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Solar Charging Station for Electric Vehicles

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ABSTRACT: Electric Vehicles are playing a major role in decreasing carbon emissions. The major problem with electric vehicles are overloading the distribution grid and availability of enough charging stations. The main objective of this project is to design and install a solar charging station for electric vehicle in our environment. This project shows the benefits of shifting from traditional gas and petrol vehicles to electric vehicles. Additionally, it intends to ease the problem of additional load that this electric vehicles impose on the grid by powering the charging station from solar energy. This will help to develop the present transportation system into a cleaner and greener system . This project uses solar panels to collect the solar energy which is stored in station battery, A charge controller is also used to manage the power through the battery bank, this stored energy is then converted from DC to AC using an inverter and is then suitably fed to the electric vehicle[1][5][6].

KEYWORDS: Electric Vehicles, Photovoltaic, Direct Current, Alternating Current .

I.INTRODUCTION

A lot of studies revealed the supply of fossil fuels such as coal, natural gas and oil are limited[2]. Our lifestyles today are depending highly on the fast consumption of energy that is generated mainly by fossil fuels. The demand for energy is increasing as the world population grows and the economic growth in many developing countries as well as the developed countries. The energy crisis can be anticipated in the near futures. Researches have also identified the impacts of using fossil fuel energy on global climate change. In case of fuel based vehicles these fossil fuels are burned in vehicle's engine , which produces harmful toxins that cause environmental pollution and pose a risk to all leaving organisms. In order to prevent these adverse effects there is a lot of focus on renewable energy.

According to [2] Alternative energy or renewable energy opposed to fossil fuels ought to be actively explored earlier rather than late. Renewable energy such as solar energy can provide a long term solution to environmental pollution. A large proportion of these non-renewable fuels are consumed by the transportation industry. The traditional transportation system needs to undergo a lot of changes and new innovative measures are underway to modernize it. The shift towards renewable energy will require a parallel upgrade of vehicle technology. Using solar energy to build solar charging stations for charging electric bikes and electric motorcycles is a practical application of sustainability. The idea in the solar charging stations utilize solar photovoltaic (PV) modules to convert solar energy to DC electricity. The DC energy can be stored in a battery bank[1].

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In [3] Electric vehicles can be classified into different types mainly hybrid, plug-in Hybrid electric and battery electric vehicles. Hybrid electric vehicles don't need an electric charger and generate energy by the car movements. Other two types however need an external charger for charging. There are two basic setups for PV electric vehicle charging systems. The first is the PV grid-connected system, and the second is the PV standalone system. PV-Grid systems are generally far feasible to operate than standalone systems.

II.SYSTEM METHODOLOGY AND BLOCK DIAGRAM

The basic theory of the Solar Charging Station is to harvest the solar energy and convert it to AC electricity that can be used to charge electric bikes and electric motorcycles. The Solar Charging Stations utilize solar PV modules to convert solar energy to DC voltage. The DC energy can be stored to a battery bank[3]. An inverter is employed to convert the DC voltage from the battery bank for charging the electric vehicles[4].

It consists of Solar panel, DC disconnect, charge controller, storage battery, inverters and Circuit breaker. It clearly shows how each of these subsystems are linked to each other, description of each component and how the specific choices were made to achieve the objective on charging electric vehicles using solar energy. In The proposed charging model ,Solar panels installed on an outdoor parking station are connected to the grid. Electricity generated from the Photovoltaic panels is stored directly in the vehicles battery. If the electricity generated exceeds the storage capacity of electrical vehicle's batteries, the surplus energy can be stored in the charging stations battery. According to [4] If electricity generated exceeds more than the station's battery limit it can be sold to the grid.

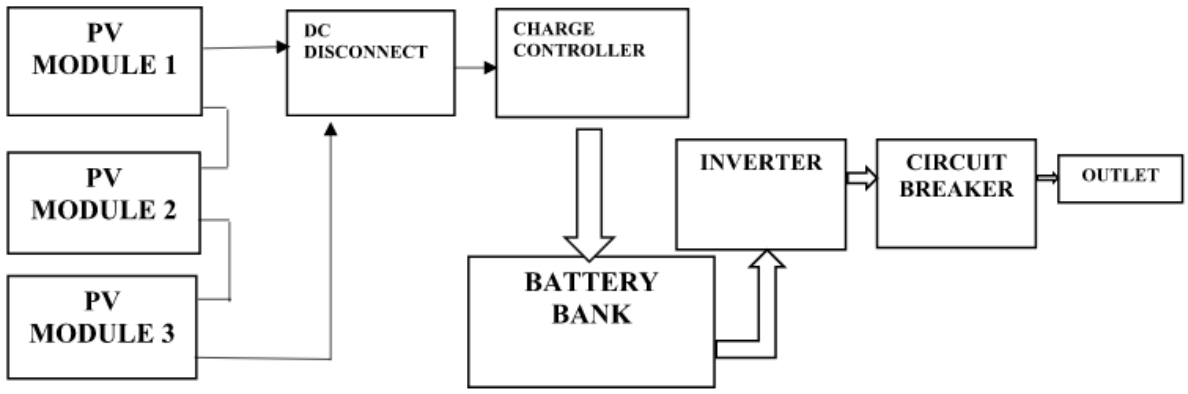

Fig.1: Block diagram of solar charging station for electric vehicles

COMPONENTS OF BLOCK DIAGRAM :

SOLAR PANELS : Most of the sun's rays are being scattered, diffracted and deflected upon reaching earth's surface , it is found that the total solar irradiance that actually absorbed by earth annually is close to 3.8 million exajoule (EJ)[5]. Solar panels being the interest of study, harness the solar energy and converts it into electricity, types of solar panels are monocrystalline, polycrystalline, thin film, amorphous silicon etc., there selection depends on desired system characteristics.

DC DISCONNECT: It is a device which provides DC isolation between the photovoltaic panels and the rest of the system whenever required. This is an essential safety switch. The PV disconnect or DC disconnect allows the DC current between the modules (source) to be interrupted before reaching the inverter. It is used to ensure that an electrical circuit is completely de-energized for service or maintenance. Disconnecters can be operated either manually or automatically.

CHARGE CONTROLLER: It is used to control the charges, the extra energy that is being generated can be saved by using photovoltaic charge controllers .These are needed to redirect the energy to storage battery cells. According to [5] Series of microcontrollers used for photovoltaic were reviewed. Which shows the importance of on and off, Pulse Width Modulated (PWM) and Maximum Power Tracking micro controllers for increasing the efficiency of solar power

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generation. Series controllers basically stop further charging when load is fully charged while shunt charge controller diverts excess electricity to other loads.

STROGE BATTERY : Batteries in solar applications ought to meet the demands of energy, that is heavy charging and discharging cycles and also irregular full recharging. There is a variety of battery types fitted for these unique requirements. Main subgroups of storage batteries for solar energies reviewed by others [4][5] include flow batteries, lithium ion batteries and lead acid batteries. Considerations for choosing a battery includes the storage capacity, power transmission rate, discharge time ,efficiency, cycling capacity, cost based on both operational and investment expenses ,disposal effects , and finally the self discharge rate.

INVERTER OR CONVERTER: The energy harnessed by the solar panels is basically DC. For this to be used in charging the electric vehicle or other automobile devices, it has to be converted to AC current. Solar inverters converts these DC to AC . Thus they have special function in photovoltaic system based on energy conversion and balanced.
The various types and specifications have been deeply researched[5][6] on such as string inverters where panels are placed parallel with central inverter, micro inverters in which solar panels placed serially with separate inverters and also power optimizers similar to micro inverters but more involved with monitoring. Power optimizers are used to monitor the total output of the PV panel arrays so as to continually adjust and modify the load attached in order the keep the system operational at its peak.

CIRCUIT BREAKER :A circuit breaker is an automatically operated electrical switch designed to protect an electrical circuit from damage caused by excess current from an overload or short circuit. Its basic function is to interrupt current flow after a fault is detected. In other Words Circuit breaker is an electronic device which can make or break the circuit under no load, full load and abnormal load conditions.

III.PRACTICALIMPLEMENTATIONANDDESIGN

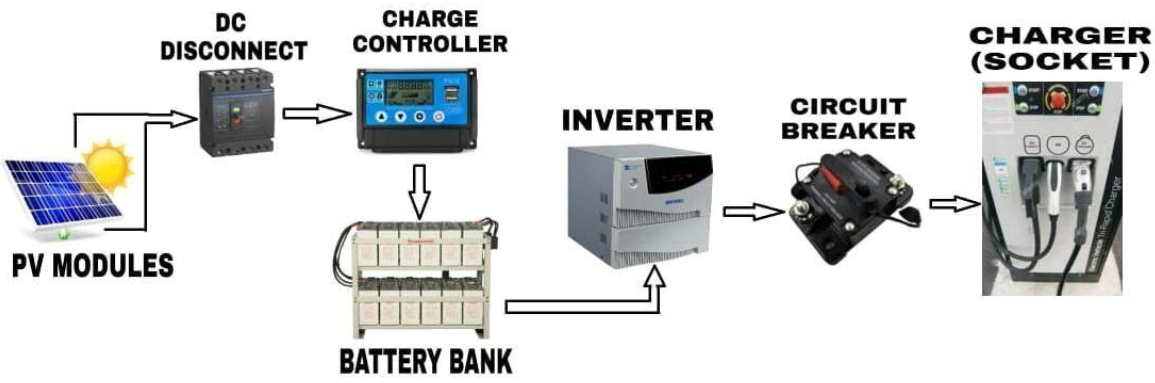

Fig 2: Practical implementation of Solar charging station for electric vehicles

CONSIDERATIONS DURING SYSTEM DESIGN:

- Bikes are parked for long durations of about 7 hours at the workplace.
- All Vehicles batteries are 48V 20Ah.
- Each Vehicle consumes 1000kwh of power.
- This Electric Vehicle charging station can charge two Electric Vehicle batteries at a time.

Solar panel selection

Maximum power required for EV = 48*20*2 = 1920Wh

According to [6] Average Global Horizontal irradiance = 5.86kWh/metersquare/day
Power Requirement of the system = 1920/5.86 = 327W
So Solar Panels of 250W are to be used in Parallel

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Area covered by the Solar panel :

Generally the size of a 250 solar panel = (L*W*H)= (100cm* 100cm *1cm) Total Area covered = 100cm*100cm = 1 sqmt

Selection of Station Battery :

The maximum energy to be stored in the station battery = 48*20*2= 1920Wh (When the Vehicles are not available)
Maximum energy transferred to vehicles in 5.86 hours = 1920*5.86/7= 1607 Wh
Minimum energy station battery must store = 1920-1607= 313 Wh
Station battery capacity = average of 1607,313= 960 Wh

Station battery current rating =960/48 = 20Ah

Station battery rating is 48V 20Ah.

Selection of other components :

- DC Disconnect: There are many DC isolation switches available from the lowest ratings to the highest ratings. The DC Disconnect best suitable for this case is low voltage DC Disconnect. So we can use 48V DC Disconnect (2.5amps).
- Charge Controller: Typically Charge controller come in 12V, 24V, 48V. Ampere ratings can be between one to 60amps and voltage ratings can be from six to 60V .So here we can use 48V charge controller up to 2.5 amps.
- Inverter and Circuit Breaker: As the battery used here is 48V 20Ah, The inverter which can be used to convert DC output of panels into AC is 48V luminous inverter.

  The ratings or selection of circuit breaker depends on the battery rating (2-3 amps).

IV.RESULTS

Since the solar energy generation and charging occurs during the day, thus using photovoltaic to charge electric vehicles during the day means most of the electric vehicles charging will have to take place during the working hours , which will have significant impact on reducing the carbon emissions during the day ,with this we can hope for a clean environment.
Vehicles are usually parked for long durations of about 7-8 hours during the day in parking slots of offices, Colleges, Schools or any other work area. This period of time can be used efficiently to charge the vehicles if we change the parking slots into charging slots by installing the above mentioned charging system. With this system we can reduce the place or land required for petrol pumps and use the open space like parking slots.

V.CONCLUSION

Striving for a greener and eco-friendly future depends on how much action we put in so as to reduce the usage of fuel based vehicles that causes environmental pollution. Efficient harnessing of solar energy involves choosing efficient components that provide the required energy capacity to charge the electric vehicles. By suitably increasing the capacity of solar panels, charge controller, storage battery and inverter used in this system we can charge a large number of vehicles at a time[7].

REFERENCES

[1] ‘Solar Charging Station For Small Electric Vehicles’, Franco G.Martinez, Guillermo L.Magaldi, Federico M. Serra. University National The San Luis, Argentina. 2018.
[2] ‘Solar Energy For Electric Vehicle’, Fred Chiou, Ph.D., Member Ieee, Electronics Engineering Technology, Weber State University, 2015.
[3] ‘Design Of Charging Unit For Electric Vehicles Using Solar Power’, Dr. K. Jamuna, R.Arubelbenela Department Of Electrical And Electronics Engineering Gkm College Of Engineering And Technology Anna University, Chennai, India.

| e-ISSN: 2278 – 8875, p-ISSN: 2320 – 3765| www.ijareeie.com | Impact Factor: 7.122|

||Volume 9, Issue 7, July 2020||

[4] 'Optimal Electric Vehicle Charging Station Placing With Integration Of Renewable Energy', Lida Yazdi, Ramin Ahadi, Babak Razaee, Industrial Engineering Department, Faculty Of Engineering, Ferdowsi University Of Mashhad, Mashhad, 15th Iran International Industial Engineering Conference 2019.

[5] 'Charging Electric Cars From Solar Energy',Xusheng Liang, Elvis Tanyi, Xin Zou, Dr.Erik Loxbo , Dr.Svenjohnsson ,Department Of Electrical Engineering, Blekinge Institute Of Technology, Karlskrona, Sweden.

[6] 'Controller For Charging Electric Vehicles At Workplaces Using Solar Energy ', K. Sankaraditya Vikas, B. Raviteja Teddy, S. G Abijith And M.R Sindhu. International Conference On Communication And Signal Processing, 2019,India.

[7] 'Solar Powered Electric Vehicle Charger', Andrew Moradpour Jessica Bombardier Shaw, Electrical Engineering Department, California Polytechnic State University, San Luis Obispo,2017.