TECHNO ECONOMIC ANALYSIS ON INTEGRATION OF GRID CONNECTED STORABLE SOLAR POWER GENERATION

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DECLARATION

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ABSTRACT

Sri Lanka is having renewable energy target of 20% at year 2020. According to "Long Term Generation Expansion Plan (LTGEP) 2015 - 2034" published by Transmission & Generation Planning Division of Ceylon Electricity Board (CEB), it is planned to add more and more renewable power plants to the National Grid. As the solar resource availability in Sri Lanka, it is planned to add also more and more solar power plants to the National Grid.

Prevailing load curve consists of a peak at night from 6.30 pm to 9.30 pm in Sri Lanka. So, additive solar power plants is useful if it has energy storable nature. But, the storable solar power plants are new to Sri Lanka and the plant technologies are advanced. So, Techno economic analysis on grid connected, storable solar power plants is required.

In the research work, three types of grid connected storable solar power plant technology options have been modeled to replace existing PV plant without storage in Hambantota hypothetically. Case study is done on existing grid connected, photovoltaic (PV) plant in Hambantota owned by Sustainable energy Authority (SEA). Discounted cash flow analysis using avoided cost scenario have been used. Analysis is done for 25 year operating period of plant.

Keywords: LTGEP, avoided cost, PV, Parabolic trough, Heliostat field, BESS, TESS

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LIST OF ABBREVIATIONS

Acronym	Definition
BESS	Battery Energy Storage System
CBSL	Central Bank of Sri Lanka
CCPP	Combined Cycle Power Plant
CEB	Ceylon Electricity Board
CNPV	Cumulative Net Present Value
DCF	Discounted Cash Flow
DNI	Direct Normal Irradiance
DOD	Depth of Discharge
GoSL	Government of Sri Lanka
GPS	Global Positioning System
GT	Gas Turbine
HCE	Heat Collector Element
HFO	Heavy Fuel Oil
HTF	Heat Transfer Fluid
IPP	Independent Power Producer
KPP	Kelanitissa Power Plant
LCOE	Levelized Cost of Energy
LTGEP	Long Term Generation Expansion Plan
NPV	Net Present Value
NREL	National Renewable Energy Laboratory
PV	Photovoltaic
SCA	Solar Collector Assembly
SEA	Sustainable Energy Authority
SOC	State of Charge
SPP	Small Power Producer
ST	Steam Turbine
TESS	Thermal Energy Storage system
VRLA	Valve Regulated Lead Acid