JOURNAL OF RESEARCH AND DEVELOPMENT

A Multidisciplinary International Level Refereed Journal

ISSN: 2230-9578

IMPACT FACTOR: 7.265

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Sb Maharashtra Mahavidhyalaya Nilanga *in recognition of the contribution of paper/article titled"* "Highly Sustainable Electric Power Generation by Solar PV

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Details of published article /paper as under:

Volume: **Issue:**

Month: 07/2021

20/07/2021

Journal of Research and Development
A Multidisciplinary International Level Refereed Journal
ISSN-2230-9578.

Dr. R. V. Bhole
Editor
Journal of Research and Development
ISSN No-2230-9578
Jalgaon

Peer reviewed Journal Impact Factor 7.265 ISSN-2230-9578

[44]

Journal of Research and Development

[44]

A Multidisciplinary International Level Referred Journal

July 2021 Volume-11 Issue-24

Impact of Environment on Agriculture, Health, Water Resources, Social Life & Industrial Development

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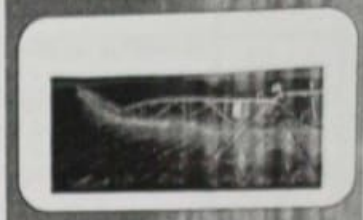

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'Journal of Research & Development' A Multidisciplinary International Level Refereed and Peer Reviewed Journal.
Impact Factor-7.263, ISSN: 2230-9578, 20 July-2021, Volume-11, Issue-24
Impact of Environment on Agriculture, Health, Water Resources, Social Life & Industrial Development

Highly Sustainable Electric Power Generation By Solar Pv's

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Abstract :

Major energy demand in India jumps from 6 % today to 11 % by 2040.207 % to 4781 TWh by 2040 , accounting for 61 % of primary energy demand growth. Solar based power generation is gaining attention worldwide as it is environment friendly , & highly sustainable . Polycrystalline crystal solar collectors (each of 320W) are used to generate an energy of 481.66 KWh / Year (3.69 KWh / day). Increasing the no. of collectors to three can generate 1445 KWh / Year and from 7- to – 9 collectors 3420 KWh / Year. Increasing the no. of collectors to nine protected 10.5 KWh / day resulting in 4733 KWh / Year of electrical energy & the average annual consumption of a house is about 15360 W. Electricity power supplied by the M.S.E.B. Mahaviran company , to the Nilanga Taluka , Latur District Maharashtra , India. And this supply from the MSEB is too low as compared to the requirement of each household. This deficiency of 50 % of electric power can be mitigated by adopting the Hybrid Renewable Energy System (HRES). This study proposes a viable approach for improving the quality of life and proposes an effective solution for improving continuous power availability and reducing peak load demand in the Nilanga Taluka by the additional generation of electric power with the solar collectors. Generation of highly sustainable and vast available solar energy should be the driving force to the Nilanga region peoples.

***Key Words** : Photovoltaic,Renewable Energy, MSEB, TEPS, Energy Analysis, Voc, HRES, EDNS.*

Introduction :

Dakkhan part in India is one of the solar belt areas having extended hours of intense sunlight. The amount of solar energy received can be used to generate electricity by solar Photovoltaic , which could exceed local consumption. This makes Nilanga region peoples highly self sustained of electricity power consumption. The average intensity of solar radiation received on India is 200 MW/Km square with a geographical area of 3.287 million Km square , this amounts to 657.4 million Mw. Most parts of India receiving 4-to – 7 KWh per square meter per day. Solar photovoltaic power can effectively be harnessed providing huge scalability in India. In addition to electricity generation from Thermal Electric Power Station (TEPS) Parli (V) , solar energy can also be utilized as an energy supplement. Electricity consumption in the Nilanga Taluka is increased by over 60% -to-90% from 2012 –to – 2020. [1]. Consequently TEPS Parli (V) is one of the power plant with total spending on coal as a fossile fuel. Nilanga is town with a Municipal Council and Taluka place in Latur district in the Indian state of Maharashtra. The latitude of Nilanga is 18.125875 and the longitude is 76.7550969with the gps co-ordinates of 18^0 7' 33.1500" N and 76^0 45' 3.4884" E . According to the 2011 census 2,89,083 peoples with 63,841 households are living in the Nilanga Taluka. In the next coming i.e. 2021 census , it is expected that the population of Nilanga Taluka will be 3,58,463 with 66,000 householders. Parli (V) TEPS is the nearest electricity power generating power plant with 6 units working with a capacity of 1380 MW, which uses coal as a primary fossil fuel. The use of rooftop for solar Photovoltaic (PV) installation and power generation is very important for the future of energy conservation and sustainability[2]. It was estimated that around 30 % of the domestic electricity needs could be generated from the rooftop installation, however, necessary govt. policy changes and an increase in Nilanga region people's awareness have to be undertaken by the respective stakeholders. [3]. In order to improve the use of rooftop certain policy changes and awareness among the peoples are recommended by the author.

Electricity Power Analysis :

On an average every households now using 90 units (KWh/ month). Electricity power requirement by the Nilanga region households everyday is too high i.e. 3,19,205 KWh. Where as actual electricity power consumed by these peoples every day is 1,91,523 KWh. This shows deficiency of 1,27,682 KWh every day. So as to mitigate this deficiency of electricity power consumption , Author recommends to make aware these Nilanga region peoples about the renewable energy as an alternative one & en-force them to install rooftop solar panels and make use of solar energy as a supplement along with the MSEB (Mahavitran Coy's) supply of thermally produced electricity power. Currently the total share of renewable energy sources accounts for less than 2 % of the total electricity generation. However this share of renewable energy sources is expected to increase very significantly following the Govt. policy to force for the generation of electricity by installing solar panels on the rooftop of every house in Nilanga Taluka , so that renewable energy will be increased and sustainable future will be built up .

Table No. 1. Daily Consumption & Actual Requirement Of Electricity Power In Nilanga Region

Daily Consumption of Electricity Power by Nilanga Region Peoples i.e. by the 63,841 households	Actual Requirement of Electricity Power by Nilanga Region Peoples	Electricity Power Deficiency Every Day of the Nilanga Region Peoples	Installation of PV w adequate No. of Rooftop Panels by a household can gener Avg.Electricity Powe Every Day
1,91,523 KWh / Day	3,19,205 KWh / Day	1,27,682 KWh / Day	3.69 KWh / Day

Initiatives By The Govt. : Govt. of India has proposed to set up 25 solar parks and Ultra Me Solar Power Projects by 2020-21 , targeting over 40,000 MW of solar power was rolled out by Ministry New & Renewable Energy on 21st march-2017.

Methodology :

If we connect a 15 kw grid rooftop Solar system , mounted on a 1-BHK single floor house Nilanga Taluka to offset the electricity demand for that resident. Polycrystalline solar modules are us with an efficiency of 16.40 % and 320 W , as maximum power. These solar PV modules have hi performance at low irradiance approximately above 96 % and power tolerance upto 5W above the rat power. The PV system comprises 16 PV modules connected in series to increase the DC voltage outp and from a string to ensure that the open circuit voltage (Voc) of a PV array is within the Maximu Power Point Tracking(MPPT) operational window of the paired inverter[4]. Then three strings a connected in parallel to increase the output current to the desired value. These strings are connec to a phase Alternating current (AC) strings inverter. The inverter uses a MPPT technology to harvest t maximum energy from the solar array and convert the main panel. This project also includes a flu mount system and a 10 degree tilt racking system on a flat roof. The azimuth angle of the plant is 175 South-East following the orientation of the building. The layout of the PV plant was calculated carefully install as many as possible panels in the available roof area, avoid inter row shading, and maximize t plants performance. This PV plant will feed its produced power into the existing house network. The gi connection point is the main switchboard located on the ground floor. An additional safety breaker of 40 was added to this distribution panel, which will act as the interconnection point. A monitoring system h also been installed to ensure the control of the system remotely and monitor system performance a power production. The system has produced a maximum power of 15,360 W in perfect weath conditions, which can rarely be the case in real life because of DC to AC conversion losses, temperatu losses, mismatch losses other losses. A 15 KW solar array can produce approximately 33000 KWh p year. A pyranometer is used to measure solar irradiance as well as irradiance by the earth's surface due reflection of sunlight. The radiation data is measured for last three years during all months.

Solar Energy Potential In Nilanga Region :

In the Nilanga region the annual average daily solar irradiation exceeds more than 200 MW/K which includes Direct Normal Irradiance (DNI), Diffuse Horizontal Irradiance (DHI), Global Horizon Irradiance (GHI), ambient temperature , wind speed , wind direction ,humidity and atmospheric pressu [5,6]. On an annual basis Nilanga region receives an average of 3.69 KWh/ day. This varies from month month , with lowest in the month of July i.e. 2.41 KWh/m^2 per day and highest in the month of M i.e. 5.06 KWh/m^2 per day. There are undeniable benefits of integration of solar energy. But still sor challenges that should not be over looked such as variability, intermittency and uncertainty availability the solar energy output. So , Nilanga region peoples are made aware to use the Hybrid Energy System i Renewable Energy System in addition with Non-renewable Energy System. Hybrid Renewable Ener System (HRES) is effective to increase reliability along with its indexes such as Expected Demand N Served (EDNS) and loss of load probability (LOLP). A battery is attached to this HRES which will abso the excess of solar energy and will provide the energy back to the grid in the event of insufficiencies solar energy[7].

Table No. 2. Solar Radiation And Temperature Data In The Last Three Years

MONTH	2017-18		2018-19		2019-20	
	TEMPERATURE ^{0}c	RADIATION KWh	TEMPERATURE ^{0}c	RADIATION KWh	TEMPERATURE ^{0}c	RADI N KV
1	28.72	3.47	30.64	3.40	26.77	3
2	32.41	3.92	35.72	4.32	34.37	4
3	37.78	4.56	41.27	4.98	39.85	4

4	42.83	5.17	44.37	5.08	41.32	4.99
5	44.32	5.18	45.23	5.08	44.58	5.06
6	40.84	4.96	41.17	5.0	35.26	4.29
7	24.18	2.93	22.70	2.75	19.87	2.41
8	17.78	2.15	18.29	2.21	20.64	2.50
9	28.83	3.49	29.32	3.55	25.92	3.14
10	31.46	3.81	33.97	4.11	34.39	4.17
11	14.73	1.8	18.39	2.24	20.64	2.52
12	20.74	2.51	19.78	2.39	22.08	2.67

Results And Discussions :

Nilanga Taluka peoples are made aware for adopting the solar PV for the residential sector. To mitigate the deficiency of the electric power supply from the MSEB , Latur and actual requirement of a household , Hybrid Renewable Energy System (HRES) with the attachment of battery has to be installed by each and every households in this region. In order to improve the rooftop certain Govt. policy changes and reduction in cost through subsidies , low interest loans for individuals to purchase the components are recommended by the Author. A PV plant installed with many possible panels in the available roof area can produce a maximum power of 15360 W in perfect weather conditions. The radiation data is measured for last three years in all months and the average irradiance per day recorded. The average irradiance energy is 3.69 KWh per day. The results from the figures 1,2,3, shows that solar irradiation in Nilanga region is disrupted in the month of 7,8 [i.e. in rainy season] & in the month of 11,12 [i.e. in winter season] which would affect solar electricity power generation performance. Due to large fluctuations , the amount of solar energy that can be harvested in the month of 7,8,11,12 is less than in the other months of the year.

Fig-1. Ave. Solar Radiation In All Months For The Year - 2017-18

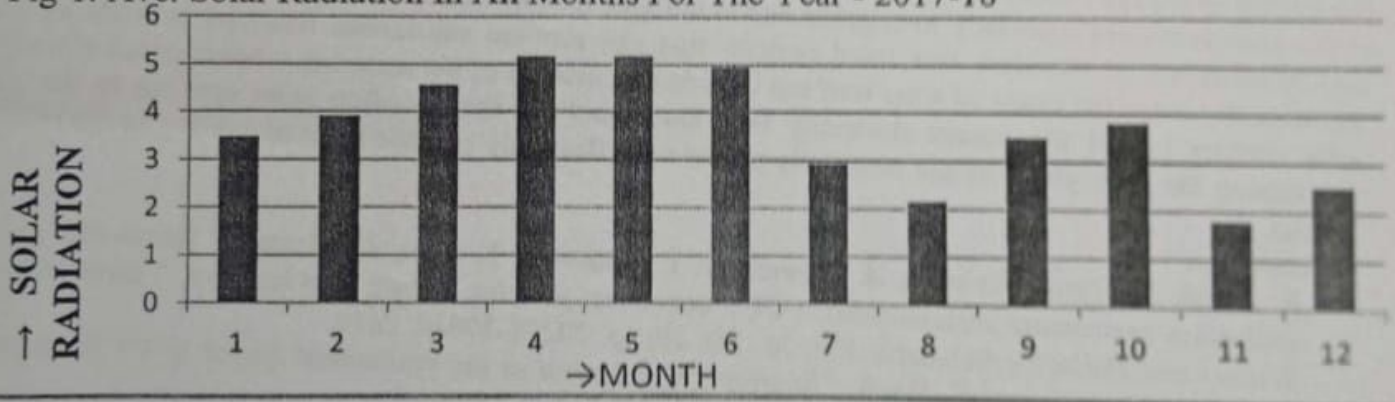
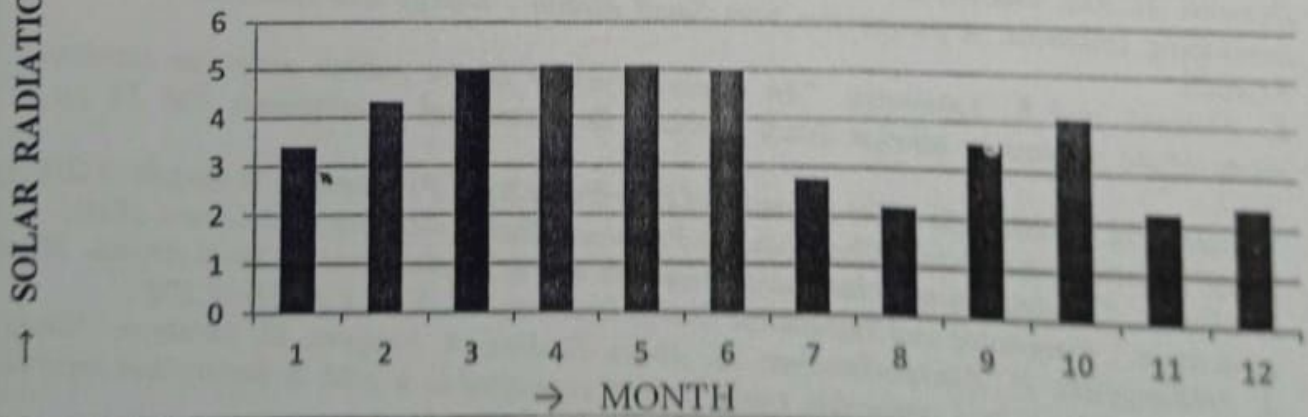


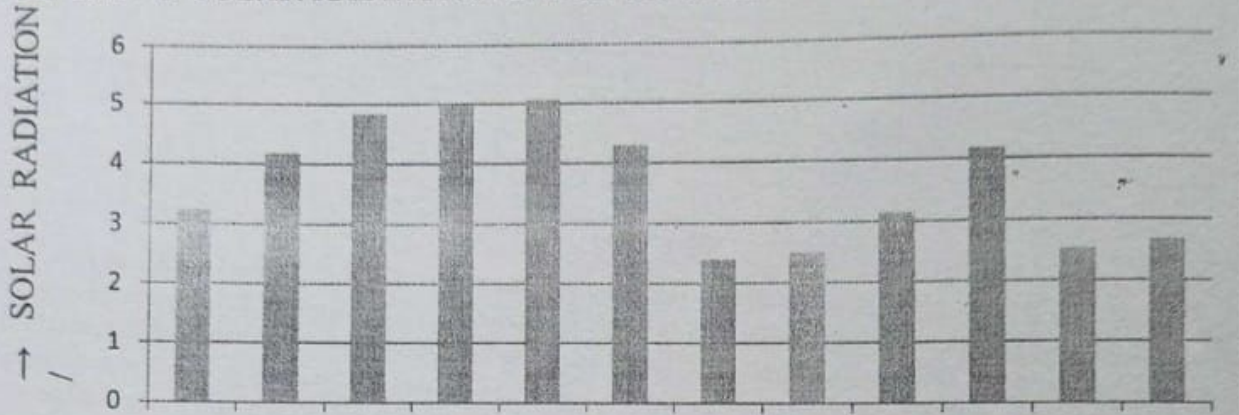
Fig.2. Ave. Solar Radiation In All Months For The Year - 2018-19



Conclusion :

This study is conducted to make aware the N

FIG. 3. AVE. SOLAR RADIATION IN ALL MONTHS FOR THE YEAR - 2019-20



ilanga region peoples about the renewable energy as an alternative one & en-force them to install rooftop solar panels and make use of solar energy. Irradiation in all months was found to be significantly greater than in the month of 7,8,11,12. It is concluded that pairing of PV with battery to generate electricity is a highly sustainable and also cost effective solution to successfully meet the deficiency of electricity power demand by the Nilanga region peoples. Addition of battery reduces the losses and stores the excess of energy . The Hybrid Renewable Energy System with a battery has the potential to be adopted in the current system especially to upgrade and to mitigate the deficiency in electricity power requirement. Government has to establish free hand policies that can provide substantial financial benefits and can significantly boost the usage of solar roof top include establishing of net metering scheme which allows the solar owners to sell the excess electricity they generate from their rooftop solar systems to the grid. Harnessing the solar photovoltaic electricity power can effectively provide huge scalability in the Nilanga Taluka.

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