Review of: "Low-Carbon Hydrogen Economy Perspective and Net Zero-Energy Transition through Proton Exchange Membrane Electrolysis Cells (PEMECs), Anion Exchange Membranes (AEMs) and Wind for Green Hydrogen Generation"

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Potential competing interests: No potential competing interests to declare.

In this paper, the authors introduce a novel approach where energy generated from wind and solar sources is seamlessly integrated with Anion Exchange Membranes (AEMs) and Proton Exchange Membrane Fuel Cells (PEMFCs) to produce clean hydrogen. This innovative integration addresses longstanding challenges encountered in previous electrolysis methods. Anion exchange membrane (AEM) electrolyzers, in particular, offer significant advantages such as the utilization of non-platinum and non-Nafion membrane materials, high hydrogen storage density, and the use of compact microcells, making them highly suitable for large-scale, low-carbon systems. Additionally, the paper explores another promising technique for hydrogen production through ethanol electrocatalysis in PEMECs, ensuring ultraclean hydrogen generation.

Moreover, the study delves into hydrogen production via water electrolysis employing anion-conducting solid polymer electrolytes and a novel integrated inorganic membrane electrode assembly (I2 MEA). This approach utilizes inorganic Mg-Al layered double hydroxides (Mg-Al LDHs) as an ionic conductor. The investigation not only explores the theoretical aspects but also assesses the economic feasibility of producing low-carbon hydrogen using this method.

However, despite these significant contributions, several concerns regarding the manuscript remain. Firstly, Figure 1 lacks sufficient information, particularly regarding the financial aspects, such as company budget allocation, to enable readers to understand the basis of the numerical data presented and assess its reproducibility.

Secondly, the authors should provide further elucidation on the novelty of their work, particularly emphasizing the practical applications of utilizing energy from wind and solar sources. Clarifying the specific applications of this energy integration would enhance the paper's significance.

Lastly, the introduction section would benefit from additional references, particularly those exploring power consumption optimization and energy-saving techniques in optical systems. Some relevant studies include "Optimizations of double titanium nitride thermo-optic phase-shifter heaters using SOI technology" (Sensors, 2023), "Data Center Four-Channel Multimode Interference Multiplexer Using Silicon Nitride Technology" (Nanomaterials, 2024), "Photonic crystal flip-flops: recent developments in all-optical memory components" (Materials, 2023), "Optimizations of thermo-optic phase shifter heaters using doped silicon heaters in Rib waveguide structure" (Photonics and Nanostructures-Fundamentals and Applications, 2022), and "Design of all-optical logic half-adder based on photonic crystal multi-ring resonator" (Symmetry, 2023). These references would provide valuable context for understanding the broader applications and implications of the research discussed in the paper.