Fuel Cell Stack

Key:
- **Red**: Hydrogen
- **Green**: Proton (+ve)
- **Blue**: Oxygen
- **Yellow**: Electron (-ve)

- **Anode**
  - Hydrogen (H₂) Fuel
  - H₂ Recycling
  - Gas Diffusion Layer
  - Catalyst
  - Proton Exchange Membrane

- **Cathode**
  - Oxygen (O₂) From Air
  - Air and Water Vapour
  - Gas Diffusion Layer
  - Catalyst
Future H₂ at Scale Energy System

Source: US DOE, H₂@Scale

BEF’s Focus Areas
Bank of America:
“We believe that hydrogen is going to take **25%** of all oil demand by 2050”

Goldman Sachs:
The addressable market for green hydrogen is **$10 trillion** by 2050

European Commission:
Promoting **$470 billion** in renewable hydrogen investment by 2050
Hydrogen for Transport

- Grid upgrades
- Business productivity
- Mineral availability
- Vehicle weight
- Fast charging losses
- Weather related losses

- Multifamily residents
- Heavy duty transport
- Heavy/light duty synergies in scaling
- Resilience
- Land use
Electric Vehicles: Fuel Cell and Battery

exoskeletons | endoskeletons | batteries | fuel cells

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Global Momentum
• 1.2GW of wind/solar to green fuels
• Will serve up to 12 methanol fueled ships out of a 700 vessel Maersk fleet
“The Tre will come with 500 or 1,000 brake horsepower, and a range of 500 to 1,200 kilometers. [Nikola] plans to have more than 700 hydrogen stations across the U.S. and Canada by 2028.”
PNW Developments
Renewable Hydrogen Action Plan

• 30+ stakeholders from diverse sectors
• Identifying priorities for early renewable hydrogen policies and development
• Final plan [released](#)
1st Renewable Hydrogen Fueling Station in the Pacific Northwest!

- Thanks to $1.9m grant from the Centralia Coal Transition Grants Board
- Additional $4m allocated from the State
- Toyota will donate 10 fuel cell electric Mirai to be loaned out for demonstration purposes
- Entirely fueled by renewable hydrogen produced by Douglas PUD
EWEB/NW Natural Hydrogen Pipeline Demonstration

- Early collaboration to gain experience in hydrogen pipeline injection
- Pipelines are efficient at moving large amounts of energy
- Duel fuel energy systems are more resilient
- Pipeline injection is a great application to grow renewable hydrogen demand
• Pacific Northwest Hydrogen Association – public/private partnership created by WA Department of Commerce to pursue DOE funding for a regional Hydrogen Hub
• WA legislature also created a new Office of Renewable Fuels and passed several hydrogen related incentives in SB 5910, nearly unanimous
• Accepting applications for the Advisory Committee

https://pnwh2.com/
Project Announcements

• Greentech Media, green hydrogen pipeline at 8.2GW or over 30x growth

• Australia, 5GW of renewable hydrogen for export

• Germany, 5GW of green hydrogen by 2030

• Los Angeles Department of Water and Power, $1B hydrogen energy storage facility

• Shell, NortH2, 10GW of offshore wind to hydrogen by 2040
Resources

- Renewable Hydrogen Alliance: https://renewableh2.org/resources/
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