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Empowering Sustainability: Viability Analysis of a Floating Photovoltaic System at Gulshan Lake

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***Abstract*—The world's increasing energy demands have intensified the need for renewable energy sources. In response to the land constraints posed by ground-mounted solar installations, Floating Photovoltaic (FPV) has emerged as a promising solution. This study focuses on exploring the feasibility of building floating solar panels in Bangladesh, with an experimental investigation conducted on Gulshan Lake, an urban water body located in Dhaka city. The lake is facing mounting pollution and degradation due to rapid urbanization, industrialization, and population growth. Consequently, the pursuit of sustainable development and clean energy has led to a keen interest in renewable energy sources, particularly floating PV systems. The paper thoroughly considers the technical, financial, and environmental aspects involved in the construction of such a system during the feasibility analysis. The design of the plant and tariff are meticulously carried out using the HOMER software, and the study calculates the optimal cost of electricity for the FPV power plant manually, projecting figures for 20 and 25-year periods at BDT 10.92 and BDT 7.23, respectively. The same calculations performed with the HOMER software yield slightly higher values of BDT 12.17 and BDT 11.87 for the same time spans. Moreover, the paper highlights the cost-effectiveness of the designed PV system.**

Keywords—floating photovoltaic, Gulshan Lake, COE, HOMER software,

I. Introduction

Floating photovoltaic (FPV) power plant have emerged as an innovative concept for generating renewable energy without straining water or land resources. FPV technology provides an excellent solution for countries with limited land availability for solar power installations. Notably, it has had a positive influence on both the economy and the overall cost of electricity generation since it doesn't require extensive land resources. Additionally, FPV plants benefit from enhanced efficiency, thanks to the natural cooling effect provided by their proximity to water bodies and the increased irradiance resulting from water surface reflection [1, 2]. These types of solar facilities are employed in various countries, including the United States, Japan, China, South Korea, India, Brazil, Singapore, Norway, and the United Kingdom, among others [3, 4].

Aichi Project, a 20 KW Japanese business, introduced pilot FPV technology worldwide in 2007. In 2008, California, USA, opened the first commercial 175 kW FPV plant. Indonesia plans to build 60 FPV projects to generate 23% of its electricity from renewable sources by 2025 and 31% by 2030. In mid-2021, Singapore opened the world's largest offshore FPV plant with a capacity of 60 MW, with an aim of 2 GW of solar capacity by 2030. Belgium was an early adopter, building its first 998 KW FPV facility in 2018. France added a 17 MW FPV system in 2019. The Netherlands began installing FPV systems in 2018, starting with 1.85 MW and cooperating with 40 firms to reach 2 GW by 2023. The UK started its 6.36 MW project in 2016. Italy, Portugal, Spain, and Sweden are also developing FPV power plants [5-7].

Bangladesh is constructing FPV plants as a developing nation. The first 10 KW project began in 2019 in Mongla, Bagerhat [8]. The Sustainable and Renewable Energy Development Authority (SREDA) and the Asian Development Bank conducted feasibility studies for four more reservoirs nationwide. A 24 MW plant at Kaptai Lake in Rangamati, a 4.5 MW plant at Mohamaya Lake in Mirsharai, Chattagram, a 9 MW plant at Joydia Baor in Jhenaidah, and a 6 MW plant at Bukbhara Baor in Jessore are among The viability of building a 40 MW FPV plant on two unoccupied lakes owned by the Boropukuria Coal Mining Company in Dinajpur is also being assessed [9]. Besides SREDA, several Independent Power Producers (IPPs) are considering installing FPV plants in the country's vast water resources, which include rivers covering 7.497 billion hectares, beels and haors covering 1.142 billion, estuaries and mangrove swamps covering 6.102 billion, and many small and large ponds [10]. This research work has been conducted to do a comprehensive feasibility study of Gulshan Lake, situated in the heart of Dhaka, the capital city of Bangladesh. This study examines PV power potential and unit tariff from economic perspectives based on theoretical point of view and also for software point of view.

II. Supplementary Materials

Floating solar represents a cutting-edge renewable energy technology, where solar panels are ingeniously installed on floating platforms atop water bodies like lakes, ponds, or reservoirs. These panels effectively harness the sun's energy and efficiently convert it into clean electricity, capable of powering various applications, from individual households to entire communities. The FPV system comprises several vital components, including a floating structure, anchoring and mooring systems, solar panels