



# AIUB DSpace Publication Details

<b>Title:</b>	Adaptive distribution network reconfiguration with renewable energy and EV integration using reverse-multiverse learning archimedes algorithm		
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<b>Published Journal Name:</b>	Frontiers in Energy Research		
<b>Type of Publication:</b>	Journal		
<b>Volume:</b>	14	<b>Paper #</b>	1731439
<b>Publisher:</b>	American International University-Bangladesh (AIUB)		
<b>Publication Date:</b>	April 08, 2026		
<b>ISSN:</b>	2296-598X		
<b>DOI:</b>	10.3389/fenrg.2026.1731439		
<b>URL:</b>	<a href="https://www.frontiersin.org/journals/energy-research/articles/10.3389/fenrg.2026.1731439/full">https://www.frontiersin.org/journals/energy-research/articles/10.3389/fenrg.2026.1731439/full</a>		

**Citation:** Md Abu Talha, Shameem Ahmad, Mohammad Abdul Mannan, Md. Rifat Hazari, A. S. Nazmul Huda and G. M. Shafiullah, “Adaptive distribution network reconfiguration with renewable energy and EV integration using reverse-multiverse learning archimedes algorithm,” *Front. Energy Res.* 14:1731439, April 2026.





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## Abstract:

The increasing integration of renewable energy sources (RES) and the widespread adoption of electric vehicles (EVs) have significantly expanded distribution networks in recent years, leading to challenges such as increased power losses and reduced transmission reliability. To address these issues, optimizing distribution network topology through reconfiguration is crucial for enhancing voltage stability and improving overall system performance. This paper presents an optimized distribution network reconfiguration (DNR) model that incorporates RES and EVs, focusing on the optimal placement of bus tie switches and reactive power regulation using the Reverse-Multiverse Learning Archimedes Algorithm (RMLAA). The main goals are to minimize power losses and voltage deviations across buses, while optimizing reconfiguration and reactive power from RES (wind and PV) and EVs, with RMLAA proposed as the decision variable. The RMLAA integrates Reverse-learning and Multiverse-directing strategies to enhance optimization precision and computational efficiency in multi-objective optimization. It focuses on minimizing reactive and active power losses while improving voltage stability. To assess its effectiveness, the RMLAA is compared with widely used algorithms, including Genetic Algorithms (GA), Particle Swarm Optimization (PSO), and Harris Hawks Optimization (HHO), using the CEC'17 benchmark test suite. Applied to the IEEE 33-bus and 69-bus systems, the RMLAA achieves remarkable reductions in active power losses of 70.35% and 69.08%, and in reactive power losses of 47.65% and 26.01%, respectively. Additionally, voltage stability improves by 15.2%, and computational efficiency increases by up to 22.3% compared to conventional methods. The study further demonstrates the effectiveness of the proposed algorithm through a comparative analysis with existing algorithms on the IEEE 33-bus and 69-bus systems. These findings confirm that the proposed RMLAA-based DNR framework is an effective and robust approach for improving efficiency, voltage stability, and computational performance in modern distribution networks with RES and EV integration.

## Keywords:

Archimedes optimization algorithm, distribution network reconfiguration, electrical vehicles, power loss minimization, reactive power optimization, renewable energy resources, voltage stability