex 19	Testing and commissioning (AEPC) • Template
Annex 20	Project completion report • Template
Annex 21	Individual/Service centre O&M agreement • Template
Annex 22	Handover checklist
Annex 23	Handover certificate • Template



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