Abstract of Ph.D. Thesis
"Techno-Economics of Solar PV Based Hybrid Power Systems for Telecom Towers in India"
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Abstract

A techno-economic assessment of solar PV based hybrid systems for powering 4G and 5G telecom towers in India is presented. A preliminary attempt has been made to design and analyze different feasible hybrid power supply configurations including renewable energy-based systems using HOMER at different locations in India. The study internalizes location-specific input parameters, such as duration of grid power outage, solar resource availability, tariff of grid electricity (which may include demand charges, unit purchase price of grid electricity), unit selling price of excess solar PV electricity to the grid , and unit purchase price of diesel while sizing the hybrid system. The economic viability of solar PV based hybrid systems designed to power 4G and 5G telecom towers at 25 locations across the country have also been assessed. Linear multiple regression expressions to estimate cost of electricity (CoE) delivered by solar PV based hybrid systems for powering 4G and 5G telecom towers have also been presented and the same can be used for preliminary estimation of the value of CoE for any location in the country. An attempt to assess and estimate the carbon dioxide emissions has been made along with estimation of CO_2 emissions mitigation potential and unit cost of carbon dioxide mitigation with the adoption of solar PV-based hybrid power systems for telecom towers in India. A preliminary attempt to assess the likely impact of a few incentives on the financial attractiveness of solar PV based hybrid power systems for telecom towers in India has also been made.

It is observed that the grid power availability in India is still not reliable enough to ensure continuous operation of the telecom towers. Moreover, for most of the locations studied, with larger durations of continuous grid power unavailability, inclusion of DG in the hybrid system is almost inevitable. The solar PV based hybrid power supply configurations may be considered for large scale adoption to meet the electricity demand of telecom towers. As compared to the conventional, commonly adopted hybrid power supply option of grid electricity with diesel generator for telecom towers, the PV based hybrid system is financially more attractive and also contributes towards mitigation of carbon dioxide emissions. Integrating a photovoltaic component into the hybrid system for powering 4G / 5G telecom towers significantly decreases the dependence on DG, lowers grid electricity consumption, and has the potential to generate revenue from surplus electricity fed into the grid. Since the values of the measures of financial performance such as Discounted Payback Period and Internal Rate of Return of the incremental investment on a solar PV based hybrid system for powering telecom tower may not satisfy the investment criteria for the corporate sector, appropriate incentives may be offered to improve their financial attractiveness. Space requirement for practical deployment of solar PV systems may be an important limiting factor particularly in urban areas.