

A feasibility study of solar photovoltaic system installation at a sectional valve substation of gas distribution network

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Abstract

Gujarat State Petronet Limited (GSPL) is a pioneer in developing energy transportation infrastructure and connecting natural gas supply sources by employing sectional valve substations. These stations are unmanned and uniform in terms of connected load (approximately 17.6kW) and free land availability (300-350m²). The abstract discusses the study undertaken by Gujarat Energy Research and Management Institute (GERMI) to set up a solar photovoltaic plant to offset the electricity consumption of the Sectional Valve substation. A pilot project is envisioned and if successful, will be replicated within the GSPL network.

The feasibility study for this pilot project is done for the Mubarakpur sectional valve substation (location: 23.35 N; 72.69 E). The study is done with the aid of simulation software PVsyst and HOMER. PVsyst is used to design the solar plant architecture, module placement on given area and the solar energy generation data, while HOMER is used to obtain data on utilization fractions between grid and solar electricity consumption and analysis. An Ms-Excel based financial model developed in-house within GERMI is used to calculate the viability in terms of Net present value (NPV), internal rate of return (IRR) tariff and payback period. Various parameters are considered while doing the financial assessment namely Operational and maintenance (O&M) cost, depreciation, insurance cost, interest on working capital, interest on term loan, discount factor, escalation in O&M cost, escalation in conventional electricity price, degradation in PV performance and project life of 25years.

Based on the sensitivity analysis done it was found that a 30kW_p system will be the most viable option compared to other systems like 25kW_p, 22kW_p etc. Field capacity of more than 30kW_p cannot be deployed over the available free land. The results of this system are: reduction in energy consumption 10,69,596kWh/project life; Greenhouse Gas (GHG) mitigation 9,41,244kg_eCO₂/project life; Net present value is Rs. 3,91,545; internal rate of return is 13.6%; payback period is 8.53 years;

levelized tariff Rs. 6.4/unit. The levelized tariff of the current scenario is Rs. 10.4/unit (discount factor: 10.74%).

I would like to conclude that a sectional valve station plays a very vital role in the gas distribution network and in order to distribute it in the correct manner a SV station has to be present after every 30km distance. With an already existing infrastructure of 1,960km of gas pipe one could totally imagine the amount of energy and GHG emissions mitigation potential if similar 30kW PV (photovoltaic system) are installed at every SV substations spread all across its network.

It's a way forward to sustainable development as it economically, environmentally and socially beneficial to the company