PCREEE
Pacific Centre for Renewable Energy and Energy Efficiency
SE4ALL Centre of Excellence to Promote Sustainable Energy Markets, Industries and Innovation

UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

GN-SEC

Unlocking MG for sustainable development

4.3 Feasibility study

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1. SESSION OBJECTIVES

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i) Discuss key aspects for the preparation of feasibility assessments for mini-grids.

ii) Share experiences projects that have not been feasible and the causes

2. FEASIBILITY ANALYSIS

FEASIBILITY STUDY

- A feasibility study is a comprehensive evaluation of a proposed project that evaluates all factors critical to its success to assess its likelihood of success.
- The feasibility study helps the stakeholders to identify any potential problems and risks of the project and consequently, project mitigation measures or solutions.
- It also helps to make business decisions, financial strategies, marketing strategies, etc.
- There are different types of feasibility studies:

TECHNICAL FEASIBILITY

- Question marks:
  - Is the technology or solution feasible from a technical point of view? → Initial technical design
  - Are there better alternatives to reach the goals?
  - Are there similar successful projects implemented in other places? → Benchmark, market research.
  - What are the technical risks?
  - Are there synergies with other sectors that can impact the feasibility? → Multisectoral approach.

ECONOMIC AND FINANCIAL ANALYSIS

- The economic and financial value of a project is usually assessed through a Cost-Benefit Analysis (CBA), where all the economic and financial costs are compared between the scenario where the project is implemented and a do-nothing scenario (Business-as-Usual) in monetary units.
- A CBA includes all relevant costs and benefits. From this perspective, the project would only be developed if the expected benefits from implementing the project are higher than the costs. Future benefits and costs are discounted using an appropriate discount rate.
- Accounting all relevant costs and benefits into a CBA can be challenging. Depending on the evaluation stage and the nature of the potential investor, the analysis can be simplified to consider only financial costs and revenues or savings.

Economic Feasibility	Financial Feasibility
Benefits and costs for the whole economy	Benefits and costs for an enterprise
Considers social and environmental benefits and costs	Considers only cash flows
Usually for public or national projects	Usually for business entities or investors
Shadow price (no taxes, subsidies, profit)	Market price

ECONOMIC AND FINANCIAL ANALYSIS

- In the case of mini-grids, the CBA is normally conducted over different generation alternatives such as diesel only, hydropower, wind energy, etc., because the benefit of having electricity is difficult to measure and highly subjective from an environmental and social perspective. In this case, the CBA is transformed into a least-cost analysis. When this analysis is related to a project variable, then the least-cost analysis transforms into a Cost-Effectiveness Analysis (CEA)

Cost-Benefit Analysis (CBA)

Compare project costs with benefits accounted in monetary units.

Useful to compare projects with different scopes / output.

Least-Cost Analysis

Compare total project costs that achieve the same outcome.

Cost-Effectiveness Analysis

Compare project costs with outcome units. For example: cost per household that gets access to electricity.

PERFORMANCE INDICATORS

- **Net Present Value (NPV):** the sum of all discounted cash flows associated with the project.

$$NPV = I_0 + \sum_{t=1}^{n} \frac{C_t}{(1+i)^t}$$

If NPV > 0, then the project is feasible.

For projects with different horizon, use the Annualized Net Present Value (ANPV).

$$ANPV = NPV \frac{i}{(1-(1+i)^{-t})}$$

- **Internal Rate of Return (IRR)** is the discount rate that can make NPV=0. It shows the “intrinsic” profitability of a project.

If IRR > i, then the project should proceed.

- **Simple Payback (SPB):** is the time needed to recover the initial investment through positive project cash flows.

- **Levelized Cost of Energy (LCOE):** is an extension of the NPV method which incorporates an ‘electricity generated’ element. It is used to compare the relative cost of energy produced by different energy generation projects regardless of their size or life span

$$LCOE = \frac{Total\ life\ cycle\ cost}{Total\ life\ time\ electricity\ generation} \left[{}^{USD}/_{kWh}\right] \Rightarrow LCOE = \frac{I_0 + \sum_{t=1}^{n} \frac{A_t}{(1+i)^t}}{\sum_{t=1}^{n} \frac{E_t}{(1+i)^t}}$$

I_0 =initial investment
A_t =anual costs
i =discount rate %
E_t =electricity output
n =Project lifetime

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FEASIBILITY STUDY

For an energy project, a feasibility study may include at least technical and economical feasibility.

For example:

1. Basement assessment
   a) Review of existing studies, if any.
   b) Legal framework and energy regulation.
   c) Local market assessment
2. Field data
   a) General information on the site
   b) Characterization of the current energy sources
   c) Current and future demand
   d) Available energy sources
3. Preliminary technical analysis and design
   a) Climate data
   b) Assumptions
   c) Concept design of different alternatives
   d) Comparison of alternatives
4. Economic analysis
   a) Total investment needs
   b) Annual operation expenses
   c) Financial analysis
   d) Sensitivity analysis*
5. Alternative recommendation
6. Risk analysis and mitigation plan

Sensitivity Analysis
Economic or financial model to determine how different values of an independent variable affect a specific dependent variable under a given set of assumptions

INSTITUTIONAL AND REGULATORY ANALYSIS

The feasibility should ensure that the project is designed in accordance with the current regulatory and institutional framework, both in domestic and international terms, and that key aspects of the project have been analyzed from a legal perspective.

- Local regulatory restrictions and opportunities
- Land use rights
- Roles and responsibilities for implementing the project
- Capacity of executing agency
- Operational sustainability
- Fiscal regulations
- Project endorsement
- Environmental regulations
- Synergies with national/local plans

ENVIRONMENTAL AND SOCIAL (E&S) IMPACTS

The term "Environmental and Social Safeguards " (ESS) is used by development institutions, international treaties and agencies to refer to policies, standards and operational procedures designed to first identify and then try to avoid, mitigate and minimize adverse E&S impacts that may arise in the implementation of development projects, as well as maximize positive impacts.

The World Bank has the following ESS:

ESS 1. Assessment and Management of Environmental and Social Risks and Impacts
ESS 2. Labor and Working Conditions
ESS 3. Resource Efficiency and Pollution Prevention and Management
ESS 4. Community Health and Safety
ESS 5. Land Acquisition, Restrictions on Land Use and Involuntary Resettlement
ESS 6. Biodiversity Conservation and Sustainable Management
ESS 7. Indigenous Peoples
ESS 8. Cultural Heritage
ESS 9. Financial Intermediaries
ESS 10. Stakeholder Engagement and Information Disclosure

Vinaka!

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