Chapter 2

Screening Method

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CHAPTER 2
Screening Method

East Asia is well endowed with RE resources, in contrast to fossil fuel, which most countries in the region still need to import to meet their current energy demands, particularly fuel for electricity generation. RE resources—such as solar energy, wind energy, micro-hydro energy and biomass—maybe available in significant quantity but may not be easily accessible in terms of harvesting or harnessing them, particularly in remote areas. The limited accessibility may not be due to economics alone but also to geographical restriction to build, for example, a wind turbine on a hilltop with almost no road access to the project site to install the conversion system. Hence, availability and accessibility are two different aspects when identifying workable RE systems.

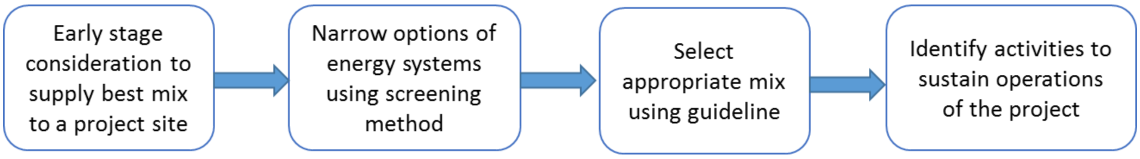
Past ERIA reports on the Sustainable Assessment of Biomass Energy Systems has brought up several times that the involvement of the community—the recipient of the energy system—is amongst the key success factors in sustaining the energy system over longer periods of time. A workable energy system that will be able to supply electricity to a rural community after the capital expenditure (CAPEX) stage is over requires considerations on how the system will be operated, maintained, and repaired at the local level. Good planning should adopt a value chain approach where considerations go beyond just installation of the energy system infrastructure. The value chain concept, adopted from business operations, means the act of considering a whole series of activities that are associated with delivering a workable energy system to a remote community—from harnessing the energy resource to delivering the electricity supply; and ownership of the system, which includes maintaining the system over the long run.

Hence, a screening stage is introduced to identify energy systems based on a value chain approach—beginning with considerations of availability and accessibility and until the end-of-life of the energy system.

2.1. Overview of the Screening Method

The screening stage is intended to provide users of the guideline with a method to narrow down the possible options of energy systems before embarking on the more demanding exercise of selecting the best mix. Figure 2.1 illustrates the flow chart of the screening method.

Figure 2.1: Screening Method for Establishing the Best Mix for Sustainable Energy Systems

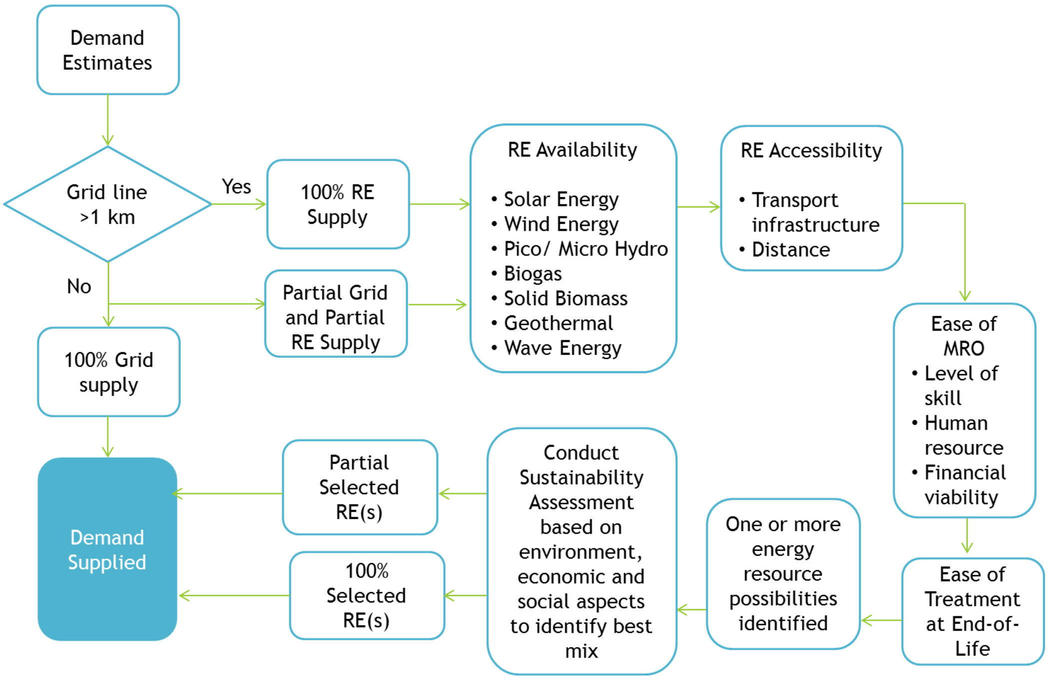


Source: Authors.

The value chain approach begins with the following considerations: demand for supply, maintenance and repair during operation, and end-of-life treatment. Almost every step in the value chain screening is decision-oriented—where potential options are eliminated along the way based on answers established using secondary information. The desired output of the screening stage can be the identification of one or more energy systems that will be subjected to sustainability assessment for the final decision of the best mix energy system for a given project site.

Figure 2.2 is a flow chart of the link between the screening method and the sustainability assessment guideline. The screening method uses available default values for broad estimates and need not do any actual site measurements. The screening method is described here based on the steps shown in the flow chart.

Figure 2.2: Value Chain Approach to Screen Potential Energy Systems Available



Note: RE = renewable energy.
Source: Authors.

2.2. Steps in the Screening Method

2.2.1. Demand estimates

The screening method begins by first estimating the demand of the project site, together with general information such as:

- Location, identified by address and by Global Positioning System (GPS) coordinates and the purpose of electrification.
- Ownership and management after completion of project.
- Type of installations or household connections, e.g. individual households or several households per square metre.
- Expected load, estimated from the number of households multiplied by typical household requirement.
- Projected growth demand based on expected increase in population of the community or expected increase in activities with the availability of electric power supply.

2.2.2. Available energy systems

The available energy systems can come from fossil-based or RE resources.

i) *Fossil-based supply*

In the case of fossil-based supply, considerations that will influence suitability include the following:

- Access to grid-connected supply—distance of project site to the nearest substation (assuming the project site is not grid-connected); grid supply is likely not viable if grid line is estimated to be more than 1 kilometre (km).
- If grid line connection is viable, check the available capacity that can still be supplied to the project site.
- If off-grid supply from stand-alone genset (electrical generator) is practical, consider ease of supply of fossil fuel.
- Estimate the proportion of electricity demand that can be supplied by the genset.

ii) *Renewable energy resources*

Available RE resources should be estimated individually to provide the amount estimated earlier.

- Solar Energy
  - ✓ Solar irradiation intensity
  - ✓ Number of hours of irradiation/day
  - ✓ Number of days/year of sunshine
  - ✓ Size of solar panels required to produce the amount of electricity required
  - ✓ Approximate CAPEX
- Wind Energy
  - ✓ Highest/lowest/average wind speed:
  - ✓ Number of windy days/year
  - ✓ Size of wind turbine required to produce the amount of electricity required
  - ✓ Approximate CAPEX
- Pico and Micro Hydropower Potential
  - ✓ Name of stream/river
  - ✓ Rainfall pattern in the vicinity of the project
  - ✓ Head of water level at intake to water level at tailrace

- ✓ Upstream and downstream activities from the project site along the specific river
  - ✓ Distance for intake to powerhouse (length of conveyance)
  - ✓ Size of hydropower system to supply required electricity
  - ✓ Approximate CAPEX
- Biomass
  - ✓ Type of biomass
  - ✓ Amount of available material on an annual basis
  - ✓ Technology of conversion (e.g. direct combustion (boiler for steam), gasification, pyrolysis)
  - ✓ Potential power
  - ✓ Approximate CAPEX
- Biogas
  - ✓ Type of feedstock (for biogas production)
  - ✓ Type of anaerobic digestion system
  - ✓ Volume of gas produced daily
  - ✓ Pre-treatment of gas required (Y/N)
  - ✓ Direct/indirect conversion
  - ✓ Potential power
  - ✓ Approximate CAPEX
- Geothermal
  - ✓ Name of location
  - ✓ Available amount (reservoir size)
  - ✓ Conversion technology (to power)
  - ✓ Potential power
  - ✓ Approximate CAPEX
- Other sources not listed (e.g. wave energy, ocean thermal energy) can be evaluated in a similar exercise as above.

2.2.3. Resource accessibility

In the context of RE, resource accessibility can be interpreted as the ease of extraction, while for both RE and non-RE, accessibility is the extent of infrastructure construction needed to deliver the electricity supply to the target community. Some key points that can be considered in this aspect are as follows:

- Is the project site connected by road to the nearest town?
- Name of nearest operational road
- Distance from project site to road (in km)
- Type of road
- Ability of road to ferry trucks and lorries

If river is the alternate mode of transport, input the following information:

- Name of river
- Name of 'jetty'
- Ability of river to ferry construction materials and equipment

2.2.4. Long-term considerations

In screening for potential viable energy systems that can contribute to the best mix, the type of maintenance, repair, and operation services needed during use should also be considered, as well as the cost of disposal at end-of-life.

The screening phase should have a general idea of the skills needed to carry out the maintenance, repair and operation services. The degree of complexity, such as regularity of servicing or changing parts/component will determine if professional versus technician or just basic hands-on-training is sufficient.

Since remote areas will mean longer distance from appropriate recovery or disposal sites, it is important that some thoughts be given to the expected life span of the energy system, as well as to the potential reuse, recycle, and refurbish rate.

Constructing the energy systems for power supply is not complete until the long-term arrangement for any monetary implication has been worked out. Amongst the factors that can be evaluated are as follows:

- Government's obligation to provide as a basic amenity
- Recipients' willingness to pay
- Possibility of monetary benefit, e.g. fit-in-tariff (FIT) as a possible source of income for the community

2.2.5. Short-listing of potential energy systems for the best mix

The screening stage is intended to enable the user to have a broad picture of energy system options that are available and that are shortlisted based on estimates and secondary data. To enable more objective shortlisting even at this preliminary stage, it will be appropriate that characterisation and activity conversion factors be obtained from the same source of reference, e.g. activity factors provided by the International Panel of Climate Change (IPCC).

Table 2.1 provides a screenshot that will enable user to do a quick evaluation of the viability of an energy system prior to subjecting the choice to a comprehensive sustainability assessment based on the three pillars of sustainability—economic, environmental, and social aspects. Without considering the sustainability impacts, the screening stage only provides an idea on the extent of availability and accessibility of an energy system, including fundamental considerations on the applicability of the energy system for the target community. Table 2.1 is designed in such a way that a value can be established for each energy system. The choices for items 1–5 are selected and then the sum of their values is given in the last column. Since the better options have smaller numbers, the smaller the value when all five items are summed imply that the energy system is a feasible option, which should now be subjected to the sustainability assessment exercise to establish the best mix, as defined by the Working Group.

Table 2.1. Screenshot for Quick Analysis of the Viability of an Energy System

№	Description	Level of contribution (Circle only one value for each parameter)			Value selected	Total Value
1.	Supply availability	1 Readily available at site for the given duration (e.g. 10 years availability)	2 Require big capex investment	3 Not available		(sum of values for items 1 – 5)
2.	Resource accessibility	1 Readily accessible	2 Require big capex investment	3 Not accessible		
3.	Operational applicability	1 Community can perform basic MRO, visits by technicians only on need basis	2 Maintenance and repair require regular visits by technicians	-		
4.	End-of-life disposability	1 Easily dismantle and will not create hazardous situation	2 Difficult to dismantle and dispose safely	-		
5.	Supplementary benefits	1 Creation of new industry	2 Mainly supply power to household			

Source: Authors.