Chapter 9
Green Energy and Smart Automation:
A Bibliometric and Systematic Review of Emerging Trends

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ABSTRACT

The rising global demand for sustainable energy and advancements in automation have driven interest in green energy and smart automation research. This study reviews trends, key contributions, and structures in this field through a bibliometric and systematic analysis of 40 English-language documents in Scopus. The search query combined "Green Energy," "Sustainable Energy," "Renewable Energy," "Smart Automation," and "Intelligent Automation." Tools such as Bibliometric (R package) and VOSviewer were used to visualise networks and patterns, while Python and NLP techniques were used to extract insights.The key findings highlight the intersection of AI-driven automation, renewable energy, and Industry 4.0, with notable advancements in smart grids, IoT-based energy management, and blockchain frameworks. However, gaps persist in policy, cross-sector collaboration and large-scale implementation. This study offers a roadmap for integrating automation with renewable energy to enhance sustainability and efficiency, thereby aiding environmental preservation and energy transition.

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INTRODUCTION

The transition to sustainable energy is the result of the development and implementation of green energy technologies to support the fight against climate change, resource scarcity, and the need for clean alternatives to fossil fuels. Green energy, which includes renewable sources such as solar, wind, hydro, and geothermal power, is considered the key to reducing carbon emissions and ensuring energy security. Simultaneously, the rapid development of digitalization and automation has revolutionized prominent fields, where smart automation is crucial for increasing efficiency, reliability, and productivity.

The integration of smart automation within the realm of green energy is an exciting research direction focused on harnessing intelligent systems to enhance the efficiency of energy production, consumption, and distribution. Smart automation technologies, which leverage the Internet of Things (IoT), artificial intelligence (AI), machine learning (ML), and advanced sensors, deliver transformative solutions that enhance energy efficiency, forecast consumer demand, and reduce waste (Sinha et al., 2024). These technologies can be implemented at additional stages of energy systems, resulting in the development of adaptive energy infrastructures with minimal operational costs and environmental footprints, while optimizing renewable energy advantages (Sudha et al., 2024).

Although such technologies are becoming increasingly important, the academic literature on the intersection between green energy and smart automation is disparate and fragmented. This study aims to fill this void by conducting a full bibliometric and systematic review of the emerging trends in this interdisciplinary field. Through a literature analysis to assess the extent of academic contributions, emerging themes, and mapping of evolutionary research, this study investigates the synergistic elements attributed to green energy and practical intelligent automation, and discloses key challenges, potentials, and future trajectories for innovation.

The findings of this review will be useful for researchers, practitioners, and policymakers who wish to gain insight into the current situation and future trends of green energy technologies and smart automation systems. This study aims to add to the literature that has already been established through the existing literature on how today's innovations can help promote a more sustainable future full of energy efficiency.