INTRODUCTION OF PARTIAL HYBRID RENEWABLE POWER GENERATION SYSTEM FOR NAVAL COMPLEX PUNEWA OF SRI LANKA NAVY

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DECLARATION OF THE CANDIDATE AND THE SUPERVISOR

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The above candidate has carried out research for the Master's thesis under my supervision.

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ABSTRACT

The rapid Industrialization and Urbanization have long driven the Sri Lankan's high energy demand. As the nation continues to process, finding more cost-effective energy solutions has become essential. A clear example of this need can be seen in the Sri Lanka Navy, which faces substantial energy costs. At the Naval Complex in Punewa alone, the monthly electricity bill exceeds 3 million rupees. This significant expenditure highlights the pressing need for more efficient and affordable energy alternatives to manage rising operational costs, particularly for large-scale facilities like those run by the Navy.

Comprehensive research on integrating hybrid renewable energy systems in military installations was lacking, especially in Sri Lanka. Furthermore, the possibility of mixing solar, wind, and biomass energy sources in a military context was not fully assessed by previous studies. The process comprised gathering information on the Naval Complex Punewa's energy usage trends and evaluating the region's supply of renewable energy sources. Various combinations of hybrid renewable energy were modelled using computer simulations and cost analysis.

According to the report, dependency on the national grid and fossil fuels would be greatly reduced by implementing a hybrid energy system that combines solar, wind, and biomass power sources. It also highlighted how combining different renewable energy sources might reduce overall operating expenses while supplying steady electricity. To lower energy expenditures and increase energy security, the Sri Lanka Navy should invest in hybrid renewable energy systems. Adopting this strategy might also act as a model for other military locations around the country.

Ultimately, installing a solar and wind energy combination with appropriate capacities was identified as the best solution for meeting the energy needs of the Punewa Naval complex. Further installing 400 kW of solar photovoltaic (PV) panels and 100 kW of wind turbine generators (WTGs) can cater to the current load.

Key Words: Renewable energy, hybrid system, applications, Sri Lanka, Internal Rate of return

CONTENT

NOTATIONS

AC	Alternating Current
COE	Cost of Energy
DC	Direct Current
DG	Diesel generator
DHI	Diffuse Horizontal Irradiance
DNI	Direct Normal Irradiance
GHI	Global Horizontal Irradiance
kVA	kilovolt Ampere
kWh	kilowatt hour
LPG	Liquid Petroleum Gases
NASA	National Aeronautics and Space Administration
NCRF	Non-Conventional Renewable Energy
NPC	Net Present Cost
NREL	National Renewable Energy Laboratory
PV	Photovoltaic
R & D	Research and development
RES	Renewable Energy Sources
SEA	Sustainable Energy Authority
TNPC	Total Net Present Cost
UN	United Nations
UNDP	United Nations Development Program
US	United States
USA	United States of America
USAID	United States Agency for International Development
WTG	Wind turbine generator

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