

## Impact of Transitioning to Renewable Energy Sources on Key Performance Indicators and Artificial Intelligence Modules of Data Center

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**Abstract :** Artificial intelligence (AI) is reshaping industries, and its potential to revolutionize renewable energy and data center operations is immense. By harnessing AI's capabilities, we can optimize energy consumption, predict fluctuations in renewable energy generation, and improve the efficiency of data center infrastructure. This convergence of technologies promises a future where energy is managed more intelligently, sustainably, and cost-effectively. The integration of AI into renewable energy systems unlocks a wealth of opportunities. Machine learning algorithms can analyze vast amounts of data to forecast weather patterns, solar irradiance, and wind speeds, enabling more accurate energy production planning. AI-powered systems can optimize energy storage and grid management, ensuring a stable power supply even during intermittent renewable generation. Moreover, AI can identify maintenance needs for renewable energy infrastructure, preventing costly breakdowns and maximizing system lifespan. Data centers, which consume substantial amounts of energy, are prime candidates for AI-driven optimization. AI can analyze energy consumption patterns, identify inefficiencies, and recommend adjustments to cooling systems, server utilization, and power distribution. Predictive maintenance using AI can prevent equipment failures, reducing energy waste and downtime. Additionally, AI can optimize data placement and retrieval, minimizing energy consumption associated with data transfer. As AI transforms renewable energy and data center operations, modified Key Performance Indicators (KPIs) will emerge. Traditional metrics like energy efficiency and cost-per-megawatt-hour will continue to be relevant, but additional KPIs focused on AI's impact will be essential. These might include AI-driven cost savings, predictive accuracy of energy generation and consumption, and the reduction of carbon emissions attributed to AI-optimized operations. By tracking these KPIs, organizations can measure the success of their AI initiatives and identify areas for improvement. Ultimately, the synergy between AI, renewable energy, and data centers holds the potential to create a more sustainable and resilient future. By embracing these technologies, we can build smarter, greener, and more efficient systems that benefit both the environment and the economy.

**Keywords :** data center, artificial intelligence, renewable energy, energy efficiency, sustainability, optimization, predictive analytics, energy consumption, energy storage, grid management, data center optimization, key performance indicators, carbon emissions, resiliency

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