Plant Archives Volume 20 No. 2, 2020 pp. 4413-4416 **e-ISSN:2581-6063 (online), ISSN:0972-5210**

SOCIO-ECONOMIC ANALYSIS OF SOLAR AND ELECTRIC WATER PUMP OPERATING FARMERS IN VILLUPURAM DISTRICT OF TAMILNADU, INDIA.

Vallava Anand A.[1], Priyanga M.[2], Thulasiyammal C.[3]*, Venkatraman R.[4] and Thangavel P.[5]

[1,2,4,5]Faculty of Agriculture, Annamalai University, Chidambaram-608 002 (Tamilnadu) India.
[3*]Teegala Krishna Reddy Engineering College, Meerpet, Hyderabad-500 097 (Telangana) India.

Abstract

The present investigation was conducted in Villupuram District of Tamil Nadu as there are large numbers of farmers operating the solar water pumps and electric operated water pumps. A quota for 30 for solar operated well farmers and 60 for electrical operated well farmers were selected spread over the Villupuram district for the study. The collected data were analysed using different valuation methods and econometric models. The investigation well revealed that, majority of the sample farmers expressed that solar pump could well be used in the small and marginal farmers at lower depth tube wells and in the case of deep bore wells operated by medium and big farmers.

Key words: Solar pump, Economical analysis, Electric Pump.

Introduction

India has tremendous scope of generating solar energy as the geographical location of the country stands to its benefit for generating solar energy. India is a tropical country and receives solar radiation almost throughout the year, with about 300 clear, sunny days per year. India's theoretically calculated solar energy incidence on its land area alone is about 5,000 trillion kilowatt-hours (kWh) per year. Almost all parts of India receive 4.7kWh of solar radiation per sq.meter. This is equivalent to 2,300-3200 sunshine hours per year, Saurav Dubey, (2013). The solar energy available in a year exceeds the possible energy output of all fossil fuel energy reserves in India. The daily average solar power plant generation capacity over India is 0.25kWh per m^2 of used land area, which is equivalent to about 1,500-2,000 peak capacity operating hours in a year with the available proven technologies.

Hemant Ingale, (2012), reported that the solar power is absolutely perfect for use with irrigation systems for gardens, green houses and polytonal. Narale, (2013) reported that the of design and economic analysis efficient solar PV water pumping system for irrigation of banana at Maharastra. The results of the study encouraged the use of the pv systems for water pumping application to irrigate orchards. Mahir *et al.,* (2012), designed an automatic drip irrigation for dwarf cherry trees with solar powered Brushless DC motors (BLDC) in Zile District of Tokat Province of Turkey. Thulasiyammal *et al.,* (2016) analysed about the operational possibilities and economic feasibility of solar powered DC motor in different Latitudes and Longitudes of Tamil Nadu based on the incidence of solar irradiation. Tamil Nadu is amongst the states with the high solar power in India with the average solar incidence of 5.5-6kh/m2/day,

India stands fifth in the world in the production and consumption of electricity. The electricity production has expanded over the years but *vis-a-vis* the population of the country is also expanding. The power produced in the country is mostly from coal and it is predicted that country's coal reserves will not last beyond 2040-50. More than 72 percent of the population live in villages and half of the villages paucity of electricity. To meet this surging demand, solar energy is the best form of energy to fulfil the energy needs of India and bridge the energy demand -supply gap.

Energy scenario in Tamil Nadu

Tamil Nadu has historically been an agricultural state and is a leading producer of agricultural products in India. In 2014 Tamil Nadu stood as India's 7th biggest producer

***Author for correspondence :** E-mail: thulasimirunaa@gmail.com

of rice. The total cultivated area in the state was 5.89 million hectares in 2011-12. About 70 percent of the state's population is involved in agricultural activities directly as well as indirectly. In terms of energy, Tamil Nadu is endowed with high Renewable Energy resources (RES), *viz*., wind and solar. These energies can be potentially contributed a great deal for green energy generation, thereby reduced the carbon footprint of the state and the country. At present, about one third of the installed capacity from renewable sources in India exists in Tamil Nadu alone. Tamil Nadu is amongst the states with the high solar power in India. To retain its leadership position, Tamil Nadu will promote setting up of solar projects to the extent of 3000MW over a period of 3 years.

Problems Identified

The seed capital cost is very high, Hence, the buying behaviour of solar pumps could well be classified into a few categories as follows :

• High income individuals setting up a solar pump for personal or commercial use, mostly in off-grid locations.

• Government funded schemes which install solar pumps for both drinking and irrigation requirements in locations with either no electricity or unsustained power supply.

• Co-operative societies or groups that wish to install solar pumps-these could be both off-grid locations and urban locations with reliable supply.

With these knowledge on solar irrigation system Villupuram District in Tamil Nadu was selected to conduct an economic study on solar power irrigation. This District was considered as a right choice because Villupuram has intensive as well as extensive agriculture installed with the highest number of solar powered irrigation pumps in the state. Moreover in this district ground water caters more than 70 percent of the gross irrigated area and more than 90 percent of the farmers belong to small and marginal farmer's category. These socio economic conditions provides the ideal background for the proliferation of solar energised irrigation pumps and thus ranks in the priority as the top potential district in the implementation of future solar energy programme as revealed by Honrao and Parmeshwar, (2015). Hence the present inquiry was contemplated to analyse the economic advantage of solar power irrigation system in comparison with electric operated wells and it would also pave the way for achieving ever green revolution, besides curtailing dependence on fossil fuel based electricity generation.

Materials and Methods

Appropriate research design is a prerequisite to draw meaningful inferences. In this section, selection of study area, sampling method adopted for selecting farm households and methodology followed in the collection of farm level data are presented.

Study area selection

Ground water source is unreliable because of stochastic nature of water availability. The problems faced by the farmers from electrically operating well irrigation system are many, such as: unreliable and unstained power supply, power rationing and poor quality etc. Miah, (1988) examined the profitability of deep tube well and shallow tube well in Bangladesh and revealed of that profitability of the project is positively related to participating farmers in command area.

The present study relied both on primary and secondary data collection methods. The secondary information related to population, literacy, occupational pattern, rainfall pattern, land use Pattern, cropping pattern and source wise irrigation, were collected for a period from 2006 to 2016 from the district statistical office, Villupuram Tamil Nadu, India. The hydro- geological information was collected from the public works department (PWD), Tamil Nadu. The other institutes like Agricultural Engineering Department, JDA office in Villupuram were also contacted to gather the necessary information. The field level primary data were gathered using a pre-tested interview schedule by personal interview method. Different valuation methods and econometric models were employed to analyse both primary and secondary data.

Results and Discussion

The table 1 explained the age distribution of electric and solar operated tube well farmers in the study area. It is noted that in the electric group more than 40 percent of farmers were in the age of category of above 50 years and in the solar group 47 percent of the farmers were in the age category of 30-50 years age category. It could be inferred that the

Table 1: Age Distribution of Electric and solar operated Tube well farmers in the Study Area.

S. No.	Particulars	Electric operated tube well		Solar operated tubewell	
		No of Farmers	Percentage	No of Farmers	Percentage
1	Below 30	12	20.00	5	16.66
2	30-50	22	36.67	14	46.67
3	Above 50	26	43.33	11	36.67
	Total	**60**	**100**	**30**	**100**

Table 2: Education Distribution of the Samples in the selected Area.

S. No.	Particulars	Electric operated tube well		Solar operated tubewell	
		No of Farmers	Percentage	No of Farmers	Percentage
1	Illiterate	16	26.67	7	23.33
2	Primary	24	40.00	5	16.67
3	Secondary	12	20.00	11	40.00
4	College	8	13.33	6	20.00
	Total	**60**	**100**	**30**	**100**

Table 3: Farming Experience Distribution of Sample Farms.

S. No.	Particulars	Electric operated tube well		Solar operated tubewell	
		No of Farmers	Percentage	No of Farmers	Percentage
1	Below 30	12	20.00	12	40.00
2	10-30	24	36.67	8	26.67
3	Above 20	26	43.33	10	33.33
	Total	**60**	**100**	**30**	**100**

Table 4: Average Depth and Hp of Wells in the Sample Farms.

S. No.	Particulars	Tube Wells	Percentage	Solar	Percentage
1.	**Average depth in feet**				
	100-150 feet	26	43.33	25	83.33
	150-250 feet	18	30.00	5	16.67
	>250 feet	16	26.67	-	-
	Total	60	100	30	100
2.	**Horse power(hp)**				
	5 & 7.5 hp	34	56.67	23	76.67
	7.5 & 12.5 hp	18	30.00	7	23.33
	15hp	8	13.33	-	-
	Total	**60**	**100**	**30**	**100**

Table 5: Area size holding and pumping hours of the sample farm in selected area.

S.No.	Particulars	Electricity tube wells		Solar Tube wells	
1	**Operational area size holding**	**Area in ha**	**Average size in ha**	**Area in ha**	**Average size in ha**
	Marginal farmers <1ha	0.74	0.26	0.49	30.00
	Small farmer1-2 ha	1.64	36.66	1.42	50.00
	Other farmers > 2 ha	4.92	36.66	4.98	20.00
	Overall average	2.43		2.29	100.00
2	**Pumping hours**	**1011.75**		**797.95**	
3	**Water output /hour**	**7547**		**5952**	
Total number			**60**		**30**

farmers with lesser age of (30-50) are more in the solar pump technology, when compared to electric operated well farmers.

The education distributions of samples are presented in table 2. It showed that the farmers with primary level of education constitutes a major share in the electric operated tube well farms and in the case of solar operated farms the share of secondary level educated farmers were more. More over the farmers with collegiate education were as noticed higher in the case of solar operated farms.

The table 3 showed the farming experience of electric and solar operated tube well irrigation of the farmers. The table 4 revealed that the farmers with more experienced farming category of >20 years comprised of major share in electric operated tube well and below 10 years compared of the major share in the case of solar operated tube well farmers.

Table 4 shows that the electric and solar operated well details of the sample forms such as operational depth and power distribution. It is observed that most of the solar powered pumps (83.33 percent) operated at lower depth of 100-150 feet where as in the case electric operate wells the average depth was higher and more than 50 per cent of the farmers operated at the depth level of greater than 150 feet. The farmers having wells operation at greater depth on solar powered pump with 250 feet was 26.67 percent and in the case of electric operated pump at this level of the operating. Accordingly the hp capacity of motors also at lower level in the case of solar water operated wells.

Majority of the solar operated farms (76.67 percent) had the hp capacity of 5-7.5 hp only. But in the case of electric operate wells 43 percent farms had the hp capacity of more than 7.5 hp.

Table 5 showed that operation size category and pumping hour of that sample farms. The average operational farm size in each category of marginal, small, medium farmer and overall size of holding was higher in electricity operated farms, compared to the solar operated farm in the selected area. Accordingly, the pumping hours were also higher in electric operated wells compared to solar operated wells. The water output/hour was also noticed higher in the case of electric operated wells and this might be due to higher capacity of motors (Table 5) existing in the case electric operated wells.

The results revealed that solar operated water pumping system were found to low than electric operated water pumping system. Though solar operated water

pumping gives relatively high cost in the initial years, continuous practice will help to increase the utilization in the later years. Farmers are facing the problem of non-availability of low cost photovoltaic panels. Hence, subsidy should be given to establish solar operated water pumping system. It is available for farmers to switch over to solar water pumping system which minimize the environmental degradation.

It could well be concluded that as there is every chance for policy changes and revoking of free power supply as well as subsidiaries, the farmers are suggested to resort to solar based power pump and relay on their own resources

References

Hemant Ingale N.N. Kasat (2012). Automated Solar Based Agriculture Pumping. *International Journal of Advanced Research in Computer Science and Software Engineering.*, **2(11)**.

Mahir Dursun and Semih Ozden (2012). Application of Solar Powered Automatic Water Pumping in Turkey, *International Journal of Computer and Electrical Engineering.*, **4(2)**.

Miah, M.T. H. and J.B. Hardaker (1988). Benefit-Cost Analysis of Deep and Shallow tube-well Projects in the Tangail District in Bangladesh, *Bangladesh Journal of Agricultural Economics, Bangladesh Agricultural University.*, **11(1):** 1-29.

Narale, P.D., N.S. Rathore and S. Kothari (2013). Study of Solar PV Water Pumping System for Irrigation of Horticulture Crops, *International Journal of Engineering Science Invention.,* **2(12):** 54-60.

Saurav Dubey, Sunil Chamoli and Ravi Kumar (2013). Indian Scenario of Solar Energy and its Application in Cooling Systems: A Review, *International Journal of Engineering Research and Technology.,* **6(4):** 571-578.

Thulasiyammal, C. and S. Sutha (2016). Impact of solar Radiation and Temperature on Photovoltaic Powered DC Appliances: An Experimental Analysis, *Journal of Computational and Theoretical Nanoscience.,* **13(8):** 5111-5118.