

Note: The TOR is for a short consultant work to develop quantified estimates of the realistic potential for replicating selected renewable energy technologies that will be piloted in the Bank project.

Assessment of Potential for Replicating Selected Renewable Energy Technologies in the Long Term Off grid Electrification Plan Consultant Terms of Reference

Background

<Brief country background and description of objectives and scope of Bank project. Brief description of selected technologies to be piloted>

Objective

The objective of this assignment is to provide a realistic and quantitative assessment of the potential for replicating selected renewable energy technologies in the long term rural electrification plan of the Government.

Scope of Work

The assessment will be focused on the following RETs: solar PV for lighting and productive uses; solar battery charging stations (SBCS); small stand alone windpower; small modular biomass fired systems; diesel/PV/battery hybrids, and diesel/wind/battery hybrids. Small windpower and modular biomass power were not selected Bank but are considered to have potential applications in areas with good wind regimes or substantial captive wastes from agricultural processes. The analysis will be limited to capacities relevant to the size of typical offgrid communities in the country, and to typical existing and potential applications. This probably implies capacities well below 300 kW.

Many studies and documents on this subject are already available, such as the GIS maps and database on rural electrification markets that relates directly to Task 2 below. The consultants should exert best efforts to collect all such available references to avoid repeating data gathering or analysis already done by others.

Task 1: Characterization of the Selected Technologies

1. RETs for Micro- and Minigrids

These include stand-alone systems such as wind turbines and modular biomass power systems, as well as hybrids of diesel gensets with PV, wind or biomass power. The task should:

Briefly review the current status of these technologies worldwide, including their recent track record and operational experience in developing countries; commercial availability of capacities in question; existing manufacturers/equipment suppliers; and costs of both investments and operation.

Identify specific situations or conditions when the RET is better used as stand-alone systems, and when better used as hybrid with diesel. Specify minimum resources requirements. Provide spreadsheet comparisons of costs and benefits of typical operations using the different RET combinations.

Identify and compare minimum manpower and other inputs required to operate and maintain the different systems, and assess the feasibility of finding these in typical offgrid communities of the country.

2. Solar Battery Charging Systems (SBCS)

Briefly review the current status of SBCS worldwide, including their recent track record and operational experience in developing countries; commercial availability of capacities in question; existing manufacturers/equipment suppliers; and costs of both investments and operation.

Identify specific situations or conditions where SBCS would be the most suitable option compared to other alternatives. Identify different system configurations that may be used in the context of the country. For the same number of customers and level of service, provide spreadsheet comparisons of the costs and benefits of an SBCS operation compared to the following alternatives: a) a diesel powered battery charging operation; b) individual solar home systems.

Identify and compare minimum manpower and other inputs required to operate and maintain the different systems, and assess the feasibility of finding these in typical offgrid communities appropriate for SBCS.

3. Solar PV

Two types of applications are considered: a) solar home systems (SHS), from about 20-100 watts peak, and b) productive and communal uses needing more than 100 watts peak.

The technology status, suitable conditions for use and equipment costs and availability of SHS are fairly well known already to the project team. The task required is to refine existing estimates of the total potential market for SHS in the country. This is assumed to be the dispersed component of unelectrified communities—those that could not be feasibly connected to the local minigrad. The gross number of dispersed households

suitable for SHS service should be further refined by affordability considerations (e.g., income level, willingness to pay, poverty index, etc). This task is best carried out in conjunction with Task 2 (described below) that characterizes the markets geographically.

For productive uses of PV, the work should:

Identify low-power applications of PV for productive and communal applications that are likely to be useful in the context of the country (e.g., electric fencing for livestock, water pumping, communications, lighting, etc). Describe typical system capacities, configurations, outputs and costs. Comment on the recent track record of such systems in other developing countries. Identify manpower needs to operate and maintain these systems, and assess the feasibility of finding these in typical offgrid communities of the country appropriate for PV.

Task 2. Geographic and Physical Characterization

The purpose of this task is to examine the geographic and physical characteristics of the unelectrified offgrid areas of the country, and match them with the technology characteristics of the selected RETS obtained in Task 1. The output would be an indicative estimate of the total number and total capacity of each of the selected RETs that could potentially be used in the offgrid electrification program.

The following sub-tasks are suggested but the consultants are free to use their own methodology:

List all communities beyond economic line extension distance from the national grid. Classify the communities into two categories: a) With existing utility diesel service b) Without utility diesel service.

For communities without utility diesel service, obtain information on:

- Total population; number of unelectrified households; estimate of percentage minigridable (balance is dispersed component)
- Existing productive activities, principal crops, etc. Socioeconomic profile.
- Renewable energy resources: Wind regime data, if available; if not, qualitative estimate only; biomass resource data, if there is significant agroprocessing;
- Solar insolation data (from solar maps); hydro resources data, and other sources.

Eliminate unelectrified communities likely to be served best by hydro resources.

Using the above information as well as the results of Task 1, make approximate matching of RETs and markets. First, classify communities into those suitable for a) RET minigrids, and b) SBCS. With information on resources availability, further classify into those suitable for: a) diesel/wind hybrids and windpower (windy areas), b) biomass power or diesel/biomass hybrid, and c) diesel/PV (no significant wind or biomass).

The last step is to summarize the matches, and provide estimates of the gross potential, in terms of number of installations or kW total, for each of the selected RET. The potential for each may be expressed as a range, to account for situations where more than one type of RET is suitable. The result of this exercise will provide an indication of the

possible replication potential for the selected technologies based on geographical, physical and demographical considerations.

Task 3. Identification of Other Market Criteria for RET Replication

It is recognized that even if there is a good matching of need with technology, and there is a favorable economic comparison with alternatives, there are many market barriers to achieving realization of the full potential determined by the above tasks. Many of these market barriers have been identified in the Bank project document. They include barriers related to lack of financing modalities, lack of information available to consumers and private investors, inadequate institutional arrangements, unfavorable tariff and subsidy policies, etc. The purpose of this task is to provide a short but detailed summary of what, in the view of the consultants, are the key policy and market barriers what are the appropriate short and long term actions that must be taken to address them, and who should take the action. The writeup of this task should not consist of generic discussions which are already available in other existing documents but brief discussion of specific items reflecting the opinion and experience of the consultants.

Outputs (Deliverables)

The output is a report containing the results of each of the three main tasks described above, with annexes containing spreadsheet calculations and other supporting materials. The results should be summarized briefly but clearly in an Executive Summary.

Timetable and Budget

The assignment should be completed in two months from contract signing. The total budget is \$xxxx inclusive of all fees, travel and other expenses. The funds will be released as follows:

- 10% or \$xx upon contract signing;
- 30% or \$xx upon submission of draft report for completed Tasks 1.
- 30% or \$xx upon submission of the draft report for completed Task 2.
- 20% or \$xx upon submission the draft final report of the assignment;
- 10% or \$xx upon submission of an acceptable final report, incorporating all comments and revisions on the draft.