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| **Title:** | Optimal sizing of islanded microgrid using pelican optimization algorithm for Kutubdia Island of Bangladesh | | |
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| **Published Journal Name:** | Electric Power System Research | | |
| **Type of Publication:** | Journal | | |
| **Volume:** | 238 | Issue | 1 |
| **Publisher:** | Elsevier | | |
| **Publication Date:** | 23 September 2024 | | |
| **ISSN:** | 0378-7796 | | |
| **DOI:** | https://doi.org/10.1016/j.epsr.2024.111088 | | |
| **URL:** | https://www.sciencedirect.com/science/article/pii/S0378779624009738 | | |
| **Other Related Info.:** | Page 1-14 | | |
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| **Abstract:** |  |
| This study proposes an optimal design approach, based on the Pelican Optimization Algorithm (POA), to configure the optimal sizing of design variables on an islanded microgrid: photovoltaic (PV) modules, wind turbines (WT), diesel generators (DG), and batteries in Kutubdia, Bangladesh based on optimal life cycle cost (LCC) and cost of energy (COE). Additionally, the economic analysis of three independent battery technologies, notably lead acid, lithium-ion, and nickel-iron are carried out to find the economically feasible technology, to ensure uninterrupted power supply. Moreover, reliability and sensitivity analyses of the optimized microgrid using POA were conducted for various reliability indices and variable interest rates. Results show that proposed POA method provides the optimal island microgrid configuration with lead acid (LA) batteries (PV/WT/LA/DG) based on a minimum LCC of $8334901, COE of 0.1080$/KWh and greenhouse gas emission amount of 19664 kgs/year. Furthermore, the outcomes generated by the POA are compared with genetic algorithm, particle swarm optimization, moth flame optimization algorithm, whale optimization algorithm and grey wolf optimization. It is found that POA method achieves more competitive results compared to other optimization techniques due to its ability to adjust parameters, fast convergence speed, and straightforward computations. | |