



An overview of Renewable Energy Technologies

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Report Format and Organization

- ▶ The Report includes:
 - ▶ Abstract
 - ▶ Introduction/Objective
 - ▶ Background
 - ▶ Technologies Overview
 - ▶ Best Practices
 - ▶ References

Objectives:

- ▶ The overview of renewable Energy Technologies (RETs) gathers comprehensive information on status of most practiced and successful RETs across the developing countries which could be chosen for being developed in Afghanistan.
- ▶ With a look to the technical nature and financing issues, the RETs report aims to increase the knowledge to either sides of RETs for anyone who is involved in developing such projects.

Objectives:

- ▶ The report looks to the reliability and sustainability of each technology in terms of long term use and easy maintenance, which could be offered to rural areas.
- ▶ The work will inform the Afghanistan Energy Study on available options and successful practices in developing countries.

Highlights:

- ▶ With a great deal of renewables deployment and developments still underway, the future of RETs in Afghanistan is promising. However, different challenges for each of RETs exist and successful development of any RE project in Afghanistan will depend largely on researches and investments.
- ▶ Beyond the well-known solar and micro-hydro, other renewables including wind, bioenergy and geothermal seems to have possible ground for growth in the areas where solar or micro hydro are not feasible.

RE Technology Option 1

SMALL HYDROPOWER

Technology Status	Suitable Conditions	Technical Challenges	How suitable is this option for Afghanistan?
<p>Small hydropower systems are suitable for off-grid power generation and also can be connected to the grid in a net-metering arrangement. Systems are available as small as 0.1 kW for battery-based systems, up to 100 kW.</p>	<p>Either steep rivers flowing throughout the entire year, or the great mountain ranges and their foothills. Low-head turbines have been developed for small-scale exploitation of rivers or irrigation canals where there is a small head but sufficient flow to provide adequate power.</p>	<p>Lack of rigorous training of the operators and managers of MH plants</p> <p>lack of end use technologies. loads other than lighting, cases low plant capacity factors.</p>	<p>More available high micro hydro potential in mountainous, regions of Afghanistan, especially in North and South East of the country</p> <p>Country's experience with developments and challenges of micro hydro over the past years and lesson learnt from this experiences, would bring more success to future projects.</p> <p>Micro Hydro not only easily can provide the electricity, but referring to agriculture based economic of the country, this kind of technologies would be a big support to development of farms and provide them with better pumping and irrigation systems.</p>

RE Technology Option 2

STAND ALONE SOLAR

Technology Status	Technical Challenges	How suitable is this option for Afghanistan?
<p>A wide range of solar PV technologies are now at various levels of development. The PV industry has grown at a rate greater than 40 percent per year from 2000. Much of this growth is the result of global programs targeted toward growing the PV industry and improving the competitiveness of PV in the marketplaces.</p>	<p>Proper backup or storages, to insure supply sustainability of PV home system is usually required and this subsequently would affect the cost as the system capacity increase.</p> <p>Lack of manpower and training on operation and maintenance of the system.</p>	<p>Afghanistan With its highest radiation value is a suitable home for such technologies. The dramatic price reductions of solar PV cells, combined with the availability of affordable and efficient appliances such as LED lights and new lithium-based batteries, have rendered solar PV systems more affordable, even for very small-scale applications. This makes solar to be one the RETs rapidly reach to any part of the country.</p>



RE Technology Option 3

SMALL WIND TURBINES

Technology Status	Technical Challenges	How suitable is this option for Afghanistan?
<p>Small wind turbines (SWT), normally with a diameter of less than 15m and with a power output below 50kW, offer excellent solutions for rural electrification. Most SWTs primarily use battery charging which can then be used for energy .</p> <p>Small wind turbines have relatively simple structure which make them straightforward to maintain.</p>	<p>Wind speeds are location-dependent and intermittent, though when averaged out annually tend to be quite consistent.</p> <p>Lack of detailed data for wind seems to be a challenge in developing SWTs.</p>	<p>Wind resources in Afghanistan is estimated around 66 GW. (estimated 36,000 Km² windy land and 5 MW/Km² according to ANREP) which presents good potential for developing wind turbines.</p>

RE Technology Option 4

BIOENERGY

Technology Status	Suitable Conditions	Technical Challenges	How suitable is this option for Afghanistan?
<p>Production of electricity from biomass occurs in much the same manner as from fossil fuels. Variety in resources type for bio-energy employed variety of electricity generation technologies.</p>	<p>As part of the screening and feasibility analysis processes, it is critical to identify potential sources of biomass and to estimate the fuel quantities needed. If possible, determine in detail the capability of potential suppliers to produce and deliver a fuel that meets the requirements of the biomass equipment.</p>	<p>A critical issue for the biomass is the feedstock, energy, ash and moisture content, and homogeneity. These will have an impact on the cost of biomass feedstock per unit of energy, transportation, pre-treatment and storage costs, as well as the appropriateness of different conversion technologies. biogas can be converted directly into electricity by using a fuel cell. However, this process requires very clean gas and expensive fuel cells</p>	<p>biogas generation from animal manure and waste-to-energy from urban discards as the most promising sustainable biomass technologies using existing resources in Afghanistan.</p>

RE Technology Option 5

GEOHERMAL

Technology Status	Suitable Conditions	Technical Challenges	How suitable is this option for Afghanistan?
<p>applications of geothermal technology include; electricity generation, supply of hot water and heat for use in buildings, agriculture, and industrial processes. Thermal power plants require steam to generate electricity</p>	<p>A good geothermal site need to includes:</p> <ul style="list-style-type: none"> • Hot geothermal fluid with low mineral and gas content • High average thermal gradients • High rock permeability and porosity while keeping fluids in place • Shallow aquifers for producing and re-injecting hydrothermal fluids • Make-up water availability, necessary for evaporative cooling. 	<p>The biggest challenge for developing such technology in Afghanistan is lack of accurate and detailed data on resources sites which cases data</p> <p>While the geothermal resource is ideal for distributed energy supplies, it is very site specific except for large scale generation that can be fed into the national grid. For distributed generation, the minimum economical size is typically 5 MW.</p>	<p>According to some reports, geothermal resources in Afghanistan is estimated around 91MW . With many new magmatic and volcanic resources in different part of country like Hindu Kush mountains area, Badakhshan, Helmand and Farahrud, the potential of geothermal sounds enormous.</p>

Main report

For each technology summarized here, the main report explains:

- ▶ Technical status,
- ▶ Implementation issues,
- ▶ Opportunities and challenges,
- ▶ Cost and economics
- ▶ Quality standard
- ▶ And basic Recommendation for the Operation and Maintenance

References:

- ▶ The main sources:
 - ▶ World Bank
 - ▶ IRENA
 - ▶ Alliance for Rural Electrification
- ▶ Sources include:
 - ▶ Reports and Publications
 - ▶ Books
 - ▶ Articles



Comments and Recommendations