POWER MANAGEMENT ALGORITHM FOR STAND –ALONE HYBRID ENERGY SYSTEM

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DECLARATION

I declare that this is my own work and this dissertation does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any other University or institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

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ABSTRACT

In Sri Lanka grid-based electrification is possible up to maximum 95% of the population and balance 5% of the electrification has to be mainly depending on off-grid technologies such as solar PV, wind, biomass and micro hydro [2].Mostly these off grid Hybrid Energy systems are used to provide electricity in rural areas which are located far away from the grid connection.

In this research, general power management algorithm has built up for standalone hybrid energy system. It controls the sharing of generated power and optimizes the hybrid operation, maximizes the use of energy produced by renewable sources and minimizes the cost of the energy produced by the system.

The simulation model of stand-alone system is developed from mathematical models of solar photovoltaic system, wind turbines, battery and diesel generators. The model of solar photovoltaic energy conversion system is constructed with maximum power point tracking control to extract maximum power from the solar photovoltaic system.

In order to validate the proposed strategy under real situations, optimized hybrid energy system was designed for Delft Island by considering the future demand. The effect of the capital cost, operation & maintenance cost, life time of the components, load pattern, available renewable resources level has been considered in the optimization. "HOMER" optimization tool was selected for optimization and optimized capacities of each component considered for power management strategy simulation in "MATLAB" simulation tool. The developed firmware permits to determination of diesel consumption and Load Loss probability of different kind of energy systems.

Results obtained from the simulation are presented to validate the control algorithms developed in this work and in order to examine the economic viability of the proposed system, the total net present cost has been calculated for 20 years of systemic lifetime.

Keywords: Off grid Hybrid Energy system, Optimization, Power Management, Rural electrification, Wind/Solar PV/battery/diesel generator

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LIST OF ABBREVIATIONS

Abbreviation	Description
CEB	Ceylon Electricity Board
DG	Diesel Generator
HRES	Hybrid Renewable Energy system
MPPT	Maximum Power Point Tracking
NPV	Net Present Value
O&M	Operation & Maintenance
PI	Proportional Integral
PSO	Particle Swarm Optimization
P&O	Perturb and Observe
PV	Photovoltaic
SOC	State of Charge

LIST OF APPENDICES