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| **Title:** | Modeling and analysis of cost-effective energy management for integrated microgrids | | |
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| **Published Journal Name:** | Cleaner Engineering and Technology | | |
| **Type of Publication:** | Journal | | |
| **Volume:** | 8 | Issue | 2 |
| **Publisher:** | Elsevier | | |
| **Publication Date:** | May 17, 2022 | | |
| **ISSN:** | 2666-7908 | | |
| **DOI:** | <https://doi.org/10.1016/j.clet.2022.100508> | | |
| **URL:** | https://www.sciencedirect.com/science/article/pii/S2666790822001136?via%3Dihub | | |
| **Other Related Info.:** | Page 1-19 | | |
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| **Abstract:** |  |
| A microgrid concept is an innovative approach for integrating hybrid and renewable energy sources into the utility grid. The uncertainties because of the intermittent nature of renewable energy resources, the load, and  market price are significant challenges. In the traditional heuristic method, data is forecast but not known perfectly. Improving energy storage systems and energy management systems (EMS) development using optimization-based methods is a possible solution to improve the performance of microgrid operations. The EMS  is an essential part of the distributed energy resources in the microgrid system, especially when power generation, transmission, distribution, utilization, and variable pricing are involved. This optimization process developed in this paper uses forecasted costs and loading conditions to store or sell the energy from an integrated grid battery system. Two approaches are introduced in this research work: the heuristic method using state flow (chart flow) and the optimization method based on linear programming (LP), which minimizes operation costs  (savings of around 19% cost) subject to operational constraints. The LP optimization saves roughly 3.44–5.01% of excess grid energy. Several plausible outcomes of this research study simplify the comprehensive, integrated microgrid simulation for EMS optimization algorithm validation. The suggested integrated microgrid management system might be a testbed for smart grid technology research. | |