


Chapter 11

Energy Policy Driven by AI Towards Sustainable Future

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ABSTRACT

The current decade is a turning point in the energy sector's transition, with the introduction of green energy along with the optimization of efficacy through machine learning and artificial intelligence (AI). As a result, competitive policies are needed to manage multifaceted tasks on one platform. When energy policies fail to accomplish both energy as well as climate targets over their entire lifecycle, the socio-economic ramifications can be profound. These deficiencies are said to result from poor decision-making and insufficient incentives, which should encourage equity, equality, fairness, and inclusivity in energy policy and decision-making regarding projects. This chapter seeks to assess the many obstacles posed by the emergence of AI in the energy industry. Specifically, the study addresses (1) the development stage decision-making process, 2) the execution stage implementation management process, (3) integrating deep learning, machine learning and data science in the energy systems, and (4) the substantiality requirements of energy systems.

INTRODUCTION

In the current day, global warming along with sustainable development have become crucial issues that call for interdisciplinary approaches. In order to quantify the shortage of energy along with sustainability pillars changing depending on both demand and supply infrastructure, a number of sustainable energy-related factors have an impact at both global and regional levels and require certain indicators,

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metrics, tools and strategies (Herremans, 2021). In light of the multifaceted circumstances and historical tendencies, the actionable (policy and strategy) procedure should be open, inclusive, and accountable to all stakeholders (Whittington, 2019). In order to promote sustainable energy use and mitigate climate change, modern energy policy driven by AI along with cutting-edge technologies is essential.

Energy policy includes a complete set of statutes, regulations, norms and strategies that regulate energy production, delivery and usage with little room for discretion (Danish et al., 2020). By defining objectives and goals, allocating resources, and creating criteria related to energy activities, it tackles a number of concerns, including security of energy, sustainability, accessibility and affordability, etc. The growth of energy industries and the introduction of novel technologies are influenced by energy policy. The targets for the generation and use of energy, efficiency incentives, rules governing renewable energy companies, assistance for development and research, along with additional areas are all included.

Promoting equality, fairness, ownership, and inclusivity in the creation of policies regarding energy and project decision-making is essential to avoid the broad implications that an ineffectiveness implementing energy policies would have on society. Throughout the policy's lifespan, usage of energy as well as climate goals must be taken into account, and prompt and efficient actions are required to avoid failures in policy and guarantee successful implementation (Sokołowski & Heffron, 2022).

Research at the leading edge of AI is still focused on analyzing a complete roadmap to overcome the deficiencies integrating energy policies including advance use of machine learning (ML) in energy policy while adhering to sustainability standards. In order to create a new paradigm, this study carefully examines international managerial practices, the principles of sustainability, and effectiveness (geopolitical, technical, ecological, etc.) (Rizos & Bryhn, 2022). The main goals are to pinpoint important elements, provide workable measures and indicators, and use cutting-edge technologies and methodologies to examine the incorporation of AI in energy laws from multiple angles.

Since the beginning of the Industrial Revolution, the world's economy has grown rapidly due to the depletion of natural resources; in 2019, the world's material consumption tripled from 1970 to a total of 96 billion metric tons. The authors suggested an economy based on circularity that emphasizes limiting, recycling, reusing and recuperating resources being a solution of worldwide financial sustainability in order to strike a balance between the demands of material upgrading and low-carbon as well as limited resource demands. But just 9% of the material in world demand is currently recycled, underscoring the requirement to close the gap that exists in research, policy, as well as technology (Li & Xu, 2022).

In (Sotiriou & Zachariadis, 2021), an optimization with multiple goals paradigm is presented to give decision makers a better understanding about the trade-offs among stronger decarbonization targets and increased expenses in the EU. The results show that the European Union's Effort Sharing industries can reduce by up to 35%, which is the highest amount that can be accomplished with significant social benefits. To achieve this, however, expenditures and public spending are needed to apply a certain policy mix strategy. In the energy industry, computer-aided decisions through machine learning and AI are becoming more and more necessary (Entezari et al., 2023). According to this study, artificial intelligence (AI) and machine learning have a lot of potential for optimizing renewable energy sources to satisfy growing demand while conserving resources.

According to a case study on AI deployment in energy industry published in (Chawla et al., 2022), the energy sector is under stress as a result of not utilizing AI to its full potential. This report outlined obstacles and problems while analyzing the impact of "AI and information management" in India's energy transformation. According to the findings of this study, there are generally not many incentives favouring AI in energy industry, indicating that policymakers are taking adaptive measures in the direction of AI

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