ISSN- 2350-0530(O), ISSN- 2394-3629(P)
IF: 4.321 (CosmosImpactFactor), 2.532 (I2OR)
InfoBase Index IBI Factor 3.86

INTERNATIONAL JOURNAL OF RESEARCH – GRANTHAALAYAH
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Science

COST BENEFIT ANALYSIS OF INSTALLING OF SOLAR AND WIND POWER PLANT USING DIFFERENT PARAMETER

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DOI: https://doi.org/10.5281/zenodo.556412

Abstract

In this paper, we are discussing about the solar power plant and wind power plant. The electrical power is depend on the ray of sun. These are optimizing output by following the sun across the sky for maximum sunlight. These typically give you about a 15% increase in winter and up to a 35% increase in summer. The panel temperatures are much lower in winter, and then find out the minimum power. And the panel temperatures are higher in summer, and then find out the maximum power.

Keywords: Cost Analysis; Parameter; Tariff.

Cite This Article: Amit Kumar Kishanpuri, and Dr. A.K.Sharma. (2017). "COST BENEFIT ANALYSIS OF INSTALLING OF SOLAR AND WIND POWER PLANT USING DIFFERENT PARAMETER." *International Journal of Research - Granthaalayah*, 5(3), 310-314. https://doi.org/10.5281/zenodo.556412.

1. Introduction

A solar charge controller is fundamentally a voltage or current controller to charge the battery and keep electric cells from overcharging. It directs the voltage and current hailing from the solar panels setting off to the electric cell. Generally, 12V boards/panels put out in the ballpark of 16 to 20V, so if there is no regulation the electric cells will damaged from overcharging. Generally, electric storage devices require around 14 to 14.5V to get completely charged. The solar charge controllers are available in all features, costs and sizes. The range of charge controllers are from 4.5A and up to 60 to 80A.

2. Types of Solar Charger Controller

There are three different types of solar charge controllers, they are:

1) Simple 1 or 2 stage controls
2) PWM (pulse width modulated)
3) Maximum power point tracking (MPPT)

Simple 1 or 2 Controls

It has shunt transistors to control the voltage in one or two steps. This controller basically just shorts the solar panel when a certain voltage is arrived at. Their main genuine fuel for keeping such a notorious reputation is their unwavering quality – they have so not many segments, there is very little to break.

PWM (Pulse Width Modulated)

This is the traditional type charge controller, for instance anthrax, Blue Sky and so on. These are essentially the industry standard now. Simple solar charge controllers just disconnect or shunt the solar battery when battery's voltage reaches about 14.4V (for storage battery with rated voltage 12V).

Maximum power point tracking (MPPT)

The MPPT solar charge controller is the sparkling star of today's solar systems. These controllers truly identify the best working voltage and amperage of the solar panel exhibit and match that with the electric cell bank. The outcome is extra 10-30% more power out of your sun oriented cluster versus a PWM controller. It is usually worth the speculation for any solar electric systems over 200 watts.

3. Solar Power Plant Calculation

We have calculated what is the radiation received by the panels per sqm. But, depending on the panels chosen and size of the solar power plant, the area of the panels is going to be different.

Assuming, a 1 kW solar plant having 4 standard 250 Wp panels of 1m x 1.65m, which leads to a cumulative area of 6.6 sqm. We, further, multiply the radiation calculated per sqm (2,300 kWh/sqm) with the total area (6.6 sqm) to get the total radiation falling on the plant:

2,300 x 6.6 = 15180 kWh

DC Current

Every panel has got its own ability to covert the solar radiation that it receives into DC Current. The percentage of radiation that gets converted into DC Current, is known as efficiency of panels which can be in the range of 7% to 20% and even higher.

The most common polycrystalline panels available today have efficiency of 15.5% leading to a DC Current of:

15180 kWh x 15.5% = 2352.9 kWh / year

Losses

The DC Current generated undergoes a series of losses before it can finally become AC Current and used by us. A summary of these losses is given below:

As 15 – 25% of the DC Current is lost through above losses, leading to the final generation:

2352.9 kWh / year x 75% (subtracting losses) = 1765 kWh

Total cost of solar power plant

One solar plate cost 12V. D.C. , 250W = Rs 10350
Cost For 1KW = Total No. of solar plate X Rs of one solar plate
Cost For 1KW = 4 X 10350
Cost of panels = 41400
Cost of mounting structures = 2000
Cost of inverter = 5000
Total cost of a 1 kW solar power plant = Rs 48400

Sr. No.	**Year**	**units**	**capacity**
1	1 - 5	8780	100 % rated capacity
2	6-10	7902	90 % rated capacity

Total number of units generated over 10 years = 16682

The cost per unit of electricity generated = Rs 48400 / 16682= Rs 2.90

4. Wind Power plant Calculation

The formula for calculating the power from a wind turbine is:

$$Power = k\, C_p\, 1/2\, \rho\, AV^3$$

Where:

P = Power output, kilowatts
Cp = Maximum power coefficient, ranging from 0.25 to 0.45, dimension less (theoretical maximum = 0.59)
ρ = Air density, lb/ft^3
A = Rotor swept area, ft^2 or π D2/4 (D is the rotor diameter in ft, π = 3.1416)
V = Wind speed, mph
k = 0.000133 A constant to yield power in kilowatts. (Multiplying the above kilowatt answer by 1.340 converts it to horse- power [i.e., 1 kW = 1.340 horsepower]).

The rotor swept area, A, is important because the rotor is the part of the turbine that captures the wind energy. So, the larger the rotor, the more energy it can capture.

The air density, ρ, changes slightly with air temperature and with elevation. The ratings for wind turbines are based on standard conditions of 59° F (15° C) at sea level. A density correction should be made for higher elevations as shown in the Air Density Change with Elevation graph. A correction for temperature is typically not needed for predicting the long-term performance of a wind turbine.

Component cost

4 blade cost = 4 X 4000 = 16000
D.C. generator cost = 13000
Shaft and gear box = 8000
Bearing cost and housing = 1800
Frame, support, clamp and base = 15000
Total cost of a 1 kW wind power plant = Rs 58300

Sr. No.	Year	units	capacity
1	1 - 5	8000	100 % rated capacity
2	6-10	6400	80 % rated capacity

Total number of units generated over 10 years = 14400

The cost per unit of electricity generated = Rs 58300 / 14400= Rs 4.04

5. Conclusion

The solar power plant and wind power plant are having the different tariff, which are depending on the various cost. In solar power plant, we are finding out the cost per unit of electricity generated are Rs 2.90. In Wind Power plant, we are finding out the cost per unit of electricity generated are Rs 4.04.

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