

RENEWABLE ENERGY IN SIKKIM

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ABSTRACT

Sikkim is the least populous state in India yet it has managed to create its own niche. With the rise in global warming, erratic weather conditions and numerous diseases, a paradigm shift in renewable energy has taken place. With the formation of SREDA, Sikkim has taken a step forward in creating an awareness and encouraging the usage of renewable energy at various institutions. The paper focuses on the accomplishments of SREDA and its present status.

KEYWORDS: Northeast Region, Mainstream of Renewable Energy, Developing Countries, Sikkim

INTRODUCTION

Sikkim is a 22nd state of India located at the Northeast region. ⁱWith 610,577 inhabitants as of the 2011 census, Sikkim is the least populous state in India. Sikkim is nonetheless geographically diverse due to its location in the Himalayas; the climate ranges from subtropical to high alpine, and Kangchenjunga, the world's third-highest peak, is located on Sikkim's border with Nepal. Almost the entire state is hilly, with an elevation ranging from 280 meters (920 ft.) to 8,586 meters (28,169 ft.). The Lower Himalayas, lying in the southern reaches of the state, are the most densely populated. The state has five seasons: winter, summer, spring, autumn, and a monsoon season between June and September. Sikkim's climate ranges from sub-tropical in the south to tundra in the north. Most of the inhabited regions of Sikkim experience a temperate climate, with temperatures seldom exceeding 28 °C (82 °F) in summer. The average annual temperature for most of Sikkim is around 18 °C (64 °F).

RENEWABLE ENERGY

Renewable energy is generally defined as energy that comes from resources which are naturally replenished on a human timescale such as sunlight, wind, rain, tides, waves and geothermal heat. About 16% of global final energy consumption presently comes from renewable resources, with 10% ⁱⁱ of all energy from traditional biomass, mainly used for heating, and 3.4% from hydroelectricity. At the national level, at least 30 nations around the world already have renewable energy contributing more than 20% of energy supply. Renewable energy resources exist over wide geographical areas, in contrast to other energy sources, which are concentrated in a limited number of countries. Rapid deployment of renewable energy and energy efficiency is resulting in significant energy security, climate change mitigation, and economic benefits. ⁱⁱⁱ While many renewable energy projects are large-scale, renewable technologies are also suited to rural and remote areas and in every developing countries. United Nations' Secretary-General Ban Ki-moon ^{iv} has said that renewable energy has the ability to lift the poorest nations to new levels of prosperity.

As of 2011^v, small solar PV systems provide electricity to a few million households, and micro-hydro configured into mini-grids serves many more. Over 44 million households use biogas made in household-scale digesters for lighting

and/or cooking, and more than 166 million households rely on a new generation of more-efficient biomass cook stoves.

MAINSTREAM OF RENEWABLE ENERGY

There are many forms and types of renewable energy which are clean energy but this paper will focus only on the three types of energies which are provided below.

Wind Energy: Power is generated by running wind turbine with the increase in wind speed. Areas where winds are stronger and more constant, such as offshore and high altitude sites, are preferred locations for wind farms. ^{vi}Globally, the long-term technical potential of wind energy is believed to be five times total current global energy production, or 40 times current electricity demand, assuming all practical barriers needed were overcome. This would require wind turbines to be installed over large areas, particularly in areas of higher wind resources, such as offshore. As offshore wind speeds average ~90% greater than that of land, so offshore resources can contribute substantially more energy than land stationed turbines.



Source: Google Image
Figure 1

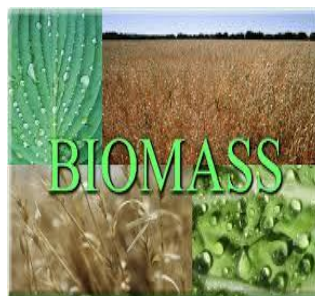
Solar Energy: Heat generated from the sun is converted into energy in the form of electricity. Solar technologies used are broadly characterized as either passive solar or active solar depending on the way they capture, convert and distribute solar energy. In 2011, ^{vii}the International Energy Agency said that "the development of affordable, inexhaustible and clean solar energy technologies will have huge longer-term benefits. It will increase countries' energy security through reliance on an indigenous, inexhaustible and mostly import-independent resource, enhance sustainability, reduce pollution, lower the costs of mitigating climate change, and keep fossil fuel prices lower than otherwise. These advantages are global. Hence the additional costs of the incentives for early deployment should be considered learning investments; they must be wisely spent and need to be widely shared".



Source: Google Image
Figure 2

Biomass: It is most often referred to plants or plant-derived materials. As an energy source, biomass can either be

used directly via combustion to produce heat, or indirectly after converting it to various forms of biofuel. Wood remains the largest biomass energy source today; examples include forest residues (such as dead trees, branches and tree stumps), yard clippings, wood chips and even municipal solid waste. The grain can be used for liquid transportation fuels while the straw can be burned to produce heat or electricity. Plant biomass can also be degraded from cellulose to glucose through a series of chemical treatments, and the resulting sugar can then be used as a first generation biofuel. Crops, such as corn and sugar cane, can be fermented to produce the transportation fuel, ethanol. Biodiesel, another transportation fuel, can be produced from left-over food products like vegetable oils and animal fats.



Source: Google Image

Figure 3

RENEWABLE ENERGY IN DEVELOPING COUNTRIES

A developing country, also called a less-developed country, is a nation with a lower living standard, underdeveloped industrial base, and low Human Development Index (HDI) relative to other countries.^{viii} A growing number of the Government of developing countries have recognized the essential role that renewable energy can play in meeting daily energy needs. A well designed policies related to the promotion and cost of renewable energy will increase the awareness level among the citizens.^{ix} Experience in recent years suggests that the following actions can play a crucial role in scaling up the use of renewable energy:

- Create Supportive Policy and Institutional Frameworks
- Promote Private Sector Involvement
- Level the Playing Field
- Nurture Micro-Enterprise
- Build Projects Around Local Needs and Capacities

Renewable energy projects in many developing countries have demonstrated that renewable energy can directly contribute to ^xpoverty reduction by providing the energy needed for creating businesses and employment. Renewable energy technologies can also make indirect contributions in alleviating poverty by providing energy for cooking, space heating, and lighting. Renewable energy can also contribute to education, by providing electricity to schools.

India falls under the ^{xi}NIC category, i.e., Newly Industrialized Countries, where nations with economies more advanced and developed than those in the developing world, but not yet with the full signs of a developed country. India lies in South Asia, is seventh largest country by area, the second-most populous country with over 1.2 billion people.^{xii} India was the first country in the world^{xiii} to set up a ministry of non-conventional energy resources, in early 1980s. Renewable energy in India comes under the purview of the Ministry of New and Renewable Energy. China and India are

rapidly expanding markets on renewable. India has become the country with fifth largest installed wind power capacity in the world.^{xiv} According to the India Renewable Energy Status Report 2014 released at the ongoing Green Summit 2014 in Bangalore on Thursday, the total renewable energy potential from various sources in India is 2,49,188 Mw. The untapped market potential for overall renewable energy in India is 2, 16,918.39 Mw that shows huge growth potential for renewable energy in India.^{xv}

FOCUS ON SIKKIM

Sikkim is located in the northeast part of India with a population of 6, 10,577 as of ^{xvi}2011 census. Sikkim is the second-smallest state of India. The entire state is hilly, with an elevation ranging from 280 meters (920 ft.) to 8,586 meters (28,169 ft.). The summit of Kangchenjunga—the world's third-highest peak—is the state's highest point, situated on the border between Sikkim and Nepal.^{xvii} The state has five seasons: winter, summer, spring, autumn, and a monsoon season between June and September.

The Sikkim Renewable Energy Development Agency (SREDA)^{xviii} was constituted by the State Government in 1999. This autonomous agency was mandated with the task of promoting and popularizing renewable energy, and to also act as the State Nodal Agency for all renewable energy programmes and projects in the State.

Mentioned below are some of the successful venture of SREDA:

- **Under Special Area Demonstration Programme (SADP):** SREDA had sanctioned installation of Solar Power Plant at State Assembly Premises, Gangtok East Sikkim, which was completed on 26th of July 2012.
- **Under the Jawaharlal National Solar Mission 2011-2012:** For Off grids Solar Applications the Ministry of New And Renewable Energy, Government of India had sanctioned SREDA installation of six (6) no. s of Solar Power Plants at various government institutions in and around Sikkim. All of the six (6) projects have been completed.
- Financial year 2012-2013 SREDA has been sanctioned two (2) no. s of solar power plant to be installed at Mintokgang and Samman Bhawan, East Sikkim.
- Places where SREDA has installed solar water heating systems are :
 - Raj Bhawan Complex, Gangtok.
 - Rongey Central Prison.
 - Sikkim Institute of Rural Development, Karfectar.
 - Janata Bhawan.
- SREDA has recently successfully installed solar water heating systems to 100 households in North Sikkim.
- Financial Year 2011-12:- 221 biogas plant was installed.
- Financial Year 2012-13:- 170 biogas plant was installed.
- In Sherathang, SREDA has installed two wind-solar hybrid systems for lighting.
- In south district three hybrid systems have been installed, one at Namthang PHC and two at Assangthang,

Namchi.

- For the financial year 2013-14 two sites have been identified at Pangthang, SAP complex East Sikkim and Soreng, West Sikkim for wind energy.
- Four wind monitoring stations are set up :
 - Assangthang, Namchi South Sikkim.
 - Thangu, North Sikkim.
 - Gnathang in East Sikkim.
 - Sadam South Sikkim.

PROMOTION & CREATION OF AWARENESS IN SIKKIM

In order to inform and generate awareness about renewable energy especially amongst the youths, youth awareness programmes are a regular feature of SREDA. Every year SREDA participates in various melas/exhibitions conducted by various government departments of Sikkim. The “Rajiv Gandhi Akshay Urja Diwas” renewable energy day is celebrated every year on the 20th of August. The programme is celebrated in order to commemorate the birth anniversary of the late Prime Minister and also to create awareness among the general public especially students about the benefits of renewable energy. Various competition are held viz quiz, painting, rallies and skit. During 2012-2013 Rajiv Gandhi Renewable Energy Day was celebrated in Gangtok in a grand manner. SREDA participated in the annual “Pang Lhabsol 2012” celebrations in Ravangla, South and “Maghey Sankrti Mela 2013”, South Sikkim whereby various solar devices were on exhibit and sale. During the event exhibition cum sale solar powered devices were exhibited and sold on subsidized rate to the general public.

Energy Parks: In order to promote awareness on the advantages of renewable sources of energy, Energy Education parks have been set up in all the four districts of the State. During 2009-2010, two(2)nos. district level energy parks at SIRD, Karfector and Phodong Monastery in North Sikkim have been set up. A State level Energy Education Park at Bhanjhakri Falls has also been set up by the SREDA which has become a hot spot for tourists.

Wind Energy: SREDA has already initiated identification of potentially windy sites by setting up wind monitoring stations. Four monitoring stations were set up at Assangthang, Namchi South Sikkim, Thangu, North Sikkim and Gnathang in East Sikkim and Sadam South Sikkim. Feasibility studies have been carried out. In windy areas, SREDA has installed wind-solar hybrid systems for lighting and police communications. In Sherathang, two such systems with 2kw each have been installed. In south district three hybrid systems have been installed, one at Namthang PHC and two at Assangthang, Namchi. For the financial year 2013-2014 two sites have been identified at Pangthang, SAP complex East Sikkim and Soreng, West Sikkim.

CONCLUSIONS

Since the inception of SREDA in Sikkim has contributed to the development of renewable energy to some extent, yet it has still a long way to go. Extensive advertisement both video and audio form should be initialized in order to instigate citizens of Sikkim to buy more of such clean products. The manufacturers can focus on designs using nano technology for such product to be bought and used by all. Sikkim has always been known as a peaceful state and a clean

state with amiable people, and is also housing an educated youths who would definitely desire to make it one of the NE states who has achieved success in the field of renewable energy. It has created a room for more researchers to contribute their work in Sikkim.

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