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Cost Optimization of Solar Plant for Household

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Introduction:-

In India, we have an abundant amount of solar energy available. But the true potential of solar energy is unexplored yet. About 5,000 trillion kWh per year of energy is incident over India's land area with most parts receiving 4-7 kWh per sq. m per day. But including both ground and roof-mounted plants, the country's installed solar power capacity was 39,083 MW (as of 28 February 2021). It will be beneficial to make solar energy available and accessible to every household in rural and semi-urban areas, which occupy almost 80 percent of India. With this idea in mind, we started working on our project. When it comes to installing solar panels in India, the users don't have the slightest idea about getting them installed on their rooftop. Our team noticed several of these questions that were flooded on various websites. We decided to help them by giving them the right advice on how much investment they need to make and how much time they will recover their cost and start earning profits.

Procedure:-

We selected the Karauli district in Rajasthan as our domain to work on the project. We started our research by analyzing the area's weather pattern to get an idea about the sunshine hours, rainfall patterns, and solar radiation data. It was necessary to determine whether the location would be suitable for installing solar panels or not. Then, we studied the variation in the electricity consumption of the households. For this, we collected the monthly electricity bills from 15 households and calculated the average monthly electricity usage in the locality. By examining the data, we got an idea of the approximate value of electricity consumption every month, which helped us select the solar panel. We also collected the details about the available area for every household and the size of solar panels and used them in our calculations.

After collecting the initial data, we began analyzing it and using that data in our calculations. Based on the needs of the people of Rajasthan, we studied various models and brands of solar panels and compared them. After observing the pros and cons of different models of solar panels, we found out that the best model according to the needs of the people of Rajasthan was - 330 W Polycrystalline solar panel of the brand Tata Solar panels. It is one of the most reliable, economic, and widely used models of solar panels in India. We also looked at the various other components required in the installation of solar panels and checked the most efficient and economical option. For the installation part, we realized that there are two methods of installing solar panel systems on houses. The first method is Grid-Tie Solar System, where an electricity-producing power module is connected to a 'power grid', i.e.,(your local utility company). In this method, you feed the extra electrical energy produced by the solar panel system back to the grid. In return, you receive some monetary benefits from the company. The second method is Off-Grid System, which is not connected to a power utility. Off-grid systems are generally utilized when you are at remote locations that do not have access to a power grid or there are frequent power cuts in your area. In this method, the excess energy is stored in the solar battery.

To obtain the required outputs, we studied various scientific papers and mathematical models. We also used the official government websites to get an idea about the subsidies provided to the people who install solar panels on their rooftops. Finally, after collecting all the relevant

information, we developed the website to answer all the queries related to solar panel installation.

Result & Conclusion:-

We came up with a website that takes inputs like the area of the roof, maximum monthly electricity consumption, and budget available from the user. Based on these inputs, we will suggest to the user parameters like Solar system size in kW, the number of solar panels needed, and the minimum area required to install these solar panels. We will also give a user a deeper understanding of the total cost (*with subsidy* and *without subsidy*) of the solar system set-up, including the cost of solar panels and the installation cost. The cost analysis is provided separately for Off-grid and Grid-tie solar systems. The user will also be informed about the time after which he/she would recover the installation cost, along with his daily, monthly, and annual earnings from the solar panel system. In addition, the user will also get information about how his or her decision of going solar will impact the environment. For the same, we are providing details like CO₂ emissions reduced within the lifespan of 25 years and the equivalent number of teak trees. We have also incorporated the elements and working of both off-grid and on-grid solar systems on the website, which our users can refer to for a better selection process.