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Solar Hybrid E –Rickshaw: Load and Cost Calculations On P-V Solar Panel Fitting on Roof – Top

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Abstract: Depletion in fossil fuel reserve coupled with a critical environment issues, we need to think on the sustainable energy. Electric vehicles (EVs) are emerging to be the new face of this field. The shifting towards EVs from the convention able IC engine vehicles can be truly sustainable if renewable energy is used for charging. This paper is about setting up solar panel on roof – top of E rickshaw. E-Rickshaw now a days has revalorized the commutation of short distance across our country as well as outside country in abroad. As these E-Rickshaws having no pollution, no sound and easy to operate. In the conventional E-Rickshaw charging to be done through grid. We are proposing hybrid method to run the E-Rickshaw i.e. by solar panel system. In conventional E-Rickshaw it to charge again and again. It takes 6-7 hours for charging and secondly the E- Rickshaw has to keep standing for this system. The above problem is solved by using solar panel mounting on E-Rickshaw. By using this technique, no charging time is required during the course of running the vehicle during day time; no controller is required in solar E-Rickshaw. This system of the operation is cost effective too, in this way we are saving the environment, economy and time of charging of the country.

Keywords: Solar E-rickshaw, Solar Panel, Electric Vehicle sustainable energy.

Introduction:

In the current scenario, Environment is polluted and the degree is increasing slowly as the time passes, major contribution of pollutant is in the form of contaminating air which is exhausted by IC engine operated vehicles, fossils are consumed by engines and it exhausts various gases carbon, nitrogen, Sulphur compounds in the atmosphere, which causes aerial environment pollution. Our country aims to decrease its carbon footprint like other countries and step into the world of sustainable energy, the government is regularly introducing transport sector changes that aim at using electricity to run almost all forms of public and commercial transports. This will lead, as per a data provided in a finding, between 2020–2027, the average yearly growth rate for the Electric –Vehicle sector in our country is estimated about 44% [15].

Various scholastic research publication and state authority mainly focus on the theme of moving towards EVs, the technology of charging stations, and the national policies to develop required facilitation for EVs [3–5]. Awareness such as the requirement for India to shift away from its petroleum imports, contribute in fight to climate change decrease its carbon footprints, and decreasing pollution have been researched in length, and conclusion regarding our country moving into the EV space along with other countries who are actively involved in this [6]. The need for charging infrastructure is also simultaneously worked upon [7–9].

EVs apparently decrease pollution noise environment and are cost effective as compared to fossil fuel consuming vehicle but the vehicle requires electrical energy. This stresses the production of electricity which is already in tremendous pressure and is deficit [3]. Our country 61% produced electricity is from coal-based thermal power plants, 15% is from hydropower, 8% is from solar PV, 5% is from wind energy, 9% is from natural gas, and 2% is from nuclear energy [10]. The Thermal Power plant are chief cause of CO_2 gas emission resulting in increasing greenhouse effect [1]-[4]. A 500 MW coal power plant can produce upto1 kg/KWh of electricity. By using renewal energy, we can reduce the usage of precious resources

like coal, water, and other fossil products this is the alternative to hand over legacy to future generation.

In our country the availability of solar energy is sufficient, this makes it most apt for the use of solar energy for electric energy generation. A time has come when the chief source of energy is electric in all walk of life. The energy generated by solar PV has become an excellent alternative for local electricity production, even for big-scale. The renewable energies especially solar is dependent on climate and in India with diverse geographical conditions, areas which are remotely located the Solar energy as stand alone basis can be a boon. Charging stations are future step which will take us forward in the directions of sustainable energies [11]. we are making the solar e rickshaw of 48V/ 960W which will charge the battery from the solar [5]-[8].

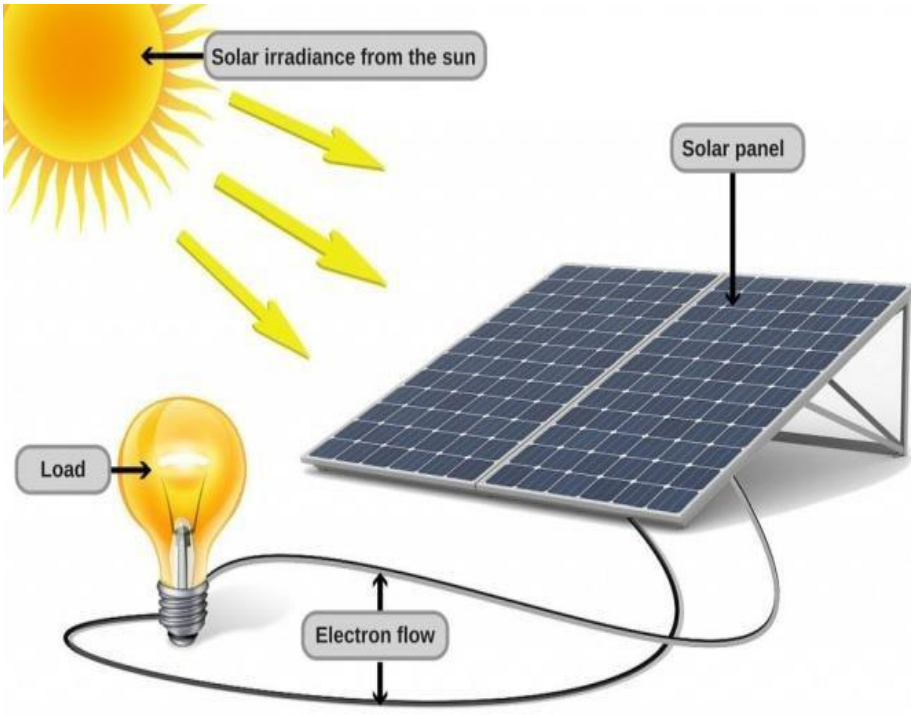

Fig 1.1: Circuit diagram of solar pa

Method and Methodology

Solar panel converts the light energy into electrical energy. Basically, solar panel is made up of semiconductor and converts the light energy into electricity by method. The process starts when the sun light falls on the photovoltaic cells containing photons of light or bundles of photon fall on the atoms it release or excites the electron from the atoms. Now the electron are free to displace from one plate to another of the semiconductors. Thus the conduction occurs in the semiconductors by the movement of electrons and holes of the atom. In the solar panel many semiconductors are there when light fall on these semiconductors electrons flow between them and current is produce by the solar panel [9]-[12].

Installation or fitting the solar panel on the roof of the Electric-Rickshaw works on the same phenomenon [13]-[14]. When the sun light falls on the solar panel the photons excite the electrons of the semiconductors and start move thus the flow of electrons occur and the light energy is converted into electrical energy. We store this energy in the battery and our battery is charged. Now after charging the battery we use the rickshaw and our rickshaw is run or operated by instant energy produced by solar plate from sun light [15]-[18].

Fig 1.2: Designed and implemented Solar E-Rickshaw

Table 1.1: Description of conventional E-Rickshaw

Seating Capacity	4 +1 driver (50 Kg Luggage)
Battery ranking	100AH
Battery sort	LEAD Acid
Electricity utilization\ charge	5-6 Unit
Charge of Time	6-7 Hours
Range per charge	65 Km & above
Maximum Power of motor	1140W& 48V(Input)
Type of Motor	BLDC
Maximum Speed	25KM\hr

Solar PV Module specifications and Calculations:

This particular model is a set of single unit of 48V, 960 Wp Monocrystalline Solar Panel which is the largest solar module currently available commercially that is popularly used for recharging 48V batteries used in E Rickshaws, for running 48V battery chargers etc

Table 1.2: Solar PV Panel specifications

Specification	Values
Maximum power	960 W
Peak Maximum Voltage	85.00 V
Imp	5.034 A
VOC	98.88 V
ISC	5.453
Fill Factor	79.27
Rsh	1086.2 ohms

Rs	1.886 ohms
Total number of cells	72
Cell type	Poly Module
Area	2.02 m2
Module efficiency	17.6
Cell Area	0.0246 m2
Cell efficiency	20.01

The battery used as electrical energy source will be charged in two ways, from National Grid and Solar PV module respectively. A perfect designed PV module is needed to charge the batteries.

Calculation of the Power Consumption for PV module

Weight of electrical rickshaw along with passengers is 706 kgs (As per company specifications)

Average speed of vehicle is assumed to be 20 Km/h

Here, Eq. (1) shows the total power needed to run the vehicle w.r.t. it's mass.

Total Power = Total weight of vehicle x g x Speed x gradient of velocity Eq. 1

= 706 x 9.8 x 20 x 0.03 Watts= 706x 9.8 x5.55 x0.03

= 1151.98 (rounded to 1152)

Here, the induction motor used is of 12V-1kW rated.

Current flow = p/v = 1500/36 = 42 amp

Load current per day = Current flow x running time perday x 1.2

= 42 x 5 x 1.2 =250 amp. Hrs /day

Capacity of the power = Load current per day x 1.2 = 250 x 1.2 = 300 amp.hrs /day (over day loss is 25 %)

Power required to run the motor = capacity of battery x voltage difference

= 250 X 36 = 9000 whrs

Number of batteries used is 4

Now, here The Capacity of Solar Panel is 48V - 960 W, Current Flow = (960/48)/4 = 5 Amp to each Battery

Charging Time = 250/5 = 50 hrs

With this Solar Panel in 8 hrs of daylight the system will be charged

100 x 8/50 % or 16 %.

Cost analysis

Total power calculated to run the system = 9000 watts hours. Power required to run the motor 9 x5 kwatts.hr/day= 45 unit In Indian commercial electric line cost 6.25 /unit Cost to charge the battery= 45 * 6.25= 281.25 /day

When we use Solar Panel

PV module will supply 16 % of total power.

Cost saved per day will be 16 x Rs 281.25 /100 = Rs 45

Cost saved per year = Rs 45x30x12 = Rs 16,200

Cost of the panel is Rs 20000/-(Approximately)

The cost of panel will be recovered in 1 years and 4 months if conservative figure for the life of the panel is 10 years the cost saved will be Rs 10x16200= Rs 162000/-

Net saving will be Rs 162000/- minus 20000/- = Rs 142000.00

The above calculation shows that if the solar panel is used for running the electrical e rickshaw then there will be saving of approximately 1,62000/- during the life of the electric panel. This advantage is apart from the additional social and environmental advantages which will be beneficial for human kind currently occupying our planet and our future generations too.

Conclusions:

In this paper a solar panel is designed and implemented on conventional E Rickshaw by implementing this we having saving many things at one time, firstly saving the electrical energy, secondly saving the Cost of operation of e rickshaw which is about 142000/ subtracting the cost of electrical panel.

Integration of renewable energy will make EVs truly cleaner than conventional fuel

vehicles taking into account the lifetime CO_2 emissions

The study is required in future by running e rickshaw practically and validating the proposed calculations of current paper.

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