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Design of a solar powered charging station for small electric devices

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The use of fossil fuels to generate electricity is related to numerous problems, ranging from enviromental impact to insufficient supply for meeting world's demand. In this context, efforts are being made to make renewable energy sources more viable. Photovoltaic Solar Energy, despite the challenges and limitations associated with its application, appears as one of the best options to supply part of the demand and also enable access to electricity in remote places. This modality is especially suitable for countries like Brazil, where there is great solar potential. The present work aimed to design a structure equipped with photovoltaic modules for powering small electric devices and, at the same time, compounding the urban ambient. Initially, the place where the charging station would be installed was defined and measured. The second step was to obtain solarimetric data, module orientation and tilt angle for the chosen location, using SunData and RADIASOL 2. The energy demand was then calculated from the comsumption of each electrical device, enabling the sizing of the solar panel and the battery bank, based in the method of the worst month. From the solar panel and the battery bank, it was then possible to size and select the suitable charge controller and inverter for the system. The results of the installation site selection presented coordinates 21,76º S and 41,33º W, having enough free of shading area. The calculated demand from all the electrical devices is 67,4 kWh per month. Solarimetric data provided a tilt angle of 27º and modules facing the north as the best options for the panel positioning. The selected photovoltaic module was Upsolar UP-M155P, due to its good price-performance ratio, and the sizing informed that 5 modules are needed to fulfill the calculated energy requirement. The selected battery model was the Heliar Freedom DF4100, and 5 batteries are needed for a depth of discharge of 20% and a battery bank autonomy of 1 day. After the solar panel and the battery bank were calculated, it was possible to select the charge controller model Epever Tracer 6415AN and the inverter model Epever IPower IP350-11. The obtained results allow the conclusion that the project could be done satisfactorily to supply the energy demand. The small area requirement, of about 5 m^2, has shown to be a positive factor, since it is easily adaptable for many locations and applications. The battery bank was responsible for most of the system's costs, representing 46% of the total.

Keywords: Renewable energy; Photovoltaic solar energy; Charging station.

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