



Achieving American Leadership in the Hydrogen Supply Chain

Summary

Hydrogen has been identified as a key energy option to enable full decarbonization of the energy system. A secure, resilient supply chain will be critical to achieving emissions reductions and capturing the economic opportunity inherent in the energy sector transition. Electrolyzers and fuel cells are two critical components of the hydrogen supply chain that today are largely nascent industries with limited data on supply chain needs and constraints. This fact sheet summarizes findings from an accompanying report that is one in a series of deep dive assessments of the energy industrial base called for in Executive Order 14017 on America's supply chains. The report identifies key considerations for the development of water electrolyzer and fuel cell supply chains and materials, focusing on polymer electrolyte and solid oxide technologies, to meet future demand for hydrogen produced by electrolysis and achieve U.S. decarbonization goals.

Market & Supply Chain Overview

Today's hydrogen market is approximately 10 million

metric tonnes per year (MMT/yr) in the United States and 65–100 MMT/yr globally. However, almost none of that hydrogen is electrolytic. The electrolytic hydrogen market could grow substantially to at least 100 MMT/yr by 2050 to meet potential future demands and help decarbonize difficult-to-abate sectors.

To meet this market size, U.S. electrolyzer capacity will likely have to increase from 0.17 gigawatts (GW) today to up to 1,000 GW in 2050—or 20% compound annual growth

from 2021 to 2050 with an annual manufacturing requirement of over 100 GW/yr. In addition, over 50 GW of domestic fuel cell capacity is required in the decarbonization scenario with an annual manufacturing requirement of over 3 GW/yr. This

U.S. Electrolytic Hydrogen Market by 2050

100 MMT/yr electrolytic hydrogen

1,000 GW electrolyzer capacity

100 GW/yr electrolyzer manufacturing requirement

50 GW fuel cell capacity

3 GW/yr fuel cell manufacturing requirement

level of growth (illustrated in Figure 1) represents a significant opportunity for the United States as electrolytic hydrogen markets and supply chains rapidly grow and develop globally.

Key Findings & Opportunities

The overarching opportunity for electrolytic hydrogen within the United States is a potential market of more than 100 MMT/yr for applications across the industrial, transportation, and power sectors. An electrolytic hydrogen market of that size powered with clean electricity would provide decarbonization opportunities for difficult-to-abate sectors, including synthetic fuels for air and marine transport, long-distance transport via heavy- and medium-duty vehicles, energy storage, and high-temperature heat.

By taking advantage of the opportunities below, the United States could capture high value-added links of the electrolytic hydrogen supply chain.

Key U.S. opportunities to enable the growth of

electrolytic hydrogen and fuel cell markets:

- Reducing cost and increasing commercialization of electrolytic hydrogen production
- Developing economically competitive applications for electrolytic hydrogen
- Leading development of codes and standards
- Expanding the U.S. electric grid capacity to meet demand for hydrogen
- Developing and managing bulk hydrogen storage
- Utilizing the natural gas infrastructure for hydrogen transport and storage
- Developing domestic material supplies
- Developing electrolyzer and fuel cell manufacturing capacity
- Leading energy and environmental justice issues for a new industry
- Potentially exporting hydrogen

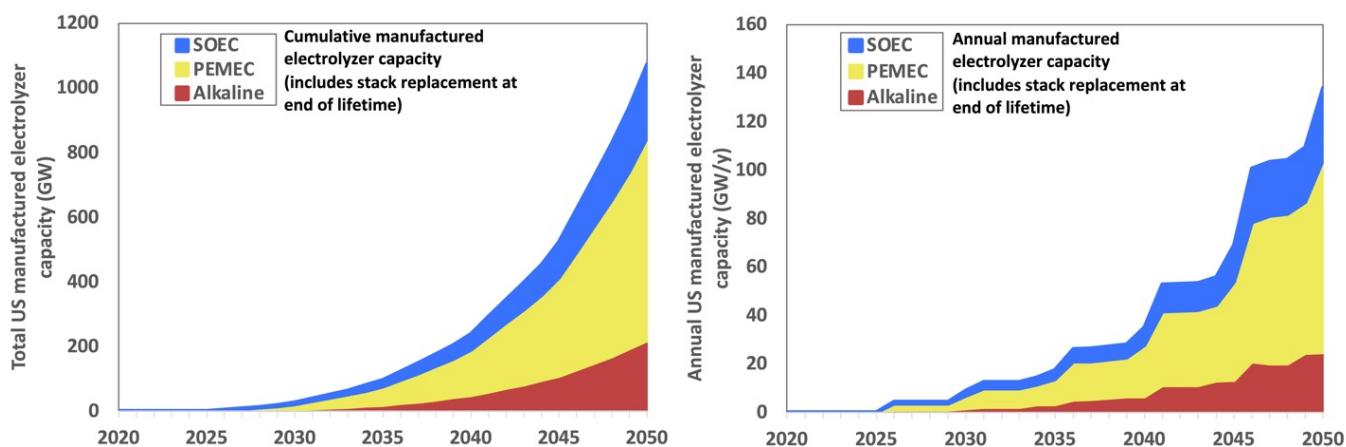


Figure 1: Estimated cumulative and annual U.S. electrolyzer manufacturing capacity

Policy Next Steps

The United States currently has manufacturing capabilities in most of the necessary key processed materials and subcomponent manufacturing for both polymer electrolyte and solid oxide technologies. Likewise, the United States has relatively well-positioned end product manufacturing capabilities for both technologies. However, the extraordinary growth required in the electrolytic hydrogen market will require policies to support those industries to meet cost reduction, growth, decarbonization, and supply chain security objectives. ■

Download the full document and the corresponding other documents that are part of the DOE response to the supply chain executive order at:
www.energy.gov/policy/supplychains