



GROWTH AND DEVELOPMENT OF SOLAR ENERGY SECTOR IN INDIA: A STUDY WITH SPECIAL REFERENCE TO TAMIL NADU

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Abstract

This paper focus on the growth and development of solar energy sector in India: a study with special reference to Tamil Nadu, and it deals with the human community faces energy crisis which threatens the depletion of conventional resources and the entire ecosystem through environmental pollution; There is a great need to examine the impact of crisis in the export of conventional energy from the perspective of oil exporting country and the import by other economies. Hence, this paper is aims to identify the role played by the government of Tamil Nadu in the growth and development of solar energy sector in Tamil Nadu and to examine the adequacy of the government incentives to the solar energy entrepreneurs and challenges faced in the promotion of solar energy unit.

Keywords:*Growth-Development-Solar Energy-Sector-Adequacy-Incentives-Entrepreneurs-Challenges-Renewable energy.*

Introduction

During the nineties, many electric utilities throughout the world forced to change their way of operation and business, from vertically integrated mechanism to open market system. The increase in energy consumption, particularly in the past several decades, has raised fears of exhausting the globe's reserves of petroleum and other resources in the future. The huge consumption of fossil fuels has caused visible damage to the environment in various forms. Every year human activity dumps roughly 8 billion metric tonnes of carbon into the atmosphere, 6.5 billion tons from fossil fuels and 1.5 billion from deforestation stand as one of the reasons in search of alternative energy and urgency of avoiding the usage of conventional energy sources.

India is one of the first few countries in following the global change in power sector by establishment of the Regulatory Commission in 1998 under the Electricity Commission Act 1998 (Central Law) to promote competition, efficiency and economy in the activities of the electricity industry and applied restructuring in this context. India's need to increase energy provision for its population and fast growing poses a formidable challenge which is perceived as both a great opportunity as well as a necessity for the country to increase the share of renewable in the overall energy mix. With more than a billion population, it has become crucial for the planners to understand the issues and concerns that the country has to face, if adoption of alternative energy is delayed.

The rapid increase in the energy demand all over the world, the depletion of conventional energy sources and the pollution caused by conventional fuels have amplified the importance of developing new and renewable energy sources. Humankind has been blinded by its need for energy and had created havoc on the earth ecosystem. The resulting fuel exhaustions and climate changes have driven the world towards energy crisis and made to realize the urgency for finding alternative sources for quenching the ever growing demand for energy.

The extensive usage of conventional energy has caused them to be depleted rapidly. In India alone the known deposits of petroleum are envisaged to last only a few decades, whereas coal reserves will last for just another hundred years. Solving this energy crisis needs combined efforts from economies all over the world, which is possible only with universal supports from the ruling governments. The rising costs of energy have started to force global leaders to realize the importance of research on alternative sources of energy. Hopefully this will drive the power hungry nations to find ways to stop further deterioration of our planet.

The search for new energy sources has indicated the need for developing approaches to evaluate feasibility and competitiveness of the alternative sources. Frequently mentioned as alternative energy sources are wind power, water power, tidal power, coal, fission energy with or without breeders, geothermal energy, ocean thermal energy conversion, low temperature solar energy through photosynthesis and solar electric generation. Among them, solar energy is prominent for its availability all through the year and cost effective both from the angle of producers and the consumers.

Significance of the Study

The human community faces energy crisis which threatens the depletion of conventional resources and the entire ecosystem through environmental pollution; There is a great need to examine the impact of crisis in the export of conventional energy from the perspective of oil exporting country and the import by other economies; The increasing usage of conventional



energy sources poses a wide variety of ecological and economic threat and their prices are soaring due ever increasing energy consumption; Present energy need heavily relies on the conventional sources, but the limited availability while signifies the need for alternative source of energy; The government of Tamil Nadu is one of the first few states to unveil the policy to tackle the shortage of power and to bridge the gap between demand and supply.

Need for the Study

There is a prevalence of anxiety over the requirement of all the energy for the rest of the century for the domestic, industrial and for the commercial purpose; The problem of exploitation of exclusively conventional sources points the fact that environmental sustainability is seriously endangered, reducing the economic potentiality; In order to provide sufficient, environment-friendly, and low-cost energy to sustain the economic growth, there is a dire need for an alternative source of energy; Renewable energysources are receiving increasing support worldwide for its environmental benefits they bring in comparison with conventionalenergysources;There is a pressing need to harness the renewable energy, especially by commercializing affordable solar energy; There need to be a strong academic research to study the essentialities that drive the solar energy industry and to learn from experience in this emerging field;The guidance of integrated programs and policies with alternative financing schemes and awareness-raising are urgently need to facilitate the solar energy sustenance;Adequate research and development in this field need to be conducted to reduce the cost of solar energy to support the development initiatives of the State government; Tamil Nadu.

Review Works

In the paper published, the authors Khalil and Tarek (1980) had examined the problems encountered by a growing demand for energy consumption and a dwindling reserve of conventional energy sources. They observed that, development of alternative lean energy sources should be vigorously pursued in order to improve or maintain the quality of life. The search for new energy sources had indicated the need for developing approaches to evaluate feasibility and competitiveness of the alternative sources. Frequently mentioned as alternative energy sources were wind power, water power, tidal power, ocean thermal energy conversion, low temperature solar energy and they were identified as the primary source of energy when the conventional energy sources would deplete.

Diana and others (2010) found that the energy crisis of 1970s had led to the vigorous intervention of the industrialized states in the energy sector. They also quoted that on any national political agenda, security of the energy supply should be given priority as a infrastructure with priority. The global financial crisis and economic crisis had caused serious setback to the economic growth in general which had its root mainly from the energy crisis. Hence there need to be a fundamental shift towards the opportunities to adopt to alternative energy usage and reducing dependence on conventional energy sources.

In the view of Avril and others (2012), renewable energy sources were receiving increasing support worldwide from public authorities due to environmental benefits and longer sustenance compared to that of conventional energy sources. They noted that many countries had set target for deployment of renewable energy preparedness. The possibility to achieve them at a lower cost had become a central issue, making it necessary to examine the efficiency of the instruments used to promote the alternative energy usage.

In an article on 'the emerging renewable energy technologies', the authors Gopakumar and others (2014) had quoted that the environmental concerns due to conventional power plants had given impetus for widespread utilization of renewable energy based distributed generation technologies. As consequences, the concepts pertaining to advanced functional architecture were evolving to incorporate these technologies. Many such strategies were focused on maximum utilization of renewable energy sources compared to conventional fossil for meeting real-time load demand.

In the Society of Malawai Journal, the author Arron Juma (2007) had mentioned that it would be necessary to produce as much energy as possible to meet national needs. One should be mindful of the environmental degradation that can emanate from the same. The production and use of energy at all levels would entail varying degrees of environmental destruction of air, vegetation and water. He also stressed that energy as an indispensable facet of human life. Obviously, one could do without energy, neither could condone environmental degradation. Hence the need for a balanced energy policy should be inbuilt in every national environmental policy. As a bottom-line factor, all the stakeholders in energy should aim at minimizing the negative impact of energy on the environment.

Towards energy plan, Deshmukh and Deshmukh (2009) had mentioned that modern energy sources were neither available nor affordable to large sections of rural households. Assessment and forecasting of the demand and supply of all forms of energy and associated problems arising had necessitated the evaluation of options and energy planning. In addition, the



environmental problems arising from increased energy consumption need to be considered while undertaking the energy plan. The energy plan should be addressed to specific strategies and intervention which were able to match demand and supply in the best possible way, considering associated constraints and factors.

A study conducted by the World Bank (2005) quoted that the continuous and uninterrupted implementation of liberalization and reforms in the Indian economy for over one and half decade had resulted in India becoming as one of the highest growing economies of the world. Thus, there was no doubt that Indian economy would be slated to observe significantly high growth rate in the coming years. However, the growth rate earmarked had been accompanied with significant increase in energy consumption in the Indian economy. The growth in energy consumption during the period of liberalization and reforms had been substantially highest than in the pre-reforms era.

In the article on sustainable energy development, Sambo (2005) had noted that the campaign for renewable energy resources utilization was based on the finite nature of fossil fuel energy resources as well as the greenhouse gases emission which many scientists believed as the major cause for global warming. The study of him also pointed out the increasing costs of providing energy specially electricity through conventional fossil fuel also paved way for the search of renewable source of energy.

In their article Jain and others (2014) had mentioned that energy as the prime mover of economic growth and vital for the sustenance of the economic growth and social upliftment. They added to say that future economical development would depend on the long term availability of energy from sources that are affordable, accessible and secure. As a renewable energy, solar would be the primary solution to the growing energy challenges as they were abundant, inexhaustible and environmentally friendly. Accelerating the use of solar energy would be indispensable for India to meet its commitment to reduce its carbon intensity. Given the vast potential of solar energy in India, all its need would be framing of comprehensive policies to make the country as the global leader in clean and green energy. Despite, the Government had taken a number of steps towards the adoption of solar energy at a large scale in the country and promoting at national and state level, still the use and production of solar energy in the country was limited.

In an article in the Financial Express (2009), it was mentioned that solar-power systems on rooftops of high-rise buildings in urban areas would greatly help to ensure uninterrupted supply of electricity and overcome the present energy crisis. Sustainable energy could ensure continuous supply of electricity and it would be imperative for the government to make it mandatory in the building code for the households to install solar power systems on roof-top of high-rise buildings for generating solar energy, which already mandatory in some countries. As the ultimate energy source of the lives on the earth having easy solution to substitute the conventional energy sources, it was estimated that nearly 300 MW of power could easily be generated from solar power system to feed the hungry national grid if the systems were installed on rooftops of about 20,000 multi-storeyed buildings.

In their book on 'bridging India's power gap', the authors Brar and others (2008) had pointed that while coal had extolled and the threat of its emissions were used as a bargaining chip in India's negotiations leading to the Copenhagen Conference, solar energy had the estimated physical potential for 94 percent of India's additional electricity would need by 2031-32. Extensive technological advancement had led the country towards loss of precious foreign exchange due to large scale import of oil and coal. Thus, there was an urgent need to push solar technology in every governmental policies and to provide financial assistance.

According to the 'discussion paper on the barriers to development of renewable energy' (2012) in order to achieve low cost manufacturing and therefore lower capital costs, and to capitalize on its inherent advantages in the solar sector, India would need to consider revamping and upgrading its solar R&D and manufacturing capabilities. Towards that, GOI should consider promoting a core company to produce water and silicon and enable substantial reduction in the costs of solar technologies. Given the continuing high capital costs of even the commercially deployed RETs despite increasing capacity, there was an urgent need to encourage price reduced capital cost manufacturing through policy.

Objectives of the Study

1. To study the role played by the government of Tamil Nadu in the growth and development of solar energy sector in Tamil Nadu;
2. To examine the adequacy of the government incentives to the solar energy entrepreneurs and challenges faced in the promotion of solar energy unit;

Hypothesis

Based on knowledge gained during pilot study, review of the various relevant studies and based on consulting with experts, the present study aims to test the following null hypothesis.

1. There is no adequate level of government incentives to support the growth and development of solar energy sector in Tamil Nadu;
2. There is no challenge faced by the solar energy entrepreneurs in the promotion of solar energy units in Tamil Nadu;

Research Design

Research design provides support in the analysis and in the interpretation of the data collected from the primary source. The information provided by the target respondents in the questionnaires is interpreted based on the objectives of the study. Structured questionnaire format is designed based on the factors relevant for the study and on the secondary information collected from various sources.

Methodology

In India, Tamil Nadu state is an important state in the aspect of solar energy sector. Hence, this state has been selected purposively. This study is an empirical study based on survey method. Required data were collected from sample respondents by direct personal interview with pre-tested and well-structured interview schedule.

Sampling

As many as 500 members of solar energy products users have been requested to give ventilation to their valuable opinion through the Questionnaire. The samples have been collected in a rational and random sampling method from different parts of Tamil Nadu. Out of 500 samples, 13 samples are rejected due to inadequate information provided and finally 487 samples used for analysis.

Analysis of Data and Findings

Hypothesis 1: There is no adequate level of support extended by the government towards the development of solar energy units.

Table1: One-Sample t-test for whether there is any adequate level of support extended by the government towards the development of solar energy units

Statement	N	Mean	Std. Deviation	t value	P value
Accelerated Depreciation	287	3.89	1.079	13.891	0.000*
Capital Subsidies	287	3.74	1.143	10.952	0.000**
Renewal Energy Certificates	287	3.22	1.384	2.730	0.007**
Net Meeting Incentives	287	3.21	1.398	2.491	0.013*
Assured power purchase Agreement	287	3.74	1.191	10.511	0.000**

Source: Computed from primary survey

The above table-1, shows the results of One-Sample t-test for whether there is any adequate level of support extended by the government towards the development of solar energy units. Since p value of all the statements are statistically significant and hypothesis is rejected at 1% level of significant. Hence it is concluded that the services providers are extended adequate level of benefits for development of solar energy industry in the study area.

The table-2, shows the challenges in the promotion of solar energy units. The results of the frequency distribution as follows

- **Land Scarcity:** Regarding the land security, majority 38 percent of the respondents are agree for land scarcity for development solar energy units, followed by 22.6 percent of them have strongly agree for land scarcity, 19.2 percent have disagreed for land scarcity for development of solar energy units and 8 percent of the respondents have strongly disagree for land scarcity for development of solar energy units in the study area.
- **Slow Progress:** In connection with the above factor, majority 34.5 percent of the respondents are agree for slow progress, followed by 22.6 percent of them have strongly agree for slow progress, 21.3 percent have disagreed, 15 percent of them are neutral and 6.6 percent of the respondents have strongly disagreed for solar energy units are slow progress.
- **Land Potential:** It is identified from the above results, majority 34.8 percent of the respondents are strongly agree for land potential is a problem, followed by 34.1 percent of them agree, 18.5 percent are neutral, 9.8 percent of them have disagreed and 2.8 percent have strongly disagreed for land potential is a problem for development of solar energy units.

Government Support

It is identified from the above table, majority 35.9 percent of the respondents disagree, followed by 33.1 percent of them agree, 15.3 percent strongly agree and 11.5 percent of them are neutral for government support for promotion of solar energy units in the study area.

Hypothesis 2: There is no challenge faced by the solar energy entrepreneurs in the promotion of solar energy units in Tamil Nadu.

Table 2 - Challenges in the promotion of solar energy units

Statement	Opinion	Frequency	Percent
Land security	Strongly Disagree	23	8.0
	Disagree	55	19.2
	Neutral	35	12.2
	Agree	109	38.0
	Strongly Agree	65	22.6
	Total	287	100.0
Slow progress	Strongly Disagree	19	6.6
	Disagree	61	21.3
	Neutral	43	15.0
	Agree	99	34.5
	Strongly Agree	65	22.6
	Total	287	100.0
Land Potential	Strongly Disagree	8	2.8
	Disagree	28	9.8
	Neutral	53	18.5
	Agree	98	34.1
	Strongly Agree	100	34.8
	Total	287	100.0
Government support	Strongly Disagree	12	4.2
	Disagree	103	35.9
	Neutral	33	11.5
	Agree	95	33.1
	Strongly Agree	44	15.3
	Total	287	100.0
Inconsistence in policy provision	Strongly Disagree	27	9.4
	Disagree	73	25.4
	Neutral	33	11.5
	Agree	122	42.5
	Strongly Agree	32	11.1
	Total	287	100.0

Source: Computed from primary survey

Industry the users belong to - It is identified from the study that majority 51.7 percent of the respondents are involving trading activities, followed by 25.3 percent are involving in service activities and 23 percent of the respondents are involving in manufacturing industry. Monthly Income - The study originated that majority 39.4 percent of the respondents monthly are in the income between Rs.2, 00,000 – Rs.4, 00,000, followed by 24.6 percent in the monthly income between Rs.4, 00,001 – Rs.6, 00,000. Type of ownership - 40.7 percent of the respondents had public company ownership, followed by 34.3 percent of them had private company. Period of using solar product - Majority 54.2 percent of the respondents are using the solar energy products less than 2 years, followed by 29.4 percent are using between 2-3 years and 16.4 percent are using for above three years. Amount invested in the installation of solar products - The study found that majority 30.8 percent of the respondents have invested the amount less than Rs.10,000, followed by 27.9 percent have invested between Rs.26,000 – Rs.50,000.

Conclusion

As a renewable source, solar energy is prominent for its availability all through the year and cost effective both from the angle of the producers and the consumers. Despite, the source of solar energy is abundant in supply and the earth is able to



meet entire requirement, still solar share of the total energy market remains small. Significant importance need to be given in drawing the policy on solar energy by all the nations individually to exploit this natural resource. Concrete government guidance and regulations are essential to encourage the funding agencies to make significant investments in the renewable energy sector. In India, the governmental agencies have started providing support to the technology development in renewable energy through regulations and subsidies. The government of Tamil Nadu is one of the first few states to unveil the policy to tackle the shortage of power and to bridge the gap between demand and supply. The policy by the State government promises incentives and tax benefits for solar power production and take significant effort in the integration of renewable energies.

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