Investigation of Solar Photovoltaic DC Micro Grid and improve its efficiency for City University

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1. INTRODUCTION:

In an era where energy sustainability is paramount, harnessing renewable energy sources is not just an environmental necessity but also a pathway to economic growth and social development. Small-scale photovoltaic (PV) panels have emerged as a transformative solution, especially for remote and underserved communities [1]. These compact solar systems, capable of generating electricity from sunlight, offer a promising means to address energy poverty, reduce carbon emissions, and foster economic resilience at the grassroots level. In the face of Pakistan's pressing energy challenges, small-scale photovoltaic (PV) panels emerge as a beacon of hope. With a significant portion of the population lacking access to electricity and the country heavily reliant on fossil fuels, sustainable solutions are critical [2].

In the current era of globalization, electricity generation, per capita electricity consumption, and energy footprint of a country are considered indicators to assess the development, economy, industrial growth, exports, and living standards of its inhabitants [3]. According to the "World Bank Database of Sustainable Energy for All" (1998–2019), only 73.914 % population in Pakistan has access to electricity. This number is the lowest among all other South Asian countries including Maldives, Sri Lanka, Bhutan, India, Afghanistan, Bangladesh, and Nepal. This situation intimates a lack of a holistic approach to power sector expansion planning and implementation to ensure reliable and indiscriminate access to electricity amid growing energy demands. To meet growing energy needs Pakistan heavily relies on carbon-intensive fossil fuels as its primary source of energy [4].

These small-scale PV installations are not just about generating electricity; they represent a shift in power dynamics. Local communities are being empowered to take control of their energy needs. With the installation of solar panels on individual homes and businesses, the people of Peshawar are becoming active participants in the energy production process, leading to increased energy independence and economic sustainability [5]. Access to clean, reliable energy opens up new opportunities for education, healthcare, and economic growth. Businesses can thrive, students can study after dark, and essential services can operate seamlessly, all thanks to the power of solar energy [6].

A micro grid is a small-scale grid system that can work freely or in conjunction with the region's principal electrical grid. Today, the micro grid is picking up a considerable measure of desirability since new renewable energy sources that occasionally work better nearer to the point of cause, are instead connected to the main electrical grid [7]. The best illustration is a photovoltaic system. Nowadays, more houses and structures are associated with the small neighborhood solar energy grid frameworks that may serve only one property [8]. Besides, as solar innovation descends in cost and turns out to be more viable, a few features can really get advantageous by a smaller economy of scale—straightforward solar cells put in accessible territories can take in free regular daylight and be changed it over to electrical energy to run a specific arrangement of machines or warming and cooling frameworks [9].

The government of Khyber Pakhtunkhwa, recognizing the potential of solar energy, has introduced supportive policies and incentives to encourage the installation of PV systems. Subsidies, tax benefits, and favorable regulations have facilitated the proliferation of small-scale PV installations across Peshawar. These initiatives have not only made solar energy affordable but also encouraged citizens to embrace renewable energy solutions [10].

2. PROBLEM STATEMENT:

Accumulation of dirt, shading from structures or trees, inverter malfunctions, solar cell degradation, and physical damage from weather conditions can reduce the efficiency of already installed PV panels. Regular maintenance is vital to address these issues and ensure optimal energy production.

3. OBJECTIVES:

- Find the total load on PV panel of City University.
- Explore innovative approaches, advanced materials, and optimized designs to enhance PV panel efficiency,

4. METHODULOGY:

First of all study different research papers in the literature and collect data of PV panels and calculate the data. After finding the total power given by PV the efficiency is improved by improving the inverter design. At the end all these data are designed by the MATLAB.

5. Applications:

- Generate electricity for household needs, reducing reliance on the grid. Industries utilize PV panels to reducing operational costs and environmental impact.
- Generating significant amounts of electricity for communities or feeding into the grid.
- PV panels power remote and off-grid areas where traditional electricity sources are unavailable.
- Small PV panels are integrated into portable devices such as solar chargers for smartphones, laptops etc.
- Solar-powered water pumping systems, especially in agriculture, provide a sustainable solution for irrigation, helping farmers in remote areas.
- Lights during the night, promoting energy efficiency and reducing electricity costs.
- PV panels are used in satellites and space probes to generate electricity in the absence of a conventional power source, harnessing energy from the sun in space environments.
- PV panels are utilized in educational institutions and research facilities for experiments.
- PV panels are used for agricultural applications such as powering irrigation systems, farm equipment, and providing electricity for rural farming communities.
- The applications of PV panels continue to expand as technology advances, making solar energy an increasingly accessible and essential source of renewable power across the globe.

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6. FLOW CHART:

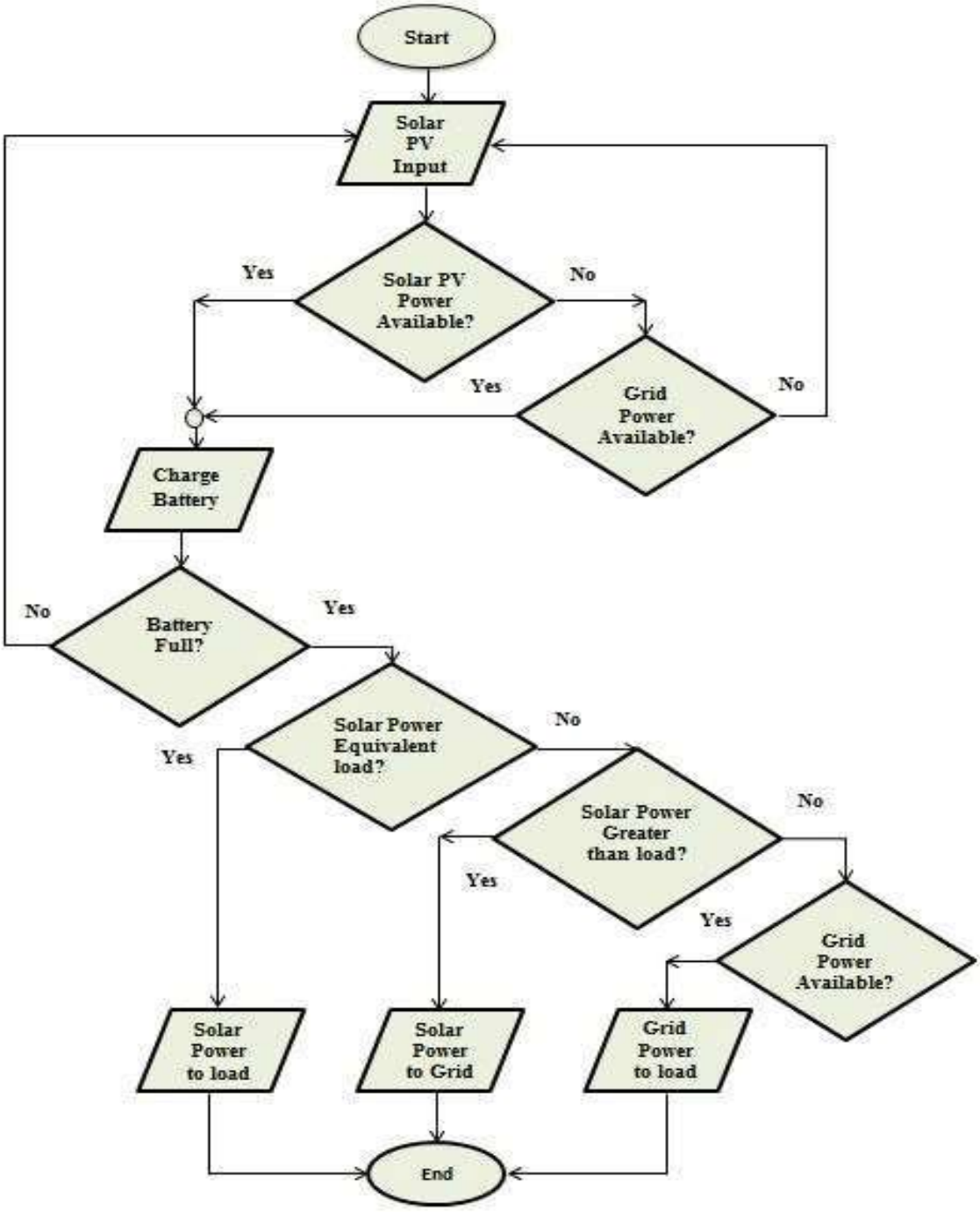

Fig: Flow chart of PV panel

7. TIME LINE:

Work Schedule per weeks	Sep-Oct	Nov-Dec	Jan-Feb	Mar-Apr	May	June
Literature Survey	18-10-2023 4-11-2023					
Data Collection	05-11-2023 01-12-2023	02-12-2023 03-01-2024	05-02-2024 31-02-2024			
Hardware/Software Implementation		02-01-2024 29-01-2024	02-03-2024 27-03-2024	01-04-2024 29-04-2024		
Result Compilation & Thesis Writing					02-05-2024 29-05-2024	01-06-2024 15-06-2024

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