

Renewable Resources & Environment Protection- Exploring Solar Energy - A Case Study

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ABSTRACT

Natural resource management refers to the management of natural resources such as land, water, soil, plants and animals, with a particular focus on how management affects the quality of life for both present and future generations. It deals with managing the way in which people and natural landscapes interact. It brings together land use planning, water management, biodiversity conservation, and the future sustainability of industries like agriculture, mining, tourism, fisheries and forestry. It recognises that people and their livelihoods rely on the health and productivity of our landscapes, and their actions as stewards of the land play a critical role in maintaining this health and productivity. It specifically focuses on a scientific and technical understanding of resources and ecology and the life-supporting capacity of those resources. Environmental management is also similar to natural resource management. In academic contexts, the sociology of natural resources is closely related to, but distinct from, natural resource management. Natural Resources are all that exists without the actions of humankind. This includes all natural characteristics such as magnetic, gravitational, and electrical properties and forces. On earth we include sunlight, atmosphere, water, land (includes all minerals) along with all vegetation and animal life that naturally subsists upon or within the heretofore identified characteristics and substances natural resources such as sunlight and air can be found everywhere, and are known as ubiquitous resources. There are very few resources that are considered inexhaustible– these are solar radiation, geothermal energy, and air. The vast majority of resources are exhaustible, which means they have a finite quantity, and can be depleted if managed improperly. Renewability is a very popular topic and many natural resources can be categorized as either renewable or non-renewable:

1. INTRODUCTION

Renewable resources – Renewable resources can be replenished naturally. Some of these resources, like sunlight, air, wind, etc., are continuously available and their quantity is not noticeably affected by human consumption. Though many renewable resources do not have such a rapid recovery rate, these resources are susceptible to depletion by over-use. Resources from a human use perspective are classified as renewable only so long as the rate of replenishment/recovery exceeds that of the rate of consumption. Non-renewable resources – Non-renewable resources either form slowly or do not naturally form in the environment. Minerals are the most common resource included in this category. By the human perspective, resources are non-renewable when their rate of consumption exceeds the rate of replenishment/recovery; a good example of this are fossil fuels, which are in this category because their rate of formation is extremely slow, meaning they are considered non-renewable. Some resources actually naturally deplete in amount without human interference, the most notable of these being radio-active elements such as uranium, which naturally decay into

heavy metals. Of these, the metallic minerals can be re-used by recycling them, but coal and petroleum cannot be recycled.

EXPLORING SOLAR ENERGY-AN ANALYSIS

Solar cells are long lasting sources of energy which can be used almost anywhere. They are particularly useful where there is no national grid and also where there are no people such as remote site water pumping or in space.

Solar cells provide cost effective solutions to energy problems in places where there is no mains electricity. Solar cells are also totally silent and non-polluting. As they have no moving parts they require little maintenance and have a long lifetime. Compared to other renewable sources they also possess many advantages; wind and water power rely on turbines which are noisy, expensive and liable to breaking down.

Rooftop power is a good way of supplying energy to a growing community. More cells can be added to homes and businesses as the community grows so that energy generation is in line with demand. Many large scale systems currently end up over generating to ensure that everyone has enough. Solar cells can also be installed in a distributed fashion, i.e. they don't need large scale installations. Solar cells can easily be installed on roofs which means no new space is needed and each user can quietly generate their own energy.

SOLAR ENERGY AND TAMILNADU

There is increasing in demand globally for renewal resources in recent years as a result of industrial development and its consequent pollution. The usage of natural resources is far less than the actual demand. Hence, unless the countries strive for renewable sources of energy and replace it with the conventional source of energy, the sustainability will be under threat. Solar energy offers a clean, climate-friendly, abundant and inexhaustible energy resource to mankind. The costs of solar energy have been falling rapidly and are entering new areas of competitiveness. Solar Power installations worldwide are growing rapidly with nearly 18-20 Giga Watt (GW) expected to be installed in 2012. Tamil Nadu has reasonably high solar insolation (5.6-6.0 kWh/sq. m) with around 300 clear sunny days in a year. Southern Tamil Nadu is considered to be one of the most suitable regions in the country for the development of solar power projects. With substantial solar insolation in the State, the commitment of the State Government and rapidly declining Solar Power costs, there are remarkable opportunities in the solar energy domain. This will enhance energy security, making Tamil Nadu the global reference in the solar energy sector.

ENERGY DEMAND IN TAMILNADU

Power sector in the State had a moderate growth and managed to meet the challenges in terms of power demand during 2008-09. The installed power generating capacity of the State was broad based by an addition of 92 MW capacities at Valuthur Gas turbine Project. The gross energy availability of the State had a marginal increase of 118 MU. or by 0.2 per cent in 2008-09 against 3285 MU in 2007-08. Against these limitations, the State's peak demand for power rose to 9459 MW in 2008-09 from 8969 MW in 2007-08. The consumers' demand for power was restricted and the State went to the extent of introducing power cuts to manage the situation in summer months. The sale of power in the State was 53506 MU in the review year, an increase of 1.28 per cent only. The per capita consumption of power was also contained at 1000 units / kwh for the year 2008-09.

During the five year period, from 2004-05 to 2008-09, the State's installed capacity had increased at an annual rate of 1.9 per cent against that of per capita consumption at 5.2 per cent. The peak demand for power rose at an annual rate of 5.6 per cent while that of gross availability and total sale at 6.3 and 6.9 per cent respectively. The State was able to overrule the supply constraints and tried to maintain the power cut free status, since 1992. The performance of the sector during the review year 2008-09 is narrated in the following sections, with the aid of certain crucial indicators in a detailed manner. The installed capacity of the State at 10122 MW in 2007-08 rose to 10214 MW in 2008-09. An additional capacity of 92 MW was created at the gas turbines of the State's own projects. The capacity additions from the Central Sector Projects and that of Independent Projects and external assistance were nil for the review year 2008-09. Limited additions from all the sources made the State sector to suffer a little at the backdrop of increasing demand for energy.

GROSS POWER AVAILABILITY

The State's gross availability of power during the year 2008-09 was 66966 MU; increased by 0.2 per cent from 66848 MU realized during 2007-08. The State's own generation and purchases from various sources were in the ratio of 43:57 in 2008-09. The energy sector's receipt from the power purchases from the Central Sector Projects was also not to be highly appreciated. The purchases at 37607 MU during 2007-08, had moved up to 37984 MU, by 1.0 per cent. The quantum of power thus available in the State, for the year 2008-09 was 53506 MU. A marginal increase of 1.3 per cent witnessed in 2008-09 made the net power availability of the State to increase from 52832 MU in 2007-08 to 53506 MU in 2008-09. The demand for electricity in Chennai City is 2579 MW/12.06.2012 and the energy consumption is 49.531 MU / 07.06.2012. The number of Consumers (LT) is 25.874 Lakhs and HT consumers is 1943 Nos.

2. OBJECTIVES OF THE STUDY

- To study the usage of various natural resources in energy generation in Tamilnadu.
- To analyse the growth, potential and economics of solar energy.

The envisaged growth of 9 per cent in the National economy during the Eleventh Plan period could be achieved only with a commensurate increase in the availability and access to energy. Meeting the challenges of energy access and ensuring lifeline supply of clean energy are essential for empowerment of individuals. For two-thirds of Indian population, non-commercial fuel such as fire wood, crop residues etc. still remains as the primary energy sources of households. The shortages in peak power and energy indicate the magnitude of the problem.

TECHNICAL ASPECTS OF SOLAR ENERGY

Sun is a primary source of energy, and all forms of energy on the earth are derived from it. The solar energy can be harnessed either by deriving energy directly from sunlight or by indirect methods. Directly the Solar energy is obtained by:-

- Solar thermal technology, i.e harnessing of solar heat into useful energy using collectors.
- Photovoltaic energy conversion technology, which is the most useful way of harnessing solar energy by directly converting it into electricity by means of solar photovoltaic

cells. When sunshine is incident on solar cells, they generate Direct Current (DC) without the involvement of any mechanical generators.

- Solar hydrogen gas production technology, which is still in embryonic stage.

ADVANTAGES OF SOLAR ENERGY ECONOMICS OF SUN LIGHT

One of the best advantages of solar energy, and the one that is primarily responsible for the rapid growth of solar installations in Europe over the past several years. Electricity can be produced by oneself, instead of buying it from the grid, which proved to be cost effective. This advantage alone is propelling the rapid adoption of solar energy in the USA and many other markets around the world.

SOLAR ENERGY IN ABUNDANT

The sun will be around a lot longer than oil, coal or gas. Some of the materials used to make solar cells to convert the solar energy into electricity, such as the more exotic composite materials may run out over time, but the basic elements used to make solar cells (e.g., silicon and aluminum) are all abundant and recyclable.

AS LONG AS THERE IS LIGHT – IT WORKS

The amount of sunshine can vary depending on where you are or what the weather is like, but as long as there is light (even a small amount) PV cells can still produce electricity.

SUNSHINE IS FREE

Solar energy is free. Sure, there is an initial capital cost to install a system that will convert the electromagnetic energy and photons sent out by the sun into electricity, but once invested production of electricity will be a continuous process.

ENVIRONMENTALLY FRIENDLY

Solar energy powers the environment and life on the planet so there's no energy source more earth-friendly. Compared to the burning of fossil fuels, which release greenhouses gases, carcinogens and carbon dioxide, solar cells don't release anything harmful into the air as they convert the sun's energy into electricity. For clean air – one of the important renewal resources is the solar energy.

SOLAR ENERGY IS COST EFFECTIVE

While a solar photovoltaic panel is still relatively expensive, it will pay for itself over time from the sale of electricity by reducing the amount of electricity.. The time it takes to recover the net investment is known as the payback period. Generally, the payback period for solar installations is getting shorter and shorter. In some geographical areas producing electricity from the sun already costs less per kilowatt hour of electricity produced than producing it from fossil fuels. As coal, gas, oil and nuclear energy fuel prices continue to rise solar energy will become even more cost effective.

SOLAR ENERGY IS CLEAN

Solar energy is a clean alternative to fossil fuels and nuclear power. Solar power can be captured anywhere without creating noise pollution that might otherwise upset neighbors and wildlife. Thus, no danger of damaging our already damaged environment.

GREATLY REDUCED CONTRIBUTION TO GLOBAL WARMING

One of the greatest advantages of solar energy, of course, is that there are no carbon dioxide, methane or other emissions that warm the atmosphere. However, manufacturing, transporting and installation of solar panels are necessarily accompanied by some of those emissions.

FALLING COSTS

The financial costs of producing solar cells and solar hot water panels are falling as technology develops and economies of scale in the manufacturing, distribution and installation of solar energy projects expands. Unfortunately, incentives to adopt solar energy are falling a bit faster – which provides an economic incentive to adopt sooner rather than later. This is happening at a time when costs for nuclear plants, coal and gas plants and the fuels they require are increasing in cost.

LOW RUNNING COSTS

After installation, the maintenance of solar energy is 5% of its annual income – much lower than fossil fuel, wind, geo-thermal, waste to fuel, or hydro-electric systems.

FOSTERS INDEPENDENCE

It is not required to connect to the power grid. It can be completely self-sufficient and live off-the-grid. Local application and independence from a centrally controlled power grid and energy transport infrastructure is insurance from upheaval through political and economic turmoil, and gives flexibility.

RELIABILITY

Solar panels are extremely reliable. In fact, while most crystalline solar panels come with performance guarantees for 25 years – some of the early installations built in the 1970's are still producing electricity today.

IT WORKS EVERYWHERE

One of the most basic advantages of solar energy is that it works wherever the sun shines. It doesn't matter how remote, solar can generate energy where no other form of power can be obtained. That's why it's used on space vehicles, boats, and in areas where there is no access to other forms of electricity.

SOLAR ENERGY POLICY OF TAMILNADU

In March 2008, Signet Solar Inc. signed a memorandum of understanding with the State government to build a INR 20 billion thin-film silicon photovoltaic module manufacturing plant in the Sriperumbudur Special Economic Zone. Further, in June 2008, Moser Baer inked a MoU with the state government to build INR 20 billion plant for manufacturing of silicon-based photovoltaic thin film modules and allied products in the Oragadam Special Economic Zone which is closer to the Signet Solar's plant in Sriperumbudur. With the state reeling under acute power crisis, Tamil Nadu government unveiled a solar energy policy under which installation of solar panels in all new government and local body buildings would be made mandatory, which seeks to tap 3000 MW of power in the next three years through solar energy. The policy hopes to generate 1000 MW each year till 2015.

Creation of solar energy parks, encouragement to people to install solar panels at home and gradual installation of solar panels in government and local body buildings are some of the salient features of the new policy, an official release said. It has been proposed that the street lighting and drinking water distribution would be managed gradually through solar energy in local body and government buildings, besides it is envisaged that the big industries and high tension power consumers should use certain percentage of power only through solar energy. Producers of solar energy equipments would be given encouragement such as net metering (which enables the rooftop solar plant to put in the surplus energy into the grid), exemption from electricity tax and power cut. The new policy was aimed at making Tamil Nadu a frontrunner in the solar power generation. Government of Tamilnadu had mandated all colleges to procure 6% of the power through Solar sources. The urge among students to work on solar technologies is growing. Over 15,000 more “green jobs” are expected to be created over the next 2 years in Tamilnadu alone, with Solar plants requiring more than 50 hands for every 1 MW. (**Times of India dt. 22.3.2013**)

COST EFFECTIVENESS-ECONOMICS OF SOLAR ENERGY

The installed capital costs of solar thermal systems generating electric power are about 3 to 5 times larger than the present cost of fossil fuel systems, but the running costs are obviously very low for solar system as the fuel is free. In Chennai the cost incurred for installing 1 KV Solar panel is approximately Rs 1.25 lakhs, which is sufficient for a house hold using 4 ceiling fans, 4 tube lights, besides other electrical and electronics appliances, except air conditioners. It is also estimated that the saving of expenditure on Power is 30 to 40% (on average), besides free maintenance for 5 years by the installing agency/ industry. On a long run, the saving on power by using Solar Energy is found to very significant and most cost effective.

STATISTICAL ANALYSIS OF PRIMARY DATA

Since P value is less than 1, hypothesis is rejected at 1% level of significance. It is therefore concluded that there exists a significant association between Power saving in Households due to usage of Solar Panels and economic benefits of Solar Energy in the long run.

FRIEDMAN TEST ANALYSIS SHOWING THE DIFFERENCE BETWEEN THE MEAN RANK TOWARDS THE OPINION REGARDING ENERGY CRISIS IN TAMILNADU AND ECONOMY OF SOLAR ENERGY

OPTIONS	MEAN RANK	CHI SQUARE VALUE	P VALUE
Solar Energy will be the main source of energy in the coming days.	8.12	711.528	0.001**
Government should go in large scale installation of solar panels for harnessing solar energy.	7.90		
Solar Energy is not fully harnessed in our country	7.87		
Solar Energy is economical compare to other forms of energy in long run and easily installable by individual households	7.84		
There is severe scarcity of energy/ electricity for your house hold	7.74		
The cost of energy/ electricity has gone up.	7.69		
Solar Energy will be non-depleting alternate source of energy.	7.72		
All the house- holds should have alternate source of energy	7.52		
There is severe scarcity of energy/ electricity for industries	7.43		
Dependence on Solar Energy will be inevitable in the days to come.	3.88		
Bio-gas Energy is economical and easily installable by individual households	2.40		
Wind Energy is economical and easily installable by individual households	1.90		

Source:- Primary data.

As per Friedman Test analysis the respondents have opinioned that Solar Energy will be the main source of energy in the coming days, followed by Government should go in large scale installation of solar panels for harnessing solar energy, Solar Energy is not fully harnessed in our country, Solar Energy is economical compare to other forms of energy in long run and easily installable by individual households, there is severe scarcity of energy/ electricity for your house hold, the cost of energy/ electricity has gone up, Solar Energy will be non-depleting alternate source of energy, all the house- holds should have alternate source of energy and there is severe scarcity of energy/ electricity for industries.

The mean rank on opinion regarding Solar Energy will be the main source of energy in the coming days is high to the tune of 8.12% and the least mean rank is regarding the Wind Energy is economical and easily installable by individual households is low to the tune of 1.90%.

From the above analysis it can be inferred that in the present scenario of energy crisis in Tamilnadu, Solar Energy, which is non depleting source of energy is the most economical form of alternate source of energy.

Since P value is less than 0.01, there is significant difference between mean rank towards the opinion regarding energy crisis in Tamilnadu and economy of Solar Energy

3. SUGGESTIONS

There is need to develop strategies for country-wide dissemination of information on solar energy as a means of promoting wider sales and use. The Government agencies are required to be more directly involved in the promotion of use of solar energy equipment in every household. The Government should provide subsidies for the purchase of solar equipments and take steps to reduce the initial installation cost of Solar panels by reducing the manufacturing cost where by making it affordable to all household. There is need to build additional technical and professional capacity in the country in the fabrication, installation and maintenance of solar equipment's. Installing solar technologies for water heating and lighting should be a mandatory housing policy. The Government needs to enforce the usage of Solar Energy for industries and other Institutions, keeping a yard stick of strength.

4. REFERENCE

- [1] India Vision 2012, Report by Planning Commission, Academic Foundation, New delhi-2011.
- [2] Economic Survey 2011-2012, Government of India, Ministry of Finance, Department of Economic Affairs, New Delhi, Oxford University Press.
- [3] Solar Energy Utilisation, G.D Rai, Khanna Publishers, 2012.