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Solar Energy Benefit to the Corporate Sector

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Abstract. The use of solar energy as a power source is not a new one. Solar energy technology has different set of dynamics from other renewable energy sources. Solar devices have the heat storage and consequently, generate power even after sunset. In solar energy there is also an added opportunity of locally sourcing raw material at a moderate cost. It has and additional advantage of being able to generate electricity right after the construction of the collector. In other technologies, there is usually a gap between plant construction and production of electricity, which increases the interest cost to investments made.
Moreover, the world has plenty of silicon. It is the second most common element in the earth's crust, trailing only oxygen. Therefore it is very much popular among the countries.

Keywords: Energy, corporate sector, cost, fossil fuels

1. Introduction

Energy in the form of heat is an important requirement in domestic, agricultural, industrial and commercial sectors of our economy. In the domestic sector, thermal energy is needed for cooking, heating water and for drying purposes. In the industrial sector there is a need for hot water for cooking to provide catering to the workers, for cleaning purposes, for different stages of production etc. In the commercial sector viz., hotels, hospitals, offices, hostels etc. need thermal energy for variety of applications like cooking, laundry and steam for sterilization, kitchen activities, washing and bathing etc. Normally, these requirements for both domestic and corporate sectors are being met by burning of coal, wood, kerosene, LPG and use of electricity. Many of these conventional sources of energy can be replaced by solar energy.

The Sun is our nearest star and it is the source of energy for life on Earth. It is about 150 million km away, a distance which sunlight covers in 8 minutes. The Sun is about 3, 00,000 times heavier than Earth. The energy output, solar constant, is about $3.8 \text{ X } 10^{33}$ ergs / sec. Within forty minutes of the sun shining on the Earth, the Sun will have given off as much energy as the entire world population will use in a year. Only about one percent of this energy put out by the Sun is harnessed and utilized by earth's inhabitants.

The basic energy source for the Sun is nuclear fusion, which uses the high temperatures and densities within the core to fuse hydrogen, producing energy and creating helium as a byproduct. The Sun has been producing its radiant and thermal energies for the past four or five billion years. It has enough hydrogen to continue producing for another hundred billion years. However, in about ten to twenty billion years the surface of the Sun will begin to expand, enveloping the inner planets including Earth [1]. It is stable, it is the ideal size, and it emits just the right amount of energy. For good reason, it has been called 'Power House' [2].

This paper gives an insight into different types of solar devices, their potentialities, ways to harness energy from the sun using these devices and the various types of solar power systems.

2. Power of the Power House

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Solar power can be harnessed in two ways, in the form of heat (or thermal energy) and in the form of light energy. The light rays of solar energy are harnessed for power generation through solar cells and are called Solar Photovoltaic (SPV) systems, where light is directly converted into electricity using silicon (solar) cells. The electricity thus generated can be used for lighting or other electrical applications [3].

Various solar and photovoltaic devices and systems are available and are proven to be useful in the field. They have been commercialized and are finding wide and increasing applications. The benefits thus accrued through application of solar devices comprise the crux of this research study.

3. Review of Literature

Eggers-Lura (1979) has presented a documentation report on solar energy in developing countries. He has highlighted solar hardware industries and their functions. He also describes the capital investments, distillation expenditures and economic effects of solar distillation [4].

Garg (1987) has opined that solar energy can not only be used for domestic purposes but also for industrial purposes. In his study, it was revealed that industrial process heat is the thermal energy used directly in the preparation or treatment of materials and items manufactured by an industry. Presently, oil, natural gas, coal or electricity meets the requirement of these industries, but a large portion of industrial process heat at sufficiently low temperatures can easily be supplied by solar energy. The continuous need for energy in industries allows a maximum utilization of solar equipment. The main advantage of using solar energy for industrial heat process is that it replaces scarce fossil fuels and no heat engine required and therefore higher efficiencies could be obtained. This study shows the various fields in which solar energy can be effectively applied [5].

Muhopadhyay et al. (1993) have done a comparative study of solar PV presented against a kerosene lantern for a life period of 25 years. This centralized charging system with solar PV provides self-employment and economical feasibility. A proper design and fabrication of the central charging station along with matching portable solar PV lantern has also been discussed in detail. This approach for central charging of the PV lanterns appears to be reliable and provides cost effective lighting to rural sectors especially in developing countries [6].

Tapan Bhattacharya (1995) has compared the direct conversion of solar energy into electricity with other forms of electricity generated from energy for a sustainable world energy system. He has stated that solar photovoltaic systems are simple to install, require little or no maintenance and have a long life span [7].

4. Objectives

To analyse the benefits accrued by the corporate sector by using the solar energy.

5. Hypothesis

There is no significant difference in the average annual benefits accrued by the corporate sector by switching over to solar devices.

6. Methodology

The present study is empirical, based on primary sources of data. The framework of the analysis has been constructed from the data collected through primary surveys by interview schedules and field visits covering Chennai and Thiruvallur districts. The data has been used to highlight and substantiate the theoretical aspects of the solar power distribution. An attempt has been made to focus on the solar power sector growth and distribution in the study area.

The total sample size is 172, of which 86 consists of users of solar energy devices and 86 samples consists of non-users of solar energy devices. For selection of samples, the purposive sampling technique has been adopted. Purposive sampling has been deliberately used in the place of popular methods such as multi-stage stratified random sampling technique. The study has been conducted in Chennai and Thiruvallur districts of Tamil Nadu. In the selected areas, solar energy users and nonusers were contacted with a specially prepared and pre-tested questionnaire.

7. Statistical Tool

$$y=b_1+b_2qty+b_3fueld_1+b_4fueld_2+b_5fueld_3+b_6fueld_4+b_7fueld_5+b_8noemply+ b_9cost+u;$$

Y is the dependent variable and gives the average annual benefits incurred by the corporate sector by using solar devices (namely solar water heaters and solar photovoltaic lamps) in rupee terms.

The independent variables are,

Qty is the quantity of fuel usage reduced due to the usage of solar devices by the corporate sector

The fuel dummies,

$fueld_1$ =1 if the fuel used is electricity
=0 otherwise

$fueld_2$ =1 if the fuel used is lpg
=0 otherwise

$fueld_3$ = 1 if the fuel used is coal
=0 otherwise

$fueld_4$ = 1 if the fuel used is kerosene
=0 otherwise

$fueld_5$ = 1 if the fuel is wood
=0 otherwise

noemply is the size or number of employees in the corporate sector using solar devices

cost is the cost of one module of the solar device used by the corporate sector,

b_i 's (where I = 1, 2 ….9) are the parameters or coefficients of the independent variables and gives the partial effect of the independent variables on the dependent one when rest of the coefficients are taken constant.

8. Result and Discussion

Table 1: Fuel Used before the Installation of Solar Device

S. No	Fuel	Corporate	
		Cswh	Cssl
1.	Electricity	30 (69.77)	43 (100.00)
2.	LPG	8 (18.60)	-
3.	Coal	3 (06.98)	-
4.	Kerosene	-	-
5.	Fire wood	2 (04.65)	-
	Total	43 (100.00)	43 (100.00)

Source: Compiled by researcher from collected data

The above Table 1 shows the different forms of fossil fuels used before the installation of solar devices, 30 user respondents used electricity, 8 user respondents used LPG, 2 user respondents used firewood, and 3 respondents used coal respectively for their fuel requirements.

The Table 2 shows the strength of the employees in the corporate sector. More than 50 percent of the solar device corporate users fall in the category which employees less than or equal to 200 employees. 24.4 percent of the solar device user in corporate sector has 200 to 300 numbers of employees and 17.4 percent of the users in the corporate sector have above 300 number of working people. It is clear that there is a need for

conventional forms of energy to satisfy their necessary daily requirement like heating, cooking purposes etc. Installations of solar device will definitely reduce their fossil fuel consumption and also it will give them monetary benefits by substantially reducing the amount spent on fossil fuel, in the long run.

Table 2: Number of Employees in the Corporate Sector

S.No	**No. of Employees**	**Corporate**	
		User	**Non-user**
1.	Below 100	22 (25.60)	4 (4.70)
2.	101-200	28 (32.60)	38 (57.60)
3.	201-300	21 (24.40)	30 (34.90)
4.	Above 300	15 (17.40)	14 (16.30)
Total		**86 (100.00)**	**86 (100.00)**

Source: Compiled by researcher from collected data

Among non-users more than 44 percent in the corporate sectors have less than or equal to 200 employees; 34.9 percent have employed 200-300 people while the rest of the 16.3 percent have employed more than 300 people. Hence it can be inferred that usage of solar device need to be tapped by these institutions.

Table 3: Regression Statistics

Multiple R	0.9818
R Square	0.9639
Adjusted R Square	0.9602
Standard Error	64296.02
Observations	86

The Table 3 shows the Coefficient of Determination R^2 0.963991 translates that 96 of the variation of the benefits incurred by the corporate sector using solar device is explained by the independent variables described in the multiple regression model. The high value of the Coefficient of Determination implies the model is strong and is a "good fit". The Adjusted R^2 0.96025 which shows that the model is strong and is a "good fit"

Table 4: Value of Coefficient

	Coefficients	T statistic	P value
Intercept	736131.72	10.5104	1,55E-16
qty	5.77516	9.9649	1.69E-15
fuel d1	-732025.73	-10.678	7.46E-17
fuel d2	-645303.6	-8.9238	1.68E-13
fuel d3	-665657.82	-8.4477	1.39E-12
fuel d4	-368907.75	-4.4565	2.79E-05
fuel d5	-799697.46	-8.7636	3.43E-13
noemply	-30.6286	-1.6587	0.10124
cost	-0.00635	-0.3201	0.74975

From the Coefficients Table 4**,** it is found that, the quantity of fuel saved has a positive effect on the benefits incurred by the corporate solar device using sector since it has positive coefficient values while the fuels used, number of employees in each corporate unit and cost of module have an inverse effect on the benefits incurred since they carry negative coefficient values.

From the Table 4, it is clearly seen that the independent variables for fuel dummies and the quantity of fuel saved due to the usage of solar devices have a highly significant effect on the benefits incurred by the corporate sector.

The coefficient of QTY 5.775167 implies that the 577 units of fuel is saved annually by the corporate units if they switch over to using solar devices. The coefficients of the various fuel dummy's are of values -732026, -645304, -665658, -368908 and -799697 translates that the benefits incurred annually by the corporate gets reduced by the respective amounts if the usage of solar devices were to be replaced by other fuels such as electricity, LPG, coal, kerosene or wood. Thus there exist positive costs which the corporate sectors bear by using fossil fuels.

Hence the null hypothesis is rejected and the alternative hypothesis is accepted that there is a significant difference in the average annual benefits accrued by the corporate sector by switching over to solar devices.

9. Conclusion

Energy is a key infrastructure, which is the backbone and prime mover of the economic development of any country because it is required for all the sectors of economy which include agriculture, industries, service, information and technology, transport and others. Economic growth too is driven by energy in the form of finite resources such as coal, oil and gas or in renewable forms such as solar, hydro, wind and biomass, or its converted form, electricity.

Modern economists believe that an index of energy could be used as an index of capital because in "economic parlance, energy caters both to the direct consumption and the production of goods: as consumer goods, their consumption tends to vary with changes in income and consumer preferences; as an input in production, their availability and increasing quantities are a sine qua non of rising national income."

Therefore, the availability of quality power in the required quantity is one of the most important determinants in the success of the country's development. In addition providing adequate and affordable electric power is essential for economic development, human welfare and higher standard of living. India being a developing country with increasing population makes power the critical infrastructure. The study concluded that the corporate sector for solar device usage, the number of employees was taken into consideration 44 percent in the corporate sectors have less than or equal to 200 employees; 34.9 percent have employed less than or equal to 300 people while 16.3 percent have employed more than 300 people. Therefore there will be more possibilities to install solar device in the non-users' side. In the case of solar water heaters and solar street lights 43 and 32 user respondents from corporate sector found it extremely useful and 11 user respondents in the corporate sector enjoyed usefulness of streetlight. None expressed their negative views of usefulness on the usage of solar devices. Hence the study suggested a constant demonstration about the benefits of solar device and its uses definitely will induce awareness among people.Government should take necessary steps for research and development in solar devices, especially to induce technological development of solar device.

10.References

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