TECHNO ECONOMICAL ANALYSIS ON INTEGRATION OF SOLAR PV WITH BATTERY ENERGY STORAGE SYSTEMS FOR DOMESTIC CONSUMERS

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ABSTRACT

As emphasis on renewable energy increases harnessing the maximum solar energy potential has become imperative. However the effective use of its potential is restricted by certain factors. The inherent feature of intermittency causes variations in power and voltage while the dependency on time of generation during day time limits its actual requirement. A night time peak as in Sri Lanka demands a cost effective renewable solution. Battery Energy Storage systems provide an integral solution for both these limitations. A case is studied on implementing a PV combined Battery Energy storage system on domestic consumers with two investment scenarios. The Levelized Cost of Energy (LCOE) of Photovoltaic and Battery Energy Storage System (PVBESS) reduces with increasing system capacity and a 5kW domestic PVBESS configuration shall have a LCOE of Rs.42.14 on a combined consumer utility investment plan. It is presented that under a peak energy system based on gas turbines could be replaced by a combined investment of consumer and utility on battery energy storage with both parties gaining equal benefit.

However the implementation of such scheme is heavily dependent on the Peak power energy mix. . Hence extensive commitment on implementing a PVBESS solution could lead to a loss to the utility, if the share of Gas turbines energy during the peak hours is less than 80%.

Keywords: Battery Energy Storage, PV systems, Peak Power

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LIST OF ABBREVIATIONS

Abbreviation	Description
BESS	Battery Energy Storage System
CEB	Ceylon Electricity Board
CI	Consumer Only Investment
CNPV	Cumulative Net Present Value
CUI	Consumer and Utility investment
DOD	Depth of Discharge
GT	Gas Turbine
IRR	Internal Rate of Return
LCOE	Levelized Cost of Energy
LTGEP	Long Term Generation Expansion Plan
MOPRE	Ministry of Power and Renewable Energy
NPV	Net Present Value
PV	Photovoltaic
PVBESS	Photovoltaic and Battery Energy Storage System
SOC	State of Charge
VRLA	Valve Regulated Lead Acid

Problem Statement

The Solar Energy being a source of renewable energy only produces energy during daytime. However a country like Sri Lanka has the highest demand occurs during the night hours mainly due to the lighting load. Since solar energy produced by domestic consumers is excess additional energy for the national gird, its ideal utilization should be to cater the excess demand during the peak hours.

Objective

The Objective of the Research is to identify the existing issues for the utility concerning the domestic connected solar PV energy sources and to introduce a economically viable solution through battery energy storage which shall be viable for both the utility and the consumer.