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Broadening the prospects for renewable energy through hydrogen energy technologies and systems

Abstract:

This review critically examines hydrogen energy systems, highlighting their capacity to transform the global energy framework and mitigate climate change. Hydrogen showcases a high energy density of 120 MJ/kg, providing a robust alternative to fossil fuels. Adoption at scale could decrease global CO2 emissions by up to 830 million tonnes annually. Despite its potential, the expansion of hydrogen technology is curtailed by the inefficiency of current electrolysis methods and high production costs. Presently, electrolysis efficiencies range between 60 % and 80 %, with hydrogen production costs around $5 per kilogram. Strategic advancements are necessary to reduce these costs below $2 per kilogram and push efficiencies above 80 %. Additionally, hydrogen storage poses its own challenges, requiring conditions of up to 700 bar or temperatures below −253 °C.

Biography

Marc A. Rosen is a Professor at Ontario Tech University in Oshawa, Canada, where he served as founding Dean of the Faculty of Engineering and Applied Science. Dr. Rosen was President of the Engineering Institute of Canada. He is a registered Professional Engineer in Ontario, and serves as Editor-in-Chief of several journals and he was a Director of Oshawa Power and Utilities Corporation. With over 60 research grants and contracts and 900 publications, Dr. Rosen is an active teacher and researcher in sustainable energy, environmental impact, and energy technology (including renewable energy and efficiency improvement). Much of his research has been carried out for industry, and he has written numerous books. Dr. Rosen has worked for such organizations as Imatra Power Company in Finland, Argonne National Laboratory near Chicago, and the Institute for Hydrogen Systems near Toronto. Dr. Rosen has received numerous awards and honors.