

An Economic Analysis of Optimized HESS with Pumped Hydro for Maximizing Solar Energy in Sri Lanka

Publisher: IEEE [Cite This](#)  PDF

[H.C. Ganegge](#) : [D.P. Chandima](#) [All Authors](#)

1 Cites in Paper 48 Full Text Views



Abstract

- Document Sections
- I. Introduction
 - II. System Configuration and Modelling
 - III. Cost Modelling
 - IV. Case Study
 - V. Results and Analysis
- Show Full Outline ▾

Authors

Figures

References

Citations

Keywords

Metrics

More Like This

Abstract:

The future world trend is towards decarbonization, considering that this research focuses on increasing renewable energy generation while minimizing thermal energy generation in power systems. When maximizing solar energy generation, energy storage can be used as a controllable resource to minimize solar energy curtailments. A Hybrid Energy Storage System (HESS) combines Pumped Hydro Storage (PHS) and Battery Storage (BS) to maximize the overall performance. Here, a techno-economic multi-objective optimization algorithm is introduced to size and cost solar PV and BS, while considering the optimal time to integrating PHS into the system. The proposed algorithm aims to minimize the total investment cost, the operation and maintenance cost, and the penalty cost incurred due to solar surplus and thermal (oil) generation. The genetic algorithm is used to achieve multi-objective optimization, implemented using the Pymoo open-source framework in Python. An energy management system is utilized to operating hours, ensuring proper regulation. Results are presented in a Pareto optimal chart for better analysis, and economic analyses were conducted for various PHS installation times. Finally, the optimal duration for integrating PHS, considering both economical and environment facts, was determined, with solar and BS capacities for each two-year interval throughout the planning horizon.

Published in: 2024 4th International Conference on Electrical Engineering (ECon)

Date of Conference: 12-12 December 2024 DOI: 10.1109/ECon64470.2024.10841859

Date Added to IEEE Xplore: 17 January 2025 Publisher: IEEE

▼ ISBN Information: Conference Location: Colombo, Sri Lanka

Recommended for You (Beta)

- Techno-Economic Analysis of Integrating Wind and BESS Into an Existing Grid-Tied...
- Optimization of Hybrid Generation (PVs, Batteries, and Generators) in an Off-Grid Area using a Multi-Objective...
- Optimizing Green Energy Technologies and Energy Storage Solutions using...

[Learn More](#)

[Sign in to Continue Reading](#)



Authors	▼
Figures	▼
References	▼
Citations	▼
Keywords	▲
Keywords assist with retrieval of results and provide a means to discovering other relevant content. Learn more.	
IEEE Keywords	
Renewable energy sources, Costs, Oils, Solar energy, Thermal management, Maintenance, Timing, Optimization, Thermal stability, Investment	
Index Terms	
Solar Energy, Economic Analysis, Hybrid Energy Storage System, Renewable Energy, Optimization Algorithm, Operational Costs, Power System, Thermal Energy, Secondary Cell, Energy Generation, Multi-objective Optimization, Renewable Energy Sources, Investment Costs, Energy Storage Systems, Pareto Optimal, Solar Photovoltaic, Thermal Power Plants, Operation And Maintenance, Solar Generation, Penalty Cost, Solar Power Plants, Solar Power, Wind Power Plants, Thermal Power, State Of Charge, Power Plants, Renewable Sources, Photovoltaic System, Reservoir Capacity	
Author Keywords	
Energy storage, Techno-economic optimization, Maximizing solar PV, Sizing and costing, Genetic algorithm	
Metrics	▼

< Previous | Back to Results | Next >

Need Full-Text

access to IEEE Xplore for your organization?

CONTACT IEEE TO SUBSCRIBE >

IEEE Personal Account

CHANGE USERNAME/PASSWORD

Purchase Details

PAYMENT OPTIONS
VIEW PURCHASED DOCUMENTS

Profile Information

COMMUNICATIONS PREFERENCES
PROFESSION AND EDUCATION

Need Help?

US & CANADA: +1 800 678 4333
WORLDWIDE: +1 732 981 0060

Follow

f @ in v

[About IEEE Xplore](#) | [Contact Us](#) | [Help](#) | [Accessibility](#) | [Terms of Use](#) | [Nondiscrimination Policy](#) | [IEEE Ethics Reporting](#)  | [Sitemap](#) | [IEEE Privacy Policy](#)

A public charity, IEEE is the world's largest technical professional organization dedicated to advancing technology for the benefit of humanity.

© Copyright 2026 IEEE - All rights reserved, including rights for text and data mining and training of artificial intelligence and similar technologies.