

Performance Evaluation of Mono Crystalline Silicon Solar Panels in Khairpur, Sind, Pakistan



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Abstract

Strength, space, weight, environmental impact, thermal conductivity and cost are important dimensions of the engineering materials. Therefore research is carried out at various levels in academics and industry to improve certain properties of materials to improve their performance, in terms of increase in their efficiency, decrease in weight, decrease in costs and increase in heat resistance. These trends are also visible in silicon solar panel materials on basis of their performance. This article presents the performance efficiency of mono crystalline silicone material solar panel in various parts of the day and periods of the year for a proposed site at Khairpur, Sind, Pakistan.

Introduction

Materials composition plays a vital role in the performance of various types of processes. Discovery of silicon followed its utilization as an important engineering material due to its capability to produce photo voltaic effect, an important solar energy conversion process. Its use has increased due to its capability of being an environmental friendly energy generation and conversion process.

Solar energy utilization is considered an important energy generation process in the solar rich countries of the world because of its ability to cope up with energy scarcity and availability of an alternative form of energy. Therefore solar energy utilization processes are widely used in developed, developing and under developed solar rich countries. Pakistan is also one of a solar rich developing Countries. There is a huge solar potential, which can be utilized for electrical power generation, water treatment and heating or cooling of the buildings at small, medium and large scale [1-3].

Due to lack of traditional energy sources infrastructure in various areas certain categorization of communities exist on basis of their access level to available energy resources [4]. Human development index represents such population categories on basis of amount of energy consumption.

Since silicon materials are used in solar photo voltaic cells these can contribute to sustainable and efficient solar energy generation processes in those areas, which are still suffering from

unavailability of traditional energy infrastructure. Solar photo voltaic energy generation process can facilitate the development of energy infrastructure to such, areas, which have still access to basic amenities like electricity and water [2,5,6].

Methodology

In order to analyze scale of solar energy utilization in any solar rich area it is necessary to estimate expected solar energy potential. Likewise, an effort was made to estimate solar energy generation capability using silicon mono crystalline solar photo voltaic cell panels at a proposed site in Khairpur, Sind, Pakistan.

Available solar radiation climatic online data is used for estimation of energy potential with the help of Ret Screen software. The data so obtained is processed for analysis and is interpreted in tables and graphs.

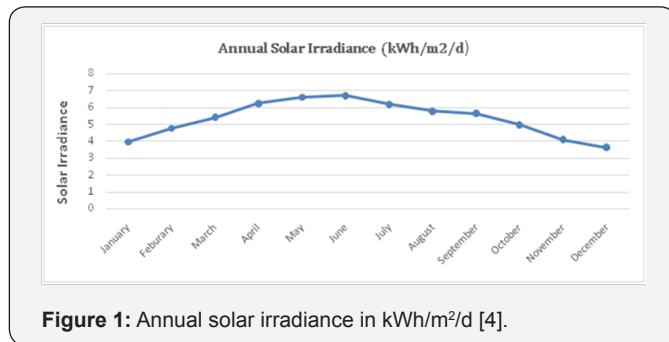
Results

The results reveal that considerable amounts of heat and electrical energy can be generated using silicon mono crystalline solar photo voltaic panels at Khairpur, Sind, Pakistan. However, there is variation in the energy generation process because of the reason that solar energy amounts received variably round the hours of day and the months of year at the proposed site. It also reveals that the amount of energy generated is more in the noon hours and in the summer season than other hours of the day and seasons of the year at the proposed site. Therefore,

it is possible to utilize efficiently silicon mono crystalline solar photo voltaic cells for energy conversion processes at the proposed site. The results are presented in Table 1 and Figure 1.

Table 1: Annual Solar Irradiance Data [4].

S.No	Month	Solar Irradiance (kWh/m ² /d)	Solar Irradiance (W/m ² /d)
1	January	3.97	165.4166667
2	February	4.78	199.1666667
3	March	5.44	226.6666667
4	April	6.25	260.4166667
5	May	6.64	276.6666667
6	June	6.73	280.4166667
7	July	6.21	258.75
8	August	5.81	242.0833333
9	September	5.66	235.8333333
10	October	4.99	207.9166667
11	November	4.12	171.6666667
12	December	3.64	151.6666667



The results are promising for energy generation and conversion process in such traditional energy deficient and solar energy efficient areas of Khairpur, Sindh, Pakistan and proposed silicon mono crystalline cell solar photovoltaic energy generation system are capable to provide required amounts of energy to cater electrical power generation and water treatment processes needs of the communities living in such underdeveloped areas.

Conclusion

It has been found that Silicon mono crystalline solar photovoltaic materials based solar panels may produce more photovoltaic effects at ambient temperature around 20-26 degree Celsius at noon in May to August in a de centralized, self-contained, independent and environmental friendly manner in underdeveloped areas of Khairpur and in vicinity of Khairpur, Sind, Pakistan.

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