Potential and Economic Analysis of Wind-to-Hydrogen Production in the Sultanate of Oman

Navid Nasiri
Electrical and Computer Engineering Department
Sultan Qaboos University
Muscat, Sultanate of Oman
nnerpr@gmail.com

Rayyan Muhammad Rafikh
Electrical and Computer Engineering Department,
College of Engineering, Northeastern University Boston,
Massachusetts 02115, USA
rayyanrafikh6@gmail.com

Maryam Farrizi
Electrical and Computer Engineering Department
Sultan Qaboos University
Muscat, Sultanate of Oman
maryamfarrizi@gmail.com

Hooman Nasiri
Head of the Department of Economics and Customs
Islamic Azad University, Bushehr
Bushehr, Iran
Hoomannasiri@gmail.com

Abstract

This study presents the hydrogen production potential using wind energy harnessed in the Sultanate of Oman. An analysis of 14 different locations throughout the Sultanate with prospective wind energy abundance was conducted to determine the economic feasibility and overall potential for wind-to-hydrogen production. Key metrics assessed included Capacity Factor, Levelized Cost of Energy (LCOE), CO2 emission reductions, annual weight of Green Hydrogen produced, and the associated Levelized Cost of Hydrogen (LCOH). The results indicate that significant potential exists for green hydrogen production in Oman, providing pathways for sustainable energy development and addressing the global demand for clean energy.

Keywords
Wind-to-Hydrogen, Green Hydrogen, Renewable Energy, Economic Feasibility, Capacity Factor, Levelized Cost of Energy (LCOE), Carbon Emissions Reduction, Sustainable Development, Sultanate of Oman, Renewable Energy Resources.

Biographies

Navid Nasiri is a PhD candidate in Electronics at Sultan Qaboos University, specializing in advanced electronics systems. With a Master's degree in Electronics from Sepidan Islamic Azad University, where he focused on the telemetry of methane using carbon dioxide lasers, Navid has cultivated a strong foundation in renewable energy solutions, solar energy systems, and robotics. His research encompasses innovative projects like oil spill detection using UAVs, microgrid inverter design, and water harvesting technologies. He has contributed extensively to academia through multiple publications in high-impact journals and is co-authoring a book chapter on AI and robotics applications in the oil and gas industry. In addition to his academic achievements, Navid has held leadership roles in green energy companies, focusing on solar and biomedical engineering projects. His work bridges the gap between academia and industry, driving innovations that address real-world energy challenges while advancing academic research in the field of electronics.

Rayyan Muhammad Rafikh is an undergraduate in Engineering from Manipal Institute of Technology, majoring in Mechatronics. My interests lie in research in the fields of Robotics, Artificial Intelligence, Autonomous Systems, Aerospace, Energy and Sustainability. An engineering student of an inter-disciplinary majors looking forward to contribute to the advancement of technology and wanting to discover and learn more about aerospace, automobile, autonomous, and AI systems, thereby implementing the knowledge of mechanical, computer science, robotics and electronics in research and developing solutions that could help the earth, humanity and nations.

Maryam Farrizi is an accomplished electronics engineer with expertise in project management and innovative design, particularly within renewable energy and electronic systems. She holds an M.Eng. in Electronic Engineering from Islamic Azad University of Sepidan, where her research focused on solar-based cooling systems. With over a decade of experience in R&D, Maryam has led significant projects in inverter design and solar power systems across multiple roles, including her current position as a Research Assistant at Sultan Qaboos University. She has published numerous articles and contributed to various international conferences, establishing herself as a knowledgeable figure in sustainable energy.
Beyond her technical skills, Maryam has a creative side, actively participating in activities like swimming, dancing, and singing. She has recorded four music clips and maintains a presence on social media. Skilled in tools like MATLAB and Proteus, she brings a hands-on approach to her work, complemented by her background in training and teaching in robotics and solar energy system design.

Dr. Hooman Nasiri is an Assistant Professor of Economics at the Islamic Azad University, Bushehr Branch. He was born on February 6, 1980, and is fluent in English. He obtained his Ph.D. in International Economics from the Islamic Azad University, Shiraz Branch, in 2020. Since then, he has been actively teaching and conducting research in his field. His areas of expertise include economic modeling and international trade, with a particular focus on the economic stability of Iran's industrial sector. He has been a faculty member at the Islamic Azad University, Bushehr Branch, since 2007, where he also serves as the Head of the Department of Economics and Customs. He has published several research papers in reputable journals, with his work exploring topics such as the impact of industrial export diversification on revenue stability and the use of composite leading indicators to forecast business cycles. Dr. Hooman has co-authored with various researchers and contributed to both national and international publications, showcasing his ongoing commitment to advancing knowledge in the field of economics.