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Preface-JES Focus Issue on Electrolysis for Increased Renewable Energy Penetration

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JES Focus Issue on Electrolysis for Increased Renewable Energy Penetration

Preface—JES Focus Issue on Electrolysis for Increased Renewable Energy Penetration

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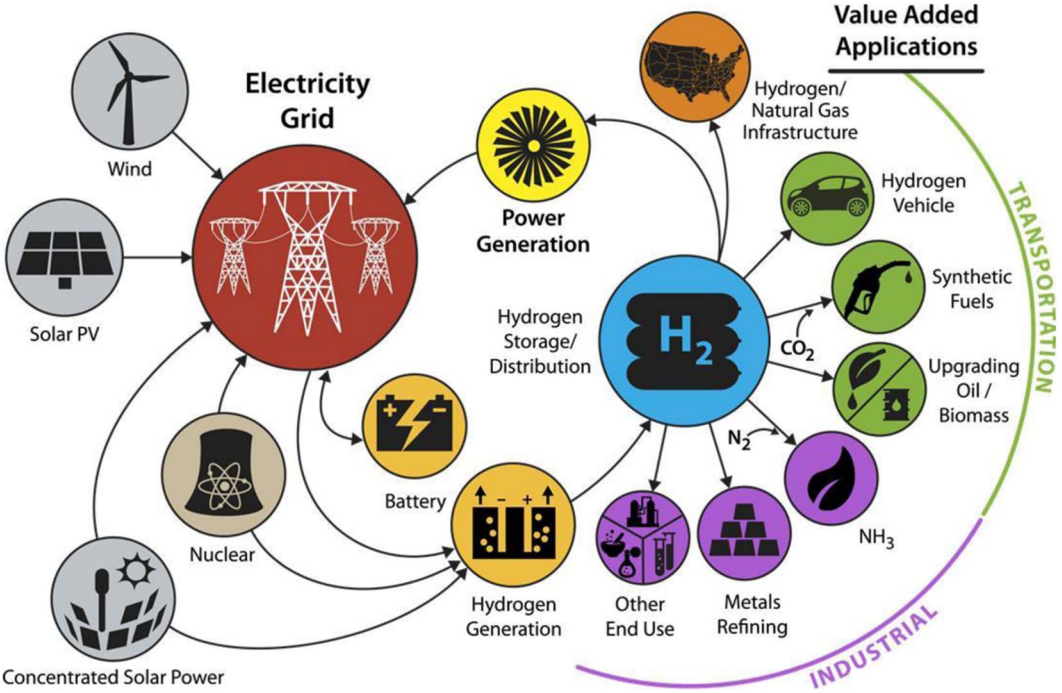
Today represents a particularly exciting time, as our planet's energy system is undergoing major changes due to dramatically decreasing renewable energy prices and increasing societal concerns over greenhouse gas emissions, criteria pollutants (arsenic, mercury, NOx, particulate matter), and climate change. These factors are pushing society toward deep decarbonization of our energy system, perhaps the most challenging issue facing the planet today. Unfortunately, wind and solar energy, while both promising generation sources, come with intermittency challenges and have limitations in their abilities to impact industrial and transportation sector demands where fossil fuel energy carriers based on chemical bonds have provided the basis for historic energy demands. Electrolysis (Hydrogen Generation) offers the potential to meet the multi-GW demand for both grid-balancing and input into the industrial and transportation sectors, as shown schematically below. In such an energy system, hydrogen acts as an energy carrying intermediate that parallels electons (electricity) within the energy system. Therefore interest in this area has increased significantly with focus on several different technological approaches, each with their own unique challenges.

The objective of this special issue is to help identify the leading research being performed in the electrolysis area and provide context for the electrolysis advances that will be required for a larger role in tomorrow's energy system.

This focus issue consists of contributions in the areas of high temperature and low temperature electrolysis. High temperature electrolysis focuses on ceramic conductors (typically oxides) that have advantages in improved kinetics and efficiencies, but significant materials challenges (often related to their high temperature of operation and concerns with sealing and durability). Low temperature electrolysis has contributions that primarily focus on traditional alkaline (aqueous KOH based) or polymer electrolyte membrane (PEM) systems. Both systems offer promise for variable or intermittent operation. Traditional alkaline systems offer the potential of increased materials compatibility, lower cost, and proved robustness, but have challenges associated with handling of a corrosive, liquid electrolyte and limited current density range due to the use of thick diaphragms. PEM systems utilize a solid electrolyte, enabling pure water as the circulating fluid, but still require cost reduction for energy markets. PEM systems also have larger dynamic range for intermittent power applications, and higher differential pressure range for electrochemical compression.

We would like to express our greatest gratitude to the authors for their contributions, the reviewers for their valuable services, and the ECS editorial staff for making this issue a success. We envision that the field will continue to grow and this focus issue will be an important part in helping to nucleate interest in the area.



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