Journal of Electrical Engineering and Electronic Technology

Editorial

A SCITECHNOL JOURNAL

Smart Grid Optimization and the Role of Artificial Intelligence in Power Systems

Dr. Alex Morgan*

Department of Electrical Engineering, Westland Technical University, USA

***Corresponding author:** Dr. Alex Morgan, Department of Electrical Engineering, Westland Technical University, USA, Email: alex.morgan.ee@westland.edu

Citation: Alex M (2025) Smart Grid Optimization and the Role of Artificial Intelligence in Power Systems. J Electr Eng Electron Technol 14: 1007

Received: 01-May-2025, Manuscript No. JEEET-26-183663; **Editor assigned:** 3-May-2025, Pre-QC No. JEEET-26-183663 (PQ); **Reviewed:** 17-May-2025, QC No. JEEET-26-183663; **Revised:** 24-May-2025, Manuscript No. JEEET-26-183663 (R); **Published:** 31-May-2025, DOI: 10.4172/2325-9838.10001007

Introduction

The global demand for reliable, efficient, and sustainable electricity has driven the evolution of traditional power networks into smart grids. A smart grid integrates advanced communication, automation, and control technologies to enhance the monitoring and management of power systems. Among these technologies, Artificial Intelligence (AI) has emerged as a key enabler for smart grid optimization. By leveraging data-driven intelligence, AI helps address the increasing complexity caused by renewable energy integration, distributed generation, and dynamic consumer behavior [1,2].

Discussion

Smart grid optimization focuses on improving efficiency, reliability, and resilience across generation, transmission, distribution, and consumption. AI techniques such as machine learning, deep learning, and reinforcement learning play a critical role in achieving these objectives. One major application is load forecasting. Accurate short-term and long-term demand prediction allows utilities to balance supply and demand effectively, reduce operational costs, and minimize energy waste. AI models outperform traditional statistical methods by capturing nonlinear patterns and adapting to changing consumption trends [3,4].

Another important area is the integration of renewable energy sources such as solar and wind. These sources are inherently intermittent and uncertain, posing challenges to grid stability. AI-based predictive models help forecast renewable generation and optimize energy storage and dispatch strategies. This improves grid flexibility and supports higher penetration of clean energy [5].

AI also enhances fault detection, diagnosis, and self-healing capabilities in smart grids. By analyzing sensor and smart meter data in real time, AI systems can quickly identify anomalies, locate faults, and recommend corrective actions. This reduces outage duration, improves reliability, and lowers maintenance costs. Additionally, AI-driven optimization algorithms support voltage control, power flow optimization, and congestion management, ensuring efficient use of grid infrastructure.

From the consumer perspective, AI enables demand response programs and intelligent energy management systems. These applications encourage users to adjust consumption patterns based on real-time pricing and grid conditions, contributing to overall system efficiency.

Conclusion

Smart grid optimization powered by Artificial Intelligence represents a transformative approach to modern power systems. AI enables smarter decision-making, enhances operational efficiency, and supports the integration of renewable energy while maintaining reliability and resilience. Despite challenges related to data quality, cybersecurity, and model transparency, continued research and technological advancement are expected to accelerate AI adoption in smart grids. Ultimately, the synergy between smart grids and AI will play a vital role in achieving sustainable, secure, and intelligent energy systems for the future.

References

1. Bilen O, Ballantyne CM (2016) Bempedoic Acid (ETC-1002) An Investigational Inhibitor of ATP Citrate Lyase. Curr Atheroscler Rep 18: 61.
2. Zagelbaum NK, Yandrapalli S, Nabors C, Frishman WH (2019) Bempedoic Acid (ETC-1002): ATP Citrate Lyase Inhibitor: Review of a First-in-Class Medication with Potential Benefit in Statin-Refractory Cases. Cardiol Rev 27: 49-56.
3. Benoit Viollet, Bruno Guigas, Nieves Sanz Garcia, Jocelyne Leclerc, Marc Foretz, et al. (2012) Cellular and molecular mechanisms of Bempedoic Acid. An overview, Clincal Science (London) 122: 253- 270.
4. Phan BA, Dayspring TD, Toth PP (2012) Ezetimibe therapy: mechanism of action and clinical update. Vasc Health Risk Manag 8:415-27.
5. Kosoglou T, Statkevich P, Johnson-Levonas AO, Paolini JF, Bergman AJ, et al. (2005) A review of its metabolism, pharmacokinetics and drug interactions. Clin Pharmacokinet 44: 467-94.