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A study on influencing factors of solar pumpsets in agricultural sector with reference to farmers of Tamil Nadu

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ABSTRACT

Tamil Nadu agriculture sector is the most overriding sector in the economy. Around 40 percent of the state's population is involved in agricultural activities as this is one of the major means of livelihood in the state. A solar-powered pump sets is a pump operated on electricity generated by photovoltaic panels or the radiated thermal energy available from collect sunlight as opposed to grid electricity or diesel run water pumps. The central and state governments motivate farmers to purchase solar pump sets for their agricultural activity. The demand of electricity is increased every day due to various reasons like high population, new connections, high utilization of water resources through motor pump sets, etc. The objective of the study is to identify the influenced factors for buying solar pump sets in agricultural sector in Tamil Nadu state. The study is based on primary data. The data's were collected from interview schedule method from Tamil Nadu farmers based on who was received subsidy for solar pump sets for farming activity. Factor analysis has been used for the study to analyze the influenced factors for buying solar pump sets.

Key Words : Solar pump sets, Government subsidy, Agriculture, Influenced factors

INTRODUCTION

Tamil Nadu has historically been agriculture state and it is heavily depend upon the river water and monsoon rains. The state was India's second largest economy and also second biggest producer of rice. Tamil Nadu agriculture sector is the most overriding sector in the economy. Around 40 percent of the state's population is involved in agricultural activities as this is one of the major means of livelihood in the state. It is also viewed as an effective instrument for attainment of inclusive growth and poverty reduction.

A solar-powered pump sets is a pump operated on electricity generated by photovoltaic panels or the radiated thermal energy available from collect sunlight as opposed to grid electricity or diesel run water pumps. The operation of solar powered pumps is more cost-effective mainly due to the lower process and repairs costs and has less natural impact than pumps powered by an internal combustion engine. It is helps to generated electricity to pump water. Solar pumps are also useful for the places where grid electricity is unavailable and alternative sources which do not provide

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sufficient energy. The pumps has common applications are water for livestock, crop irrigation, drinking and cooking water supply. Submersible water pumps can be used to lift water from great depths of up to 700 feet deep.

The central and state governments motivate farmers to purchase solar pump sets for their agricultural activity. The demand of electricity is increased every day due to various reasons like high population, new connections, high utilization of water resources through motor pump sets, etc. The governments announced 2000 Nos solar pump sets of 5Hp subsidy in the year 2013 for Cauvery delta zone (500 Nos) and other districts (1500 Nos) with 80% subsidy with original price of 500000 INR. In The year 2017, Tamil Nadu government pushing to adopt the solar pump sets for agriculture with subsidy price of 90% to the farmers. State government made an announcement including extension of subsidy to 1000 solar pump sets at 90% subsidy aimed at giving a boost to the agriculture sector. Out of 90 % subsidy, the state share is 40% ministry of new and renewable energy, government of India assistance is 20% and TANGEDCO share is 30%.

In the year 2001, Tamil Nadu crossed national average per capita electricity consumption, and also crossed the 1000 units of mark in the year 2007, followed by the year 2009 consumption number was 1134 units ,and its ranking 11th among the Indian states. Tamil Nadu has average consumption per day is more than 300 million units in the year 2017. The state has an acute power shortage of more than 3000 MW in the year 2011, and the demand is increasing every year by 6%. The present power demand in Tamil Nadu is around 13500 to 14500 MW which is expected to go up to 15500 MW. Agriculture is categorized as third segment in state's high volume of electricity consumption.

Reviews of literature :

Rupert Gouws and Thendo Lukhwareni (2012) reviewed the influencing factors of performance and efficiency of sola water pumping system specifically in South Africa. The study discussed and reviewed the factors which are related to environmental conditions, PV panels, controllers, energy storages, converters and inverters, pumps and motors. It research concluded that solar irradiation, metrological data, air mass and diffuse radiation are the important factor that influenced solar pumping system and it has a high efficiency and an affordable price.

Chandel *et al.* (2015) review the solar photovoltaic water pumping system technology for irrigation and drinking water purpose. The objective of the research is to present a literature review, evaluate economic viability and identified research gaps of solar pumping system. The parameters like solar radiation availability, total dynamic head, sum of suction head, discharge head, flow rate of water, quantity water requirement, frictional losses and dynamic gauge are discussed to identify the performance level.

Agarwal and Jain (2016) discuss about sustainability and solar based irrigation in India. The researcher used three approaches, *i.e.* literature review, semi- structured interviews of different stakeholders and field visit to multiple solar installations in India. The study identifies the determinants and its impact of sustainability of solar-based irrigation and the researchers identifies that eighteen key determinants of SPIS sustainability and underlines several pertinent strategies. And the study also tries to bring together all the key factors, which could influence sustainability of solar-based irrigation.

Statement of the problem :

Tamil Nadu energy department reported that power consumption of agriculture sector is 20.2

% with 20.62 lakhs agriculture connections. About 4.3 lakhs farmers are waiting for new free connections when only 40000 connections are given every year. To overcome the current situation the state and central government motivate farmers to buy solar pump sets by providing subsidies and it helps the farmers to produce energy for their own needs. Solar energy production helps to generate electricity to meet own demand by the farmers. The solar pump set scheme also encourage an existing free power connection holder can also go for solar pump sets installation Hence, the study is focused to find out influence factors of solar pump sets in agriculture sector in Tamil Nadu.

Objective :

– To identify the influenced factors for buying solar pump sets in agricultural sector in Tamil Nadu state.

METHODOLOGY

The study is based on primary data. The data's were collected from interview schedule method from Tamil Nadu farmers based on who was received subsidy for solar pump sets for farming activity. Factor analysis has been used for the study to analyze the influenced factors for buying solar pump sets. Convenient sampling technique is adopted for the study. The beneficiary details are found from ministry of new and renewable energy sources. Around 2000 beneficiaries are received solar pump sets under the scheme in the year 2013-2017. Hence, the research identified that influenced factors for buying solar pump sets in agriculture sector in the state of Tamil Nadu.

Scope of the study :

The central and state government providing subsidy for installing solar pump sets in agriculture sector for growing production of solar energy in all over the country. The study helps to identify the influenced factors of solar pump sets for farming activity in Tamil Nadu and it will benefit a large spectrum of farmers to go for alternative energy source.

RESULTS AND DISCUSSION

The Table 1 reveals the application of the factor extraction process it was performed by principal compound analysis to identify the number of factors to be extracted from the data and by specifying the most commonly used Varimax conation method. In this principal component analysis, total variance is explained by the sixteen factors in each variable. The proportion of variable is explained by the common factor called communalities of the variance are common, therefore, before extraction the communalities are all 1.000. Then the most common approach for determining the number of factors to retain *i.e.* examine Eigen values are done.

Table 1 : Communalities of factors

Items	Initial	Extraction
Cheapest source of electricity	1.000	.814
Location of farm land	1.000	.750
Lack of electricity connection	1.000	.555
Ground water level	1.000	.469
Multiple usage	1.000	.512
Government subsidy	1.000	.844

Table 1 contd…

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No power cut	1.000	.693
Carbon foot print reduction	1.000	.608
Sustainability and Fossil free future	1.000	.851
New farming technology	1.000	.531
Reasonable price	1.000	.744
Convenient usage	1.000	.803
Working for long term	1.000	.533
Attractive paybacks	1.000	.686
Quick power generation	1.000	.746
No maintenance cost	1.000	.658

Source: Computed from primary data

The Table 2 represents that the result of the factor analysis regarding influenced factors of solar pump sets have revealed that there are 16 factors that have Eigen values exceeding "four" among these sixteen factors, the first factor accounted for 30.80 percent, followed by the second variance 18.00 percent, the third variance 10.80 percent and finally 7.86 percent in the dataset. The first four factors are the final factor solution and they all together represent 67.48 per cent of the total variances in the scale items measuring the impacts of influences. Hence from the above result, it is concluded that the above factors influences solar pump sets.

Table 2 : Eigen values and proportion of total variance of each underlying factor

Component	Initial Eigen values			Extraction sum of squared loadings			Rotation sums of squared loadings		
	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %
1	4.928	30.803	30.803	4.928	30.803	30.803	3.510	21.939	21.939
2	2.881	18.006	48.809	2.881	18.006	48.809	3.217	20.108	42.047
3	1.729	10.808	59.617	1.729	10.808	59.617	2.059	12.870	54.917
4	1.257	7.859	67.475	1.257	7.859	67.475	2.009	12.558	67.475

Source: Primary data

Table 3 elucidate that the rotated component matrix, which is an important output of Principal Component Analysis .the co-efficient are the factors and sixteen variables. From the above factor matrix it is found that co-efficient for economic factor (factor I) have high absolute correlation with variable No maintenance cost, Working for long term, quick power generation, attractive paybacks, multiple usage , ground water level and location of farm land is .861, .765,.707,.687,.613,.565,.532, respectively. The risk reduction factor (factor II) matrix it is found that co efficient for factor I have high absolute correlation with variable no power cut, convenient usage, new farming technology, carbon foot print reduction, cheapest source of electricity is .850,.759,.745,661,.586, respectively. The convenient factor (factor III) matrix it is found that co efficient for factor I have high absolute correlation with variable lack of electricity connection and reasonable price is .820 and .739, respectively. The boosting factor (factor IV) matrix it is found that co efficient for factor I have high absolute correlation with variable government subsidy and sustainability and fossil free future is .856 and .827, respectively.

Table 3 : Rotated Component Matrix

		Component			
		1	2	3	4
1.	No maintenance cost	.861			
2.	Working for long term	.765			
3.	Quick power generation	.707			
4.	Attractive paybacks	.687			
5.	Multiple usage	.613		.535	
6.	Ground water level	.565			.403
7.	Location of farm land	.532			
8.	No power cut		.850		
9.	Convenient usage		.759		
10.	New farming technology		.745	.405	
11.	Carbon foot print reduction		.661		
12.	Cheapest source		.586		
13.	Lack of electricity connection			.820	
14.	Reasonable price			.739	
15.	Government subsidy				.856
16.	Sustainability and fossil free future				.827

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization
a. Rotation converged in 7 iterations.

Conclusion :

Solar energy production plays a very important role by taking care of state agriculture sector. The utilization of electricity is very high in agricultural sector but lack of electricity connection for their agricultural activity is one of the major problems. In this study 16 important factors are considered, among those factors economic factors like no maintenance cost, working for long term, quick power generation, attractive paybacks, multiple usage, ground water level and location of farm land are influencing mostly. Risk reduction factor, convenient factor and boosting factors influenced the greater part for installing solar pump sets for the agricultural purpose. Inventiveness from government is supposed to be helpful for the production of solar energy, so that the farmers can make use of solar energy at all levels of agricultural activities.

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