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Optimizing Industrial Energy Systems with Green Hydrogen: AI-Powered Efficiency and Environmental Resilience

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Abstract

The potential revolutionization changes can be seen in the industrial energy system by implementing green hydrogen, giving unprecedented efficiency and environmental sustainability with zero carbon footprints. Produced through electrolysis which is powered by renewable energy sources such as solar, wind, and hydropower which have zero carbon emits during its production and its use makes it the best replacement for fossil fuels. Its versatility allows it to be one of the best replacements of coal and natural gas in energy-intensive industries creating a significant reduction in greenhouse gas. Therefore, hydrogen is one of the most efficient and promising forms of renewable energy sources when it comes to high-temperature generation supported by optimization systems. With the advancements in AI and the subsequent application of algorithms in several aspects of hydrogen production, storage, and manual workload, it mean that the cost of production and overall scalability of the hydrogen supply chain is feasible for industrial use. While it is creating substantial growth in heat production, the cost of this facility is high, and have to face challenges in storage and transportation. Apart from its virtues as a clean fuel, green hydrogen provides stability for energy systems coupling extremely well with renewable energy sources thereby providing reliable energy to industries. These cost and technical challenges could be overcome to place green hydrogen at the heart of energy security and an environmentally friendly energy mix. AI will continue to be a proactive innovation in the enhancement of green hydrogen technology in aspects of efficiency, cost reduction, and observance of production and utilization of hydrogen.

Keywords

Green Hydrogen, Industrial Decarbonization, Energy Efficiency, Sustainable Energy, Renewable Integration.

Biographies

Hasan Mahmud is an undergraduate student pursuing a B.Sc. in Computer Science and Engineering at the American International University-Bangladesh (AIUB), with a strong passion for AI, machine learning, quantum computing, and web development, including HTML and CSS. In addition to academic pursuits, he works as a Marketing and Merchandising Coordinator at APPAREL RESOURCE BD and runs his own apparel buying house. Hasan also serves as a Community Manager at Alphant, engaging with users and simplifying access to Web3 technologies. A passionate

gamer, he has created his own cloud gaming service and actively participates in gaming tournaments and festivals. As an executive member of the International Leadership Competition, he manages tasks, coordinates with teams, and ensures the smooth execution of events. With expertise in Java, C++, C#, HTML, CSS, and a strong drive for innovation, Hasan continues to seek opportunities for growth both academically and professionally.

Sumshun Nahar Eity is currently a 6th-semester undergraduate student in the Department of Computer Science and Engineering (CSE) at the American International University-Bangladesh (AIUB). Passionate about research and competitive programming, she actively explores new technological advancements that drive innovation. She is deeply interested in Data Science and aims to apply her research passion in innovative, impact ways that expand the boundaries of research for herself and others, ultimately benefiting society. Her areas of research focus include Information Systems, Computational Statistics, Artificial Intelligence, and Smart Technology.Sumshun recently published an abstract related to artificial intelligence (AI) at the 1st National Research Conclave held at the Military Institute of Science and Technology (MIST), showcasing her dedication to advancing research in the field. In addition to her academic pursuits, she is involved in extracurricular activities such as sports and art, further highlighting her well-rounded personality and commitment to both personal and professional growth.

Md. Mortuza Ahmmed is an Associate Professor at the department of Mathematics, American International University Bangladesh. He is a statistician with an extensive range of research interests, primarily focused on application-based methodologies. His work revolves around applying various statistical techniques across different sectors to enhance the accuracy and precision of analyses and projections. His core academic research areas include public health, education, and machine learning. One of his primary goals is to assist students in acquiring the technical knowledge necessary to transform their ideas into successful outcomes, contributing to the development of a modern society. Through his efforts, he aims to empower the next generation of professionals to leverage statistical tools effectively in addressing real-world challenges.