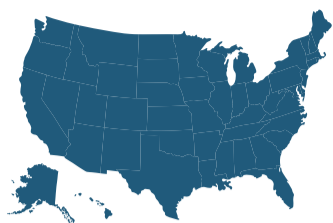




The U.S.' National Clean Hydrogen Strategy and Roadmap

The U.S.' National Clean Hydrogen Strategy and Roadmap 2022-2036



1 Target strategic, high-impact uses of hydrogen

2 Reduce the cost of clean hydrogen

3 Focus on the development of regional hydrogen hubs

Identified high-impact uses of hydrogen:

- Ammonia
- Passenger Cars
- Maritime
- Industrial Heat
- Methanol
- Buses
- Aviation
- Backup, Stationary Power
- Steelmaking
- Trucks
- Rail

Clean Hydrogen Production Targets:

- 10 million tonnes of clean hydrogen per year by 2030
- 20 million tonnes of clean hydrogen per year by 2040
- 50 million tonnes of clean hydrogen per year by 2050
- At least 3 GW electrolyzer manufacturing capacity by 2028

Carbon intensity of clean hydrogen revised to 2 kg CO₂e / kg H₂

2 USD / kg by 2026

1 USD / kg by 2030

Identified regional hydrogen hubs:



Key Targets of the U.S. National Clean Hydrogen Strategy and Roadmap

By 2028:

Hydrogen Production

- 51 kWh/kg efficiency, 80,000-hour life, and 250 USD/kW for low-temperature electrolyzers
- 44 kWh/kg efficiency, 60,000-hour life, and 300 USD/kW for high-temperature electrolyzers
- 20 MW of nuclear heat extraction, distribution, and control for electrolysis

Hydrogen Supply Chain

- 7 kWh/kg efficiency for H₂ liquefaction
- 50% cost reduction of carbon fiber for H₂ storage vessels vs. 2020 baseline
- 50% of membrane/ionomer material and >95% of PGMs recoveries from fuel cell MEA pathways

End-use Enablers

- 3 H₂ fuel cell Super Truck projects completed
- 4 or more Regional Clean Hydrogen Hubs constructed
- 140 USD/kW heavy-duty truck fuel cell cost
- 50% reduction of fuel cell PGMs vs. 2020 baseline

By 2036:

Hydrogen Production

- 46 kWh/kg efficiency, 80,000-hour life, and 100 USD/kW for low-temperature electrolyzers
- 80,000-hour life and 200 USD/kW cost for high-temperature electrolyzers with maintained or improved efficiency

Hydrogen Supply Chain

- 70% of membrane/ionomer material and 99% of PGMs recoveries from MEA pathways
- 3 or more pathways validated for emissions reductions

End-use Enablers

- 80 USD/kW heavy-duty truck fuel cell cost while also meeting durability and performance
- 900 USD/kW and 40,000-hour durability fuel-flexible stationary fuel cells
- 4 or more end-use demos (steel, ammonia, storage) at scale

Aspects of the National Hydrogen Strategy



Enable national net-zero and clean grid goals through strategic deployment of clean hydrogen



Encourage collaboration between government, academia, industry, national laboratories, and other stakeholders



Facilitate the growth of local manufacturing, establish strong and reliable clean hydrogen supply chains, and enhance export opportunities



Promote energy and environmental justice by implementing novel programs, tools, and initiatives that enhance transparency, economic opportunities, engagement, and accessibility to clean hydrogen technologies



Preserve and expand well-compensated, job opportunities within the hydrogen industry