LCRI LOW-CARBON RESOURCES INITIATIVE

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EXECUTIVE SUMMARY

Electrolysis Systems Operation and Maintenance Overview

PRIMARY AUDIENCE

Stakeholders in the energy sector include utility companies, policy makers, investors, and operators interested in large-scale hydrogen production technologies.

SECONDARY AUDIENCE

Engineering teams, maintenance personnel, and technical staff involved in the setup and day-to-day operations of electrolysis systems.

KEY RESEARCH QUESTIONS

This report delves into the operational and maintenance (O&M) responsibilities of large scale electrolysis systems, specifically focusing on Alkaline and Proton Exchange Membrane (PEM) technologies.

1. What are the comprehensive O&M requirements for large scale electrolysis systems?
2. What are the maintenance requirements and replacement intervals for other balance of plant components?
3. What are the annual O&M costs?

RESEARCH OVERVIEW

The objective of this report is to give stakeholders a comprehensive understanding of the financial and labor commitments associated with operating and maintaining these systems. This includes both planned and unplanned maintenance, labor for monitoring and operations, and other related costs. The information provided draws on data from electrolyzer manufacturers and component vendors.

KEY FINDINGS

- The majority of O&M costs for electrolysis systems are attributed to variable costs, with electricity being the dominant factor. For a 20 MW system, electricity accounts for 85% of the total O&M cost, while for a 200 MW system, it represents over 90%. Access to low-cost electricity can significantly reduce the overall O&M cost.
- Both water and hydrogen purification are critical to maintaining system efficiency and ensuring high-purity hydrogen production. Advanced water purification systems, such as reverse osmosis (RO) and deionization, are essential to prevent impurities from affecting the electrolyzer stacks.
- Stack replacement is one of the largest investments, representing 30-50% of the total capital expenditure for an electrolysis system.

WHY THIS MATTERS

Effective O&M practices are crucial for the safety and efficiency of hydrogen production via water electrolysis. Owners and operators of electrolysis systems need to be prepared to hire sufficient staff to operate and maintain such systems and have appropriate tools and equipment available on-site.

HOW TO APPLY RESULTS

Members should integrate advanced monitoring technologies and develop training programs to enhance safety and system reliability. Access to cost effective electricity will help reduce operational costs. Future research and development should focus on improving stack durability and performance.

LEARNING AND ENGAGEMENT OPPORTUNITIES

- Opportunities for cross-industry collaboration to enhance knowledge sharing and innovate O&M practices.
- As more electrolysis systems are being deployed, electrolyzer operators will gain more O&M experience to create collective knowledge bases that benefit the entire industry.
- Stakeholders are encouraged to participate in workshops and seminars focusing on the latest advancements in electrolysis technology.

THE LOW-CARBON RESOURCES INITIATIVE

This report was published under the Low-Carbon Resources Initiative (LCRI), a joint effort of EPRI and GTI Energy addressing the need to accelerate development and deployment of low- and zero-carbon energy technologies. The LCRI is targeting advances in the production, distribution, and application of low-carbon energy carriers and the cross-cutting technologies that enable their integration at scale. These energy carriers, which include hydrogen, ammonia, synthetic fuels, and biofuels, are needed to enable affordable pathways to economy-wide decarbonization by mid-century. For more information, visit www.LowCarbonLCRI.com.

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About EPRI

Founded in 1972, EPRI is the world's preeminent independent, non-profit energy research and development organization, with offices around the world. EPRI's trusted experts collaborate with more than 450 companies in 45 countries, driving innovation to ensure the public has clean, safe, reliable, affordable, and equitable access to electricity across the globe. Together, we are shaping the future of energy.

GTI Energy is a leading research and training organization. Our trusted team works to scale impactful solutions that shape energy transitions by leveraging gases, liquids, infrastructure, and efficiency. We embrace systems thinking, open learning, and collaboration to develop, scale, and deploy the technologies needed for low-carbon, low-cost energy systems. www.gti.energy

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