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# Simulation and Optimization of Hybrid Energy System at SKIT Jaipur and Environmental Impact: A Real Case Study

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**Abstract**—SKIT M&G campus Jaipur is the first campus in Rajasthan and second in India after IIT Bombay, to install a rooftop 400 kW solar power plant. The objective of this paper to propose a hybrid energy system which is a combination of solar plant and diesel generator available at the campus is economically viable or not. Here we are using HOMER (Hybrid Optimization of Multiple Energy Resources) software for analysis. In this paper, we study four different cases including only external grid, only diesel generator, only solar power plant and mixer of diesel generator and solar power plant available at the campus. The simulation results indicate that the proposed hybrid energy system would be a feasible solution for distributed generation of electric power for remote locations. The hybrid energy system is sustainable, economically viable and environmentally friendly.

**Keywords**— Solar power plant; Diesel generator; HOMER; Hybrid energy system

## I. INTRODUCTION

Electrical energy demand increase rapidly due to industrialization, urbanization day by day. In all over the world, about one hundred thirty million people in the world live without access to electricity in [1]. The challenge of providing cost-effective and reliable electricity services remains the major global challenge. This problem isn't only facing by India but also by the world. Grid extension still remains the preferred mode of rural electrification. The grid extension of the central electricity grid to urban and rural area electrification can either be financially feasible or practical impossible [2].

Swami Keshvanand Institute Of Technology (SKIT) M&G, Jaipur campus install a 400 kW net meter solar power plant on the campus [3]. This solar power plant will generate nearly 6 Lakh/year units of electricity and reduce 510 tons of CO<sub>2</sub> emissions that save nearly 15,000 trees/year. The SKIT campus also has two diesel generators with capacity of 320 KVA and 220 KVA.

HOMER software is the widely used for system simulation and optimization. For optimization result first, we identify the available resources at the remote location, model electricity

generation based on various mixtures of nonconventional energy sources and biodiesel/diesel generator. Secondly, we used HOMER software and obtain the best optimization result of the Hybrid Energy System (HES). The object of the literature review presented here is two-fold: first, this presents proof of knowledge gap that justifies the requirement for this work and second, it also presents support for the methodology used in the research and is a source of knowledge for identification and referencing. For the above object, we use the literature to explain the boundaries of existing investigations by focusing principally on studies that depend on HOMER.

For example, Tshering Dorji et al. (2012) determine the possibilities for off-grid electrification of the rural villages in the Bhutan. The study was conducted in separate places in the country to find optimization unit. Moreover, the load was considering lighting and communication services. Solar PV and battery power generating system were the affordable technology for Gasa and Lunana, Diesel, solar PV, battery system were affordable in Getena area [4]. Deepak kumar et al. examined the cost of electricity (COE) from fuel cell based electricity generation with the cost of supply from the grid for a rural health Centre in India, using HOMER simulations. The results determined beyond a distance of 44 km from the grid, the cost of supply from an off-grid source is cheaper. This work just considered the demand of a rural health Centre and was not part of any rural electrification [5]. Bhattacharya and Hafez investigated the optimal model of the RES based micro grid system for a hypothetical rural area. Where the base load demand is 600 kW and daily energy demand is 5000 kWh/day. The hybrid system is combination of flat PV array, wind turbine, hydro and diesel generator resources for electricity generation [6] and AHM Yatim et al. analyzed the case of a hypothetical residential area with peak demand 80kW in Malaysia and used HOMER software to optimization of a hybrid system [7].

By using HOMER software, in this paper, we are trying to address the following issues.

- How economical would it be if electricity supply by the hybrid energy system?