Enhancing Wind Energy Systems through Geological Hydrogen Storage: A Case Study in the Bakken Formation, Williston Basin, North Dakota

Shree O. Bade[1], Emmanuel Gyimah[1], Rachael Josephs[1], Toluwase Omojiba[1], Rockson Aluah[2], and Olusegun Tomomewo[1]

[1]Institute for Energy Studies, University of North Dakota, Grand Forks, ND, USA (shree.bade@und.edu), (emmanuel.gyimah@und.edu)
[2]Department of Petroleum Engineering, University of North Dakota, Grand Forks, ND, USA

Abstract

Geological hydrogen storage, which involves storing large-scale hydrogen produced by electrolysis using wind energy sources, is increasingly recognized as a viable solution for meeting energy demands and mitigating the intermittent of wind sources. This study aims to assess and quantify the feasibility of producing and storing hydrogen on a significant scale within the depleted oil and gas field of the Bakken Formation in North Dakota, utilizing wind energy resources. The methodology encompasses field selection through site screening and characterization, along with mathematical modeling to simulate the integrated wind-hydrogen production and storage system. Using a hypothetical 15 MW wind farm as a case study, the findings reveal that the middle Bakken formation has a significant storage capacity, capable of storing hydrogen for a minimum of 128, 79, and 53 days, corresponding to 54,000,000 kg, 33,000,000 kg, and 22,000,000 kg storage capacity, for W24814, W19693, and W26990 wells respectively. These results provide valuable insights into the role of geological hydrogen storage in integrating renewable energy sources into the existing energy infrastructure.