U.S. DEPARTMENT OF ENERGY

Office of ENERGY EFFICIENCY & RENEWABLE ENERGY

U.S. Department of Energy Hydrogen and Fuel Cell Technologies Office and Global Perspectives

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Japan FC Expo – March 4, 2021

President's Plan for a Clean Energy Economy: 9 Key Elements

1. **Take executive action** on Day 1
2. Enact an irreversible path to **economy-wide net-zero emissions by 2050**
3. **Act and lead globally**
4. **Public investment in clean energy** and innovation
5. **Accelerate the deployment of clean technology** throughout our economy
6. **Make environmental justice a priority** for all federal agencies
7. **Require public companies to disclose climate risks** and GHG emissions
8. **Create millions of good-paying jobs** with the choice to join a union
9. **Fulfill our obligation to communities** and workers that have risked their lives to produce fossil fuels

100% carbon-pollution-free electric sector by 2035

from Executive Order on
Tackling the Climate Crisis signed Jan 27, 2021

whitehouse.gov/briefing-room/presidential-actions/2021/01/27/executive-order-on-tackling-the-climate-crisis-at-home-and-abroad/

Global Perspectives

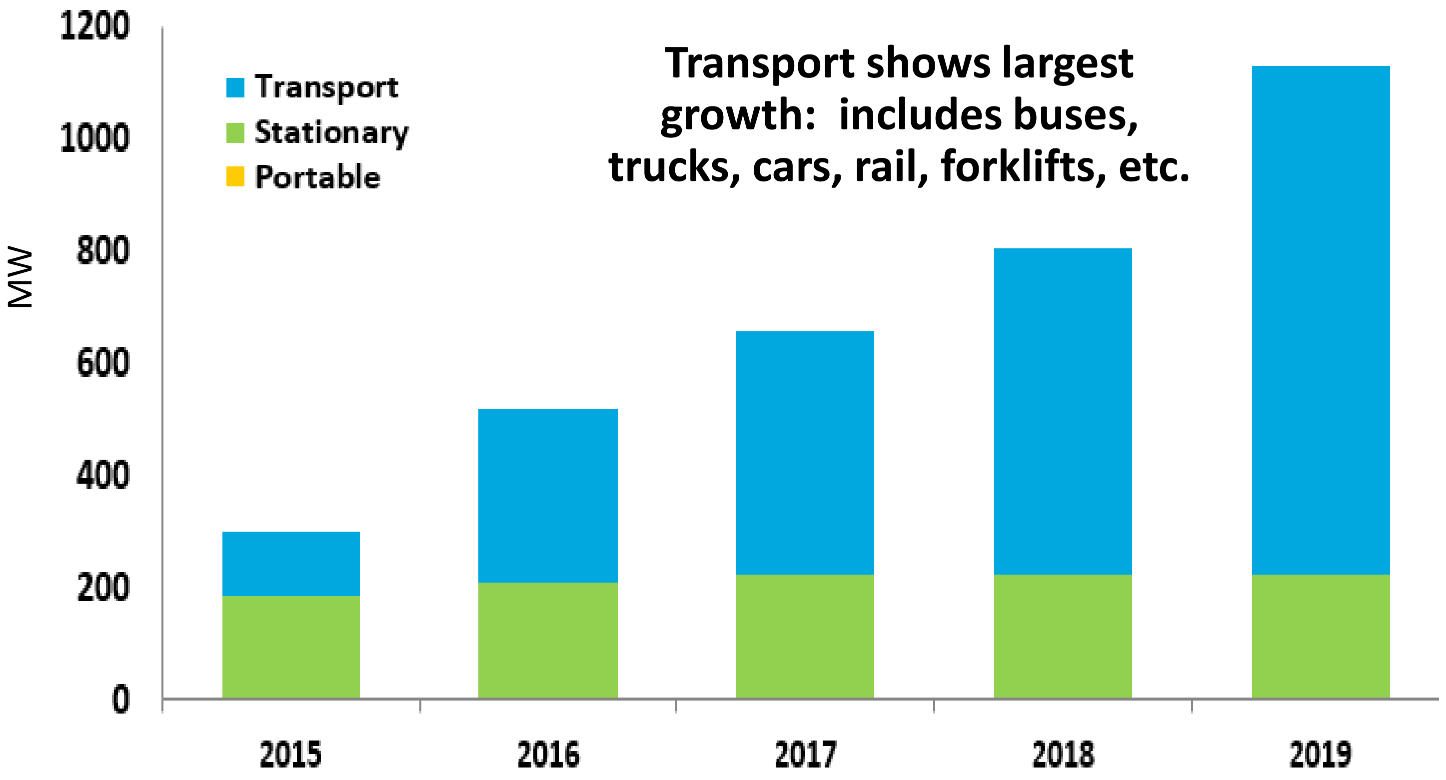
Commercial Hydrogen and Fuel Cell Technologies Now Available across Sectors

> 1/3 Million Stationary Fuel Cells, > 25,000 Fuel Cell Vehicles, 470 Stations Worldwide, Trains, Trucks, Buses and Various End Uses

>1 GW Fuel Cells Shipped in 2019

Hydrogen and Fuel Cell Technology Growth Worldwide

Global fuel cell shipments surpass 1 GW



Source: E4tech for DOE analysis project

25-fold increase in electrolyzers deployed in the last decade

Announcements made for GW scale

Global FCEVs doubled to >25,200

>12.3K sold in 2019 vs. 5.8K in 2018

470 H_2 fueling stations worldwide

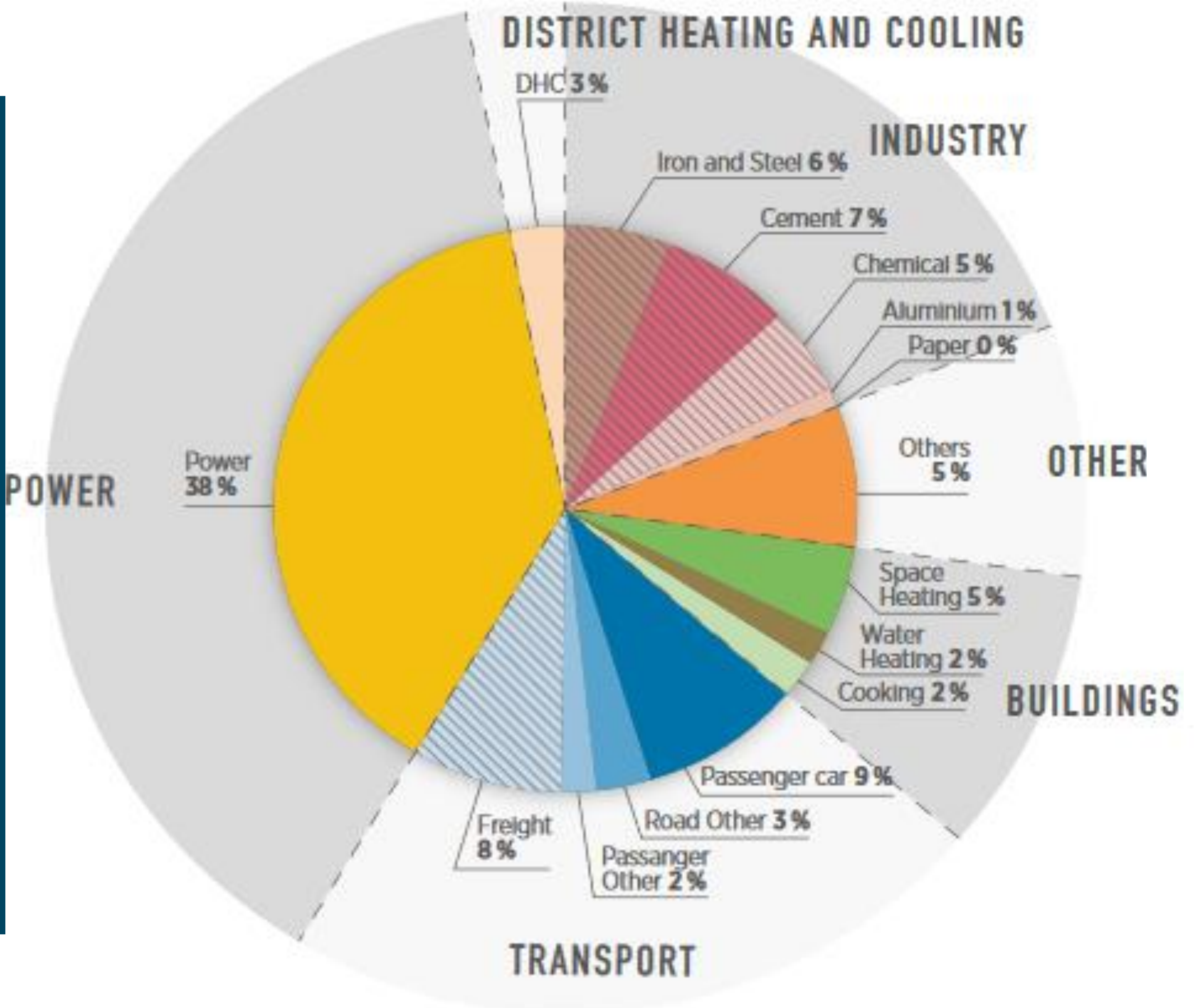
> 20% increase in 2019 vs. 2018

Source: IEA (2020), *Hydrogen*, IEA, Paris, https://www.iea.org/reports/hydrogen

Global Drivers and Energy Related Carbon Emissions by Sector

Drivers include:

- Emissions reduction
- Energy security
- Economic growth
- Resiliency
- Energy storage
- Energy efficiency
- Innovation potential
- Environmental benefits



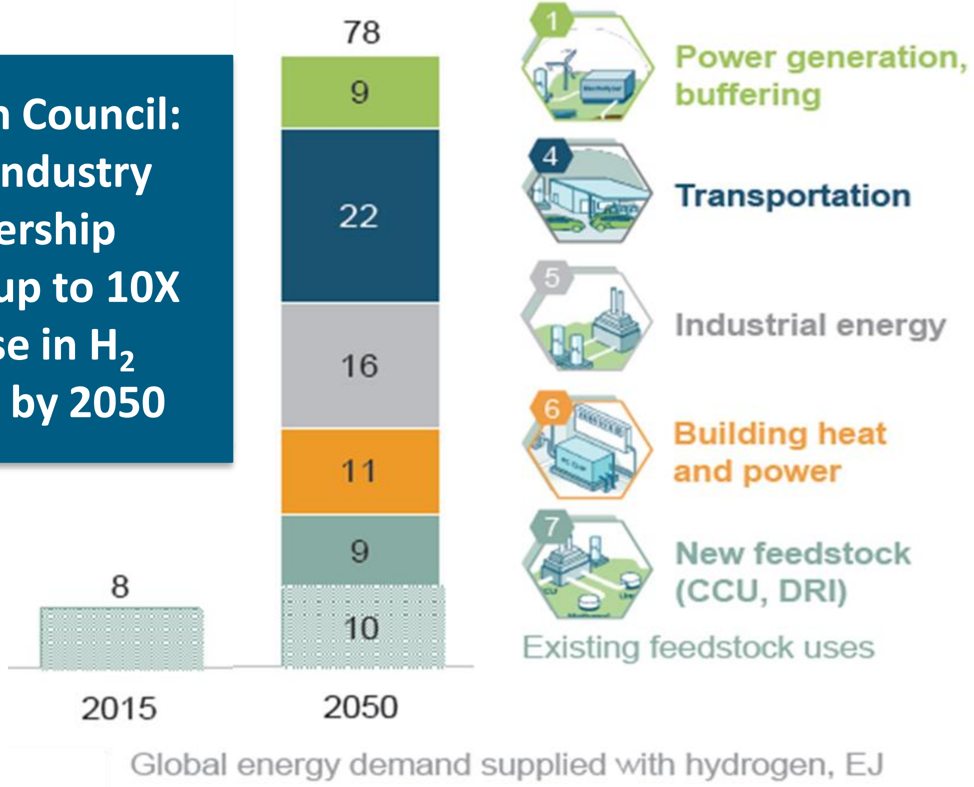
Sectors today with no economically scalable option for deep emission reductions

Source: IRENA, 2017a from: https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2018/Sep/IRENA_Hydrogen_from_renewable_power_2018.pdf

Roadmaps and Plans Developing Worldwide

H2 Ministerial Global Action Agenda Goals:
“10, 10, 10”
10M systems, 10K stations, 10 years

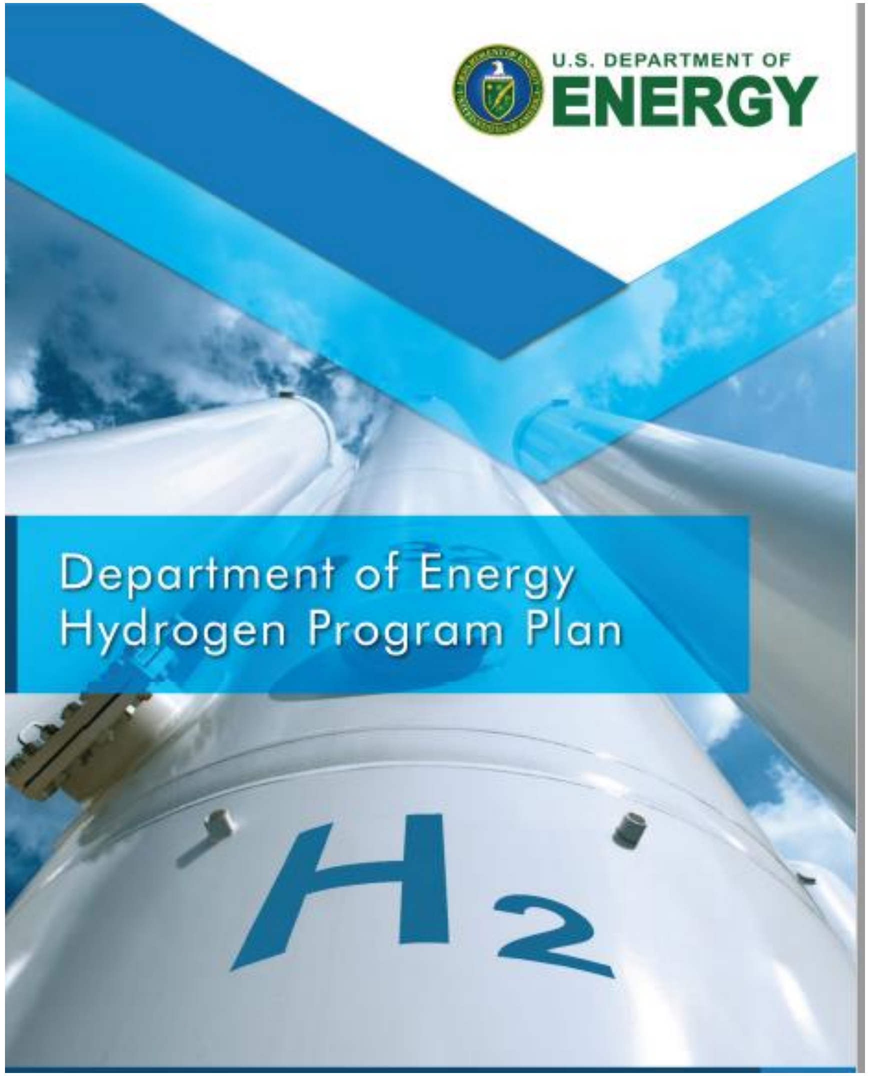
Hydrogen Council: Global industry partnership projects up to 10X increase in H_2 demand by 2050



Industry Example H2 Council Global Impact Potential by 2050

U.S. Department of Energy Hydrogen Program

US DOE Integrated Hydrogen Program



Released November 2020 - www.hydrogen.energy.gov

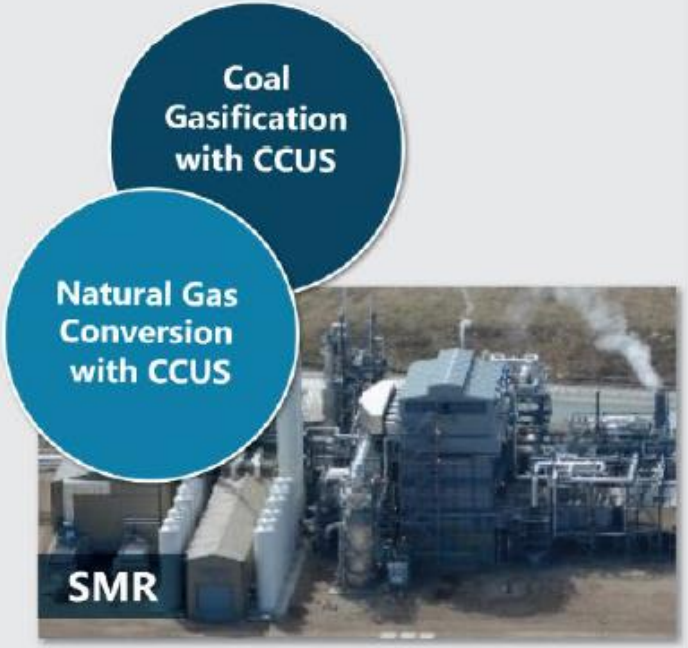
Vision

The Program's vision is a prosperous future for the nation, in which clean hydrogen energy technologies are affordable, widely available and reliable, and are an integral part of multiple sectors of the economy across the country.

Portfolio includes hydrogen production from diverse sources and pathways

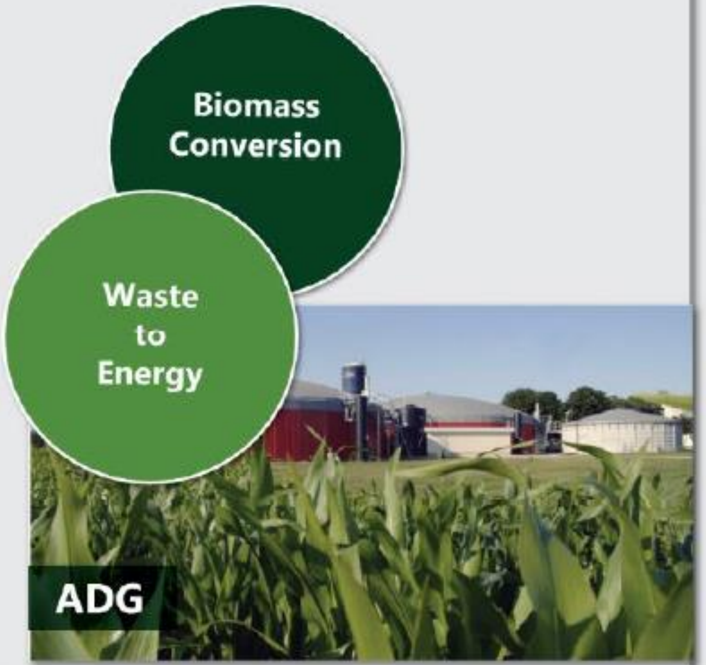
FOSSIL RESOURCES

- Low-cost, large-scale hydrogen production with CCUS
- New options include byproduct production, such as solid carbon



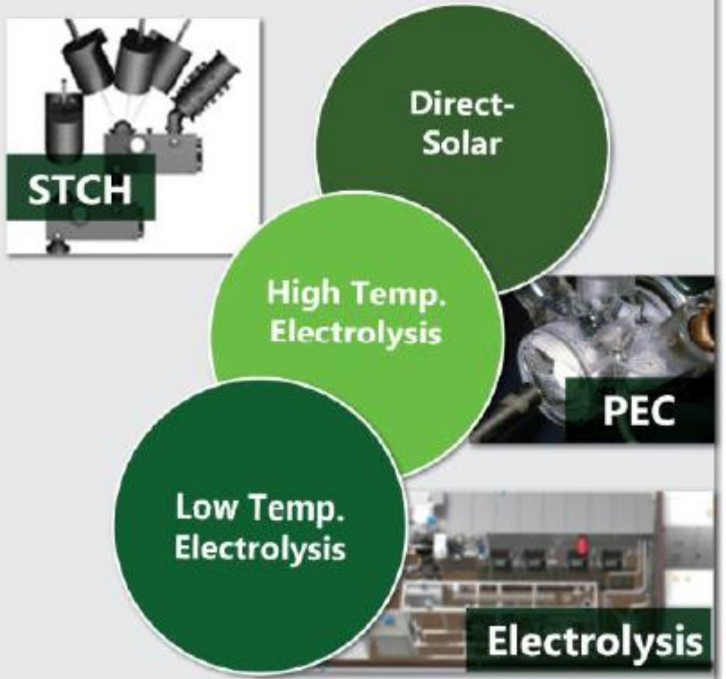
BIOMASS/WASTE

- Options include biogas reforming and fermentation of waste streams
- Byproduct benefits include clean water, electricity, and chemicals



H_2O SPLITTING

- Electrolyzers can be grid-tied, or directly coupled with renewables
- New direct water-splitting technologies offer longer-term options



Low-cost hydrogen production from diverse domestic feedstocks & energy resources—enhancing long-term resiliency & opening regional market opportunities

Hydrogen Program Objectives

Examples of Key DOE Hydrogen Program Targets

DOE targets are application-specific and developed with stakeholder input to enable competitiveness with incumbent and emerging technologies. These targets guide the R&D community and inform the Program's portfolio of activities. Examples include:

- $2/kg for hydrogen production and $2/kg for delivery and dispensing for transportation applications
- $1/kg hydrogen for industrial and stationary power generation applications
- Fuel cell system cost of $80/kW with 25,000-hour durability for long-haul heavy-duty trucks
- On-board vehicular hydrogen storage at $8/kWh, 2.2 kWh/kg, and 1.7kWh/l
- Electrolyzer capital cost of $300/kW, 80,000 hour durability, and 65% system efficiency
- Fuel cell system cost of $900/kW and 40,000 hour durability for fuel-flexible stationary high-temperature fuel cells

The Program works in partnership with stakeholders to:

- **Overcome technical barriers** through basic and applied research and development
- **Integrate, demonstrate, and validate** "first-of-a-kind" hydrogen and related technologies
- **Accelerate the transition of innovations** and technologies to the private sector
- **Address institutional issues** including safety concerns, education and workforce development, and the development of codes and standards
- **Identify, implement, and refine appropriate strategies** for federal programs to catalyze a sustainable market and concomitant benefits to the economy, the environment, and energy security

Key Hydrogen Technology Options

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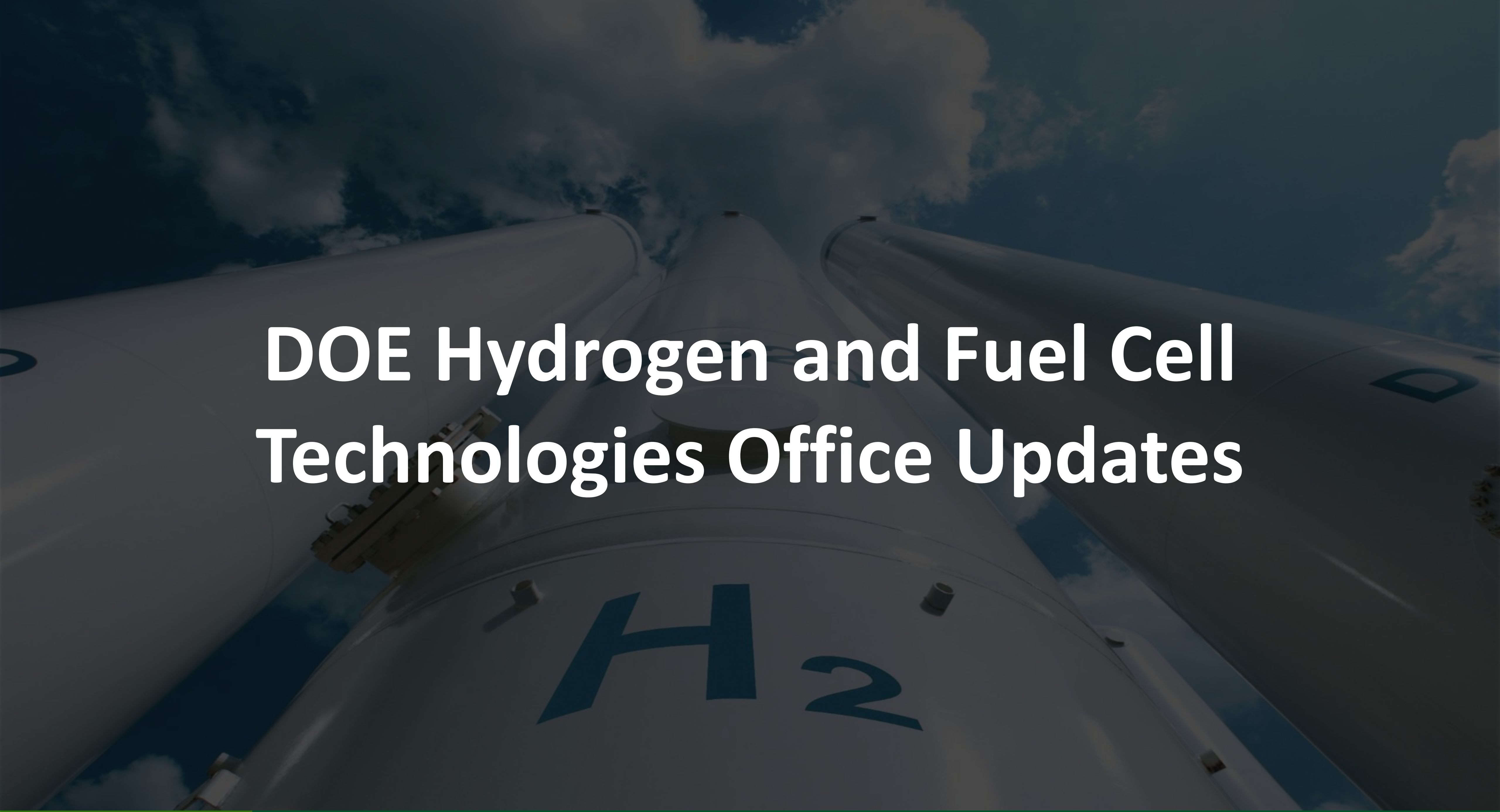
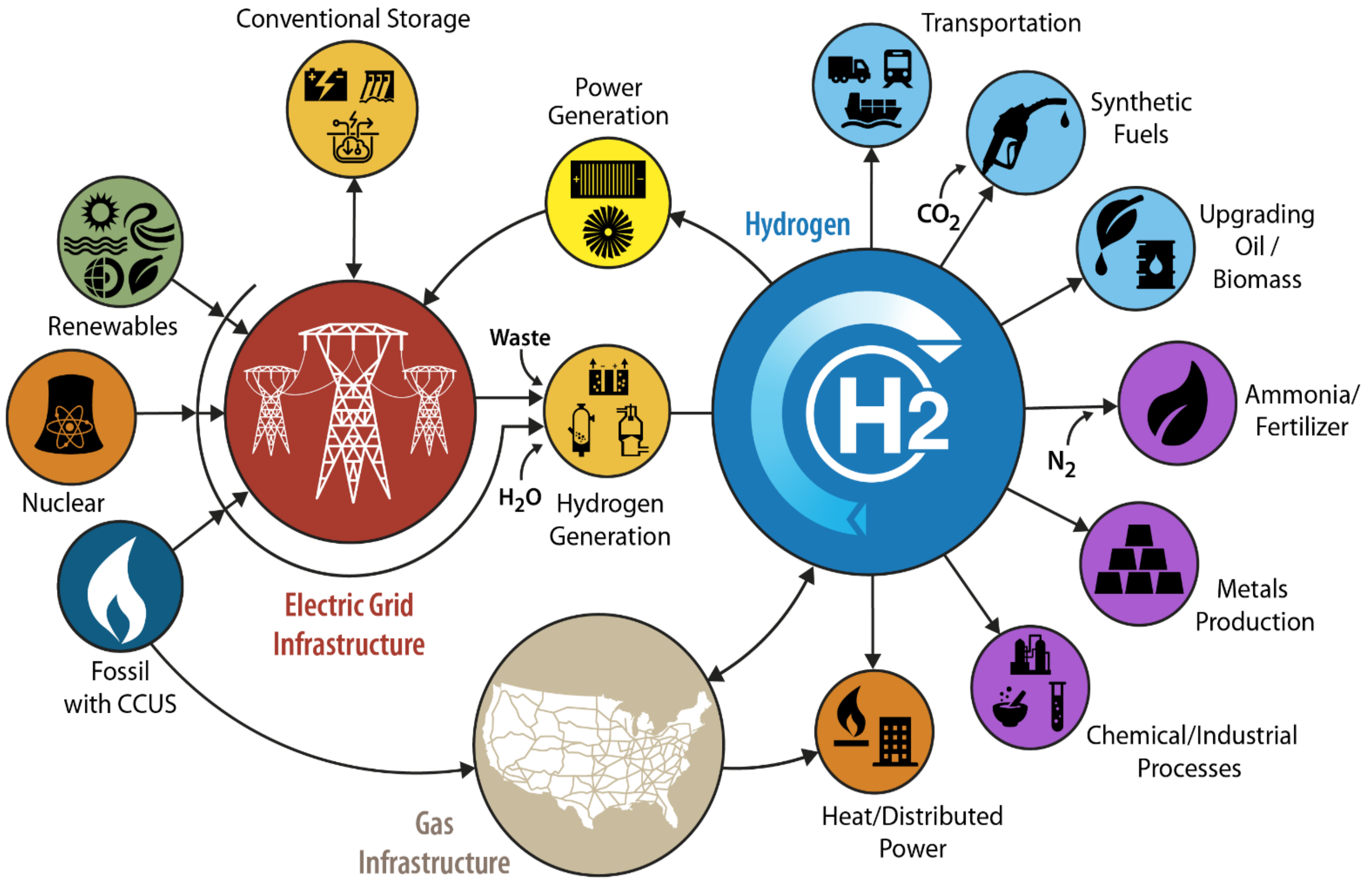
	NEAR-TERM		LONGER-TERM
Production	Gasification of coal, biomass, and waste with carbon capture, utilization, and storage Advanced fossil and biomass reforming/conversion Electrolysis (low-temperature, high-temperature)	Advanced biological/microbial conversion	Advanced thermo/photoelectro-chemical H_2O splitting
Delivery	Distribution from on-site production Tube trailers (gaseous H_2) Cryogenic trucks (liquid H_2)	Chemical H_2 carriers	Widespread pipeline transmission and distribution
Storage	Pressurized tanks (gaseous H_2) Cryogenic vessels (liquid H_2)	Geologic H_2 storage (e.g., caverns, depleted oil/gas reservoirs) Cryo-compressed Chemical H_2 carriers	Materials-based H_2 storage
Conversion	Turbine combustion Fuel cells	Advanced combustion Next generation fuel cells	Fuel cell/combustion hybrids Reversible fuel cells
Applications	Fuel refining Space applications Portable power	Blending in natural gas pipelines Distributed stationary power Transportation Distributed CHP Industrial and chemical processes Defense, security, and logistics applications	Utility systems Integrated energy systems



DOE Hydrogen and Fuel Cell Technologies Office Updates

Hydrogen is one part of a Comprehensive Energy Portfolio

H2@Scale: Enabling affordable, reliable, clean, and secure energy across sectors



- Hydrogen can address specific applications across sectors that are hard to decarbonize
- Today: 10MMT H_2 in the U.S.
- Economic Potential: 2 to 4x more

Strategies

- Scale up technologies in key sectors
- Continue R&D to reduce cost and improve performance, reliability
- Address enablers: harmonization of codes, standards, safety, global supply chain, workforce development, sustainable markets

Source: U.S. DOE Hydrogen and Fuel Cell Technologies Office, https://www.energy.gov/eere/fuelcells/h2scale

Snapshot of Hydrogen and Fuel Cell Applications in the U.S.

Examples of Applications

>500MW
Backup Power

>35,000
Forklifts

>14 MW
PEM* Electrolyzers

>60
Fuel Cell Buses

>45
H_2 Retail Stations

>9,000
Fuel Cell Cars

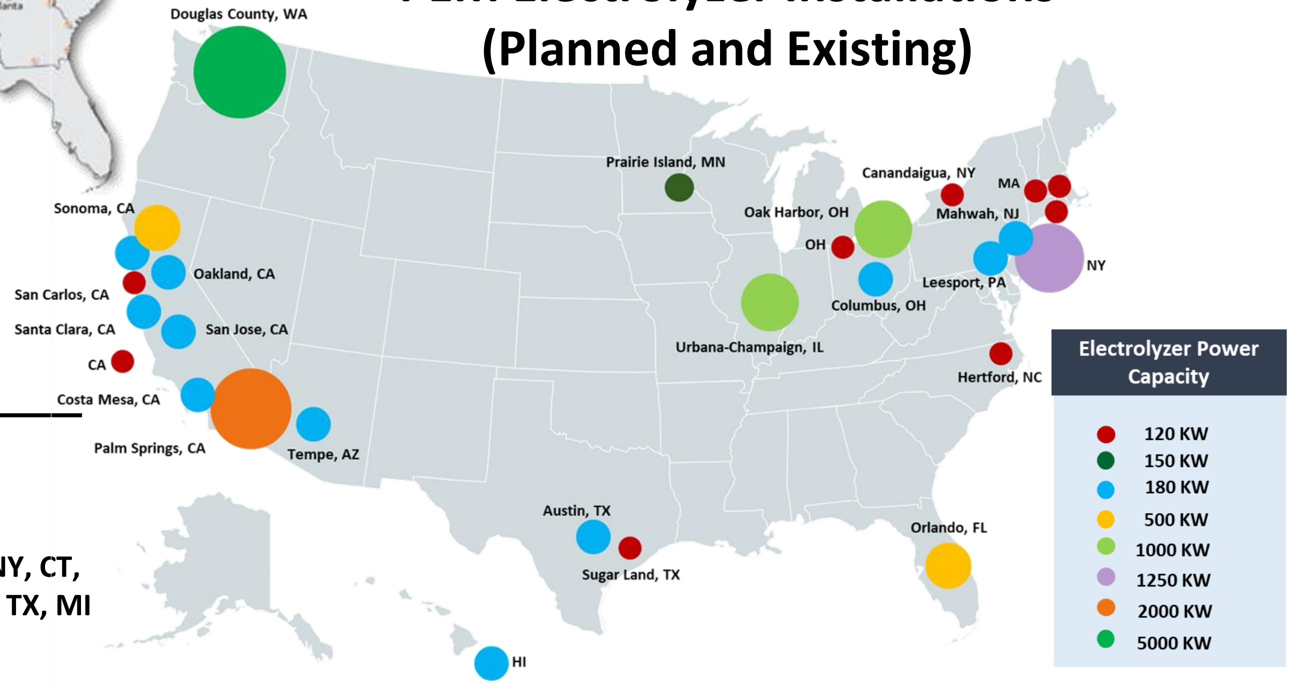
Hydrogen Produced

- 10 million metric tons produced annually
- More than 1,600 miles of H_2 pipeline
- World's largest H_2 storage cavern

Hydrogen Stations Plans Across States

California	Northeast	
200 Stations Planned CAFCP Goal	12 – 20 Stations Planned	**HI, OH, SC, NY, CT, MA, CO, UT, TX, MI** And Others

PEM Electrolyzer Installations (Planned and Existing)



* Polymer electrolyte membrane

Fuel Cell Forklifts for Material Handling Applications

More than **35,000 forklifts**

Over **20 million refuelings**

Heavy Duty Applications Emerging

Several companies developing long haul Class 8 fuel cell trucks

Fuel cell buses in CA surpass 20M passengers

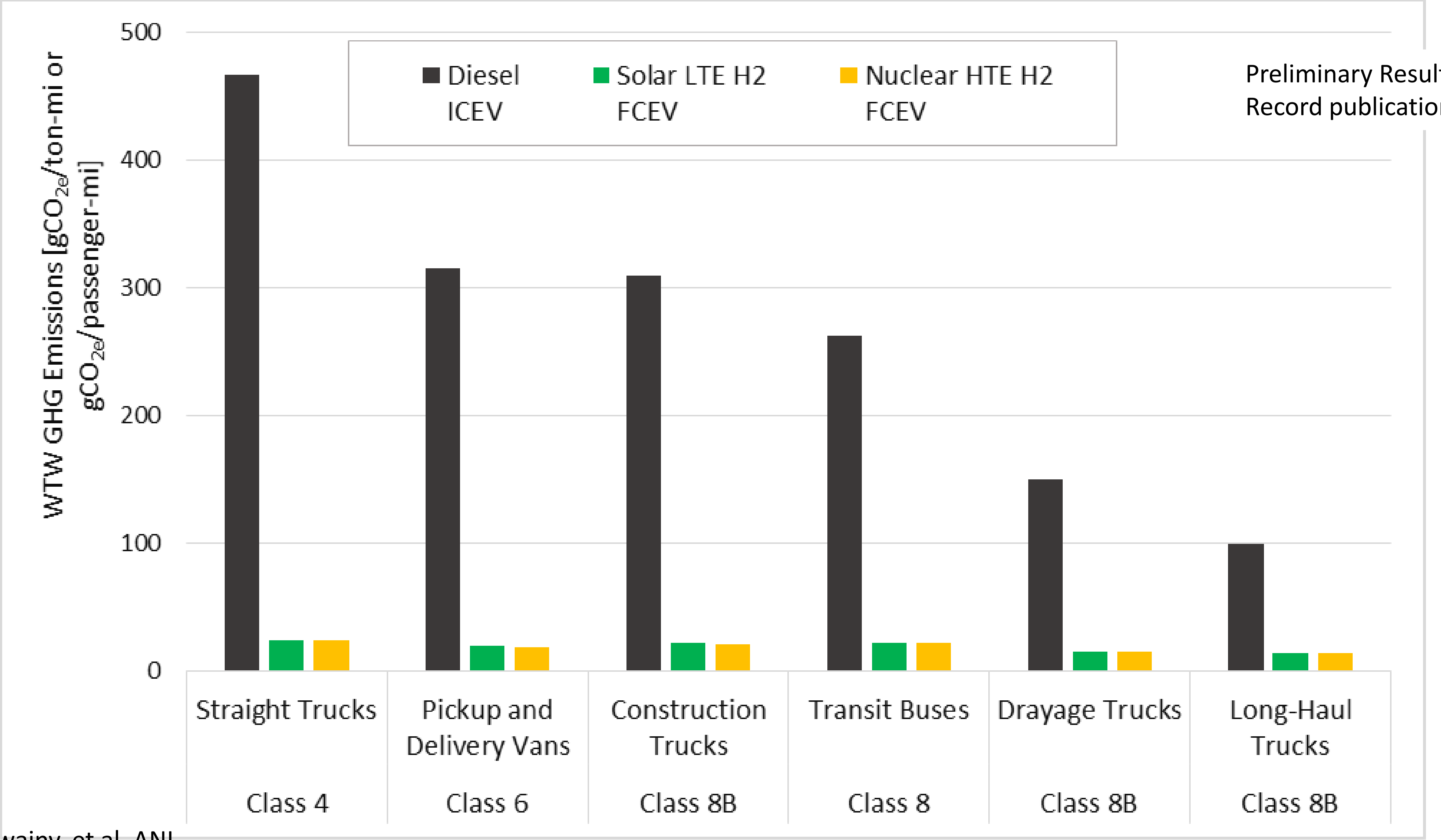
High-speed fuel cell ferry under development in the US

Fuel cell parcel truck demonstration projects by DOE + industry

Fuel cell delivery truck projects by DOE + industry

Fuel cell commuter rail in Europe, and Asia- first planned in the US

Benefits and Impacts Analyses Underway – Example



Preliminary Results
Record publication underway

Source: A. Elgowainy, et al, ANL

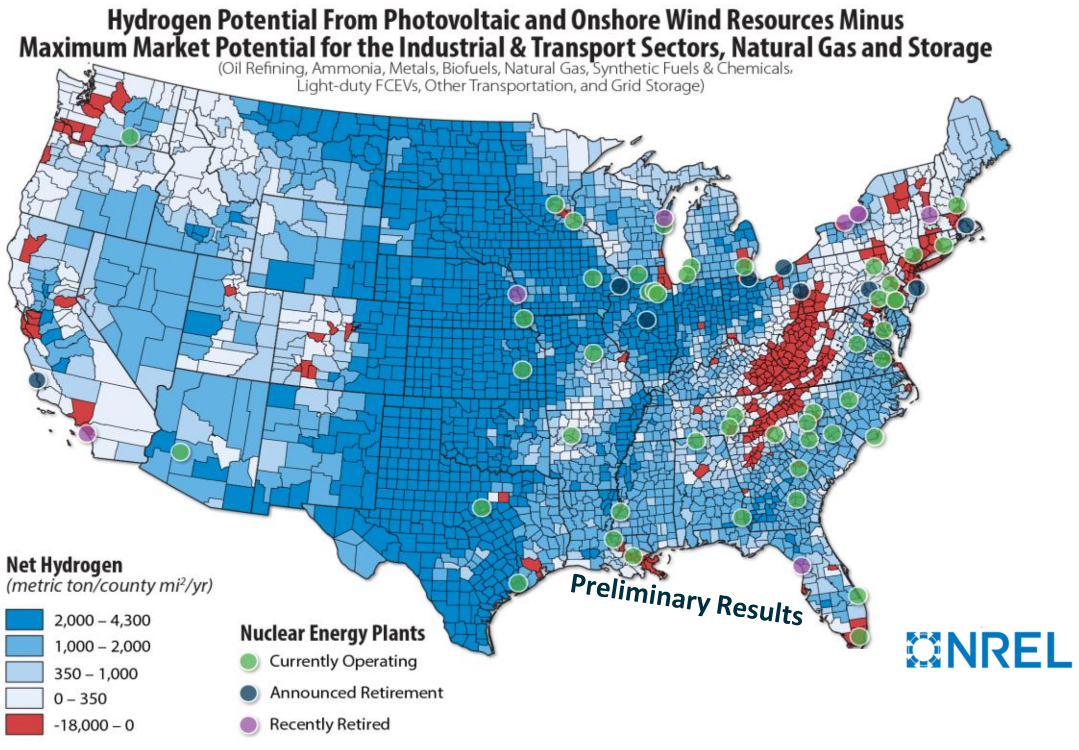
Examples of H2@Scale Analysis and Demonstration Projects

Assessing resource availability.
Most regions have sufficient resources.

New H2@Scale demonstration projects cover range of applications

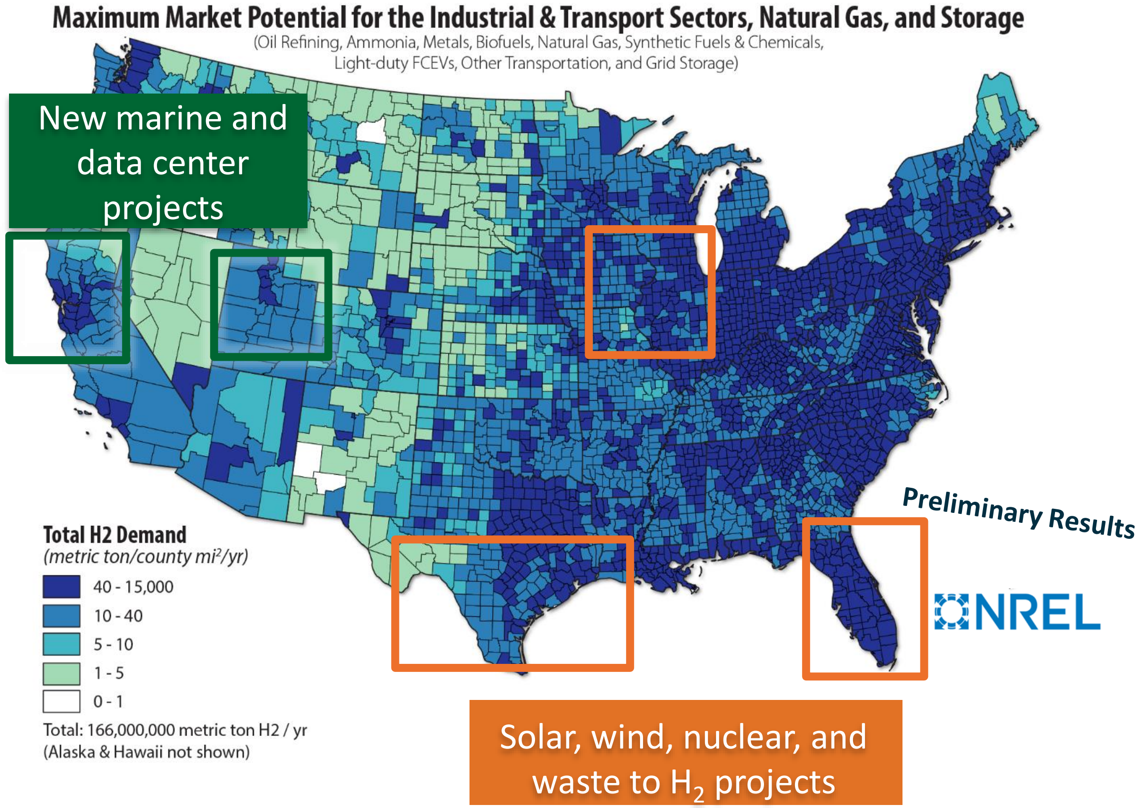
*Includes 1 project by Office of Nuclear Energy

Hydrogen Availability



Red: Only regions where projected industrial & transportation demand exceeds supply.

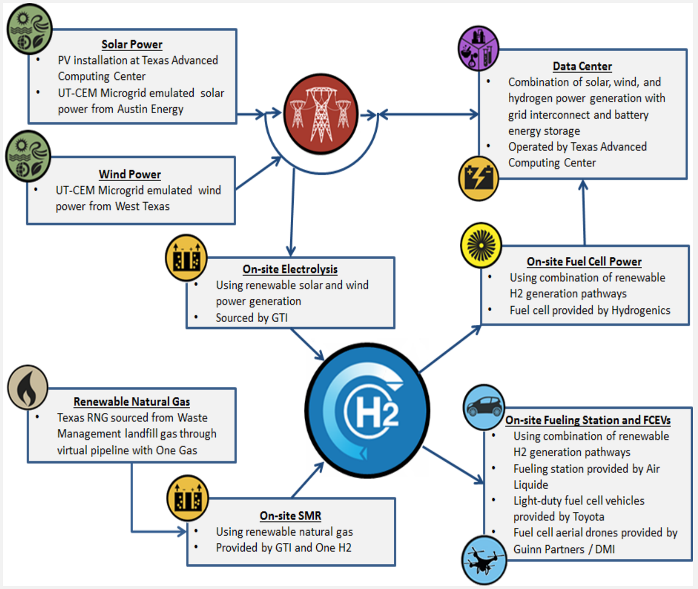
Hydrogen Demand Potential

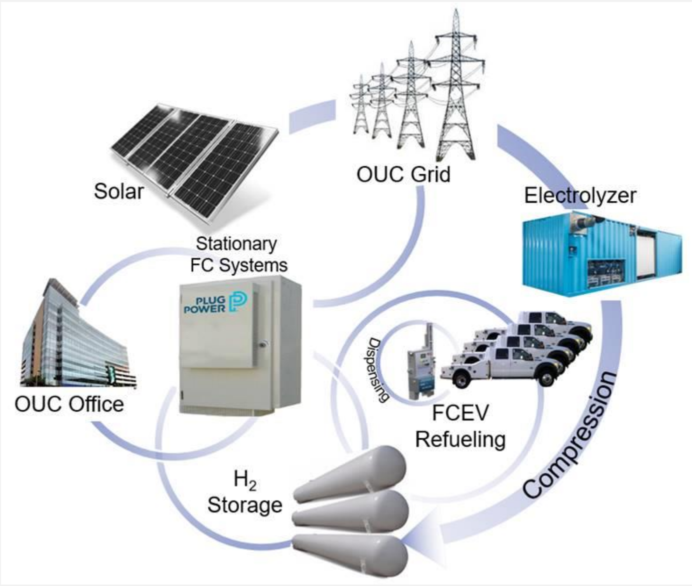


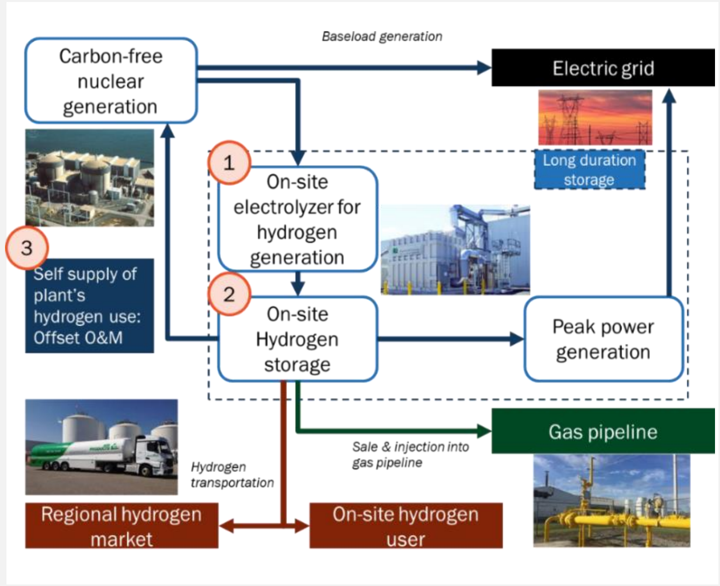
Example of H2@Scale Demonstration Projects

Demonstration of H2@Scale: Different regions, hydrogen sources and end uses

Texas		Florida		Site selection in process	
Total Budget $10.8M	Wind, Solar, RNG/Waste	Total budget $9.1M	Solar-to-H_2 with End Uses	Total Budget $7.2M	Nuclear-to-H_2 for at-Plant Use







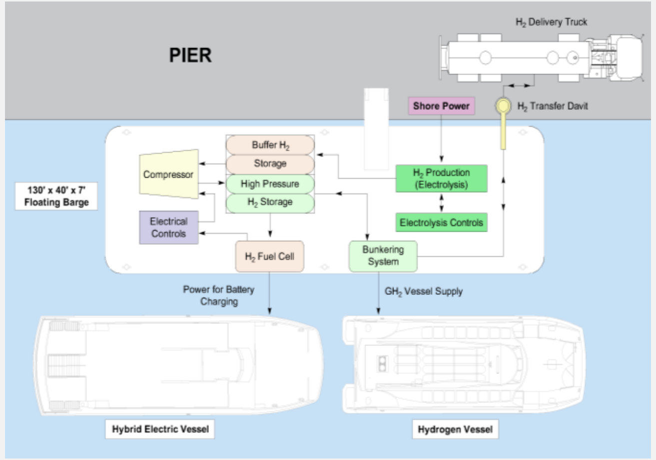
Examples of H2@Scale Demonstration Projects -2020

Demonstration of H2@Scale: Different regions, hydrogen sources and end uses

Marine Application

Total Budget $16M

Electrolyzer and fuel cell for marine application

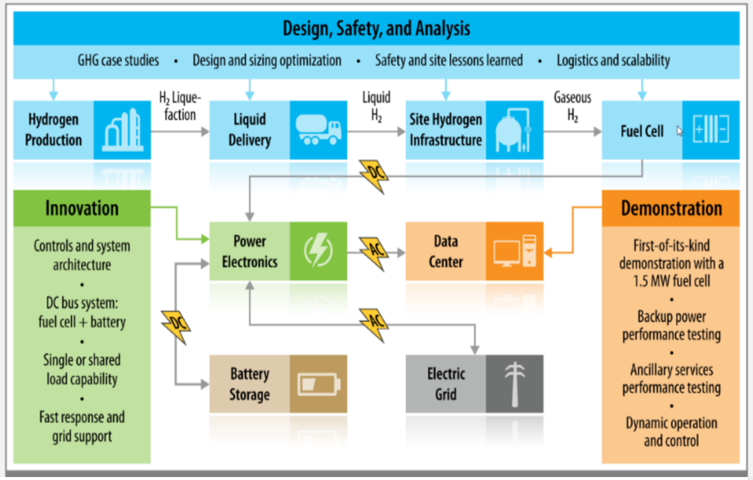


1st-of-its-kind maritime H_2 refueling on floating barge - up to 530 kg H_2 /day

H_2 for Data Center

Total Budget $13.7M

PEM fuel cell for data center power

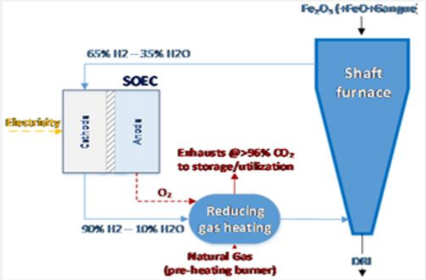


1.5MW fuel cell to meet data center requirements and future scale up

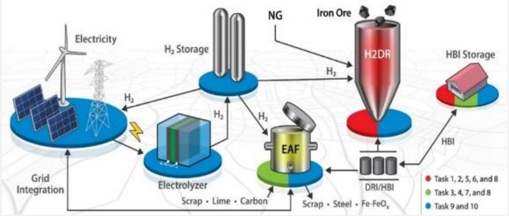
H_2 for Steel Production

Total Budgets $5.7M & $7.2M

DRI-process and grid-interactive steelmaking



Reduction of 30% in energy and 40% emissions vs conventional DRI processes



1 ton/wk iron prod.; scaled to 5,000 ton/day

First Carbon-Free, “Power-to-Gas” System in U.S.

Flagship Power-to-gas Project

Funded By DOE EERE In Partnership With Southern California Gas Company (SoCalGas)

- Approx. $2.5 million funded through EERE’s Solar, Hydrogen and Fuel Cells, and Bioenergy Offices along with cost share by SoCalGas
- Process uses a low-temperature water electrolyzer to produce hydrogen from **renewable power**, then feeds the hydrogen and carbon dioxide into a bioreactor where methanogens produce methane and water
- With minor filtration, the product gas from the bioreactor will meet pipeline quality, allowing it to be injected into the **existing natural gas infrastructure**

Located at NREL, Golden, CO

- **Utilizes H_2+ CO_2 to generate pipeline quality natural gas** (> 97% CH_4)
- **Biocatalyst used in the process** - Methanothermobacter thermautotrophicus

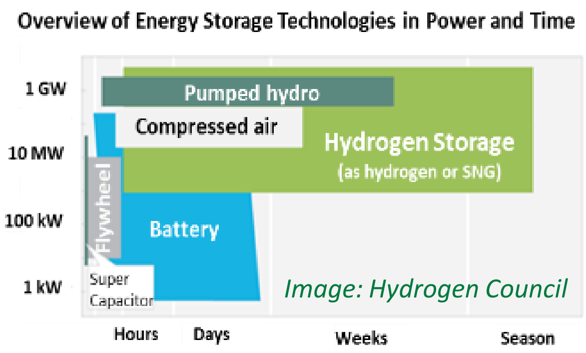
Biomethanation Process:

$$CO_2 + 4H_2 \rightarrow CH_4 + 2H_2O$$

- **Industry and lab partners:** Southern California Gas Company, NREL and Electrochaea

Press Release
https://www.nrel.gov/esif/partnerships-southern-california-gas.html

Increased Activities on Integrated/Hybrid Systems and Energy Storage

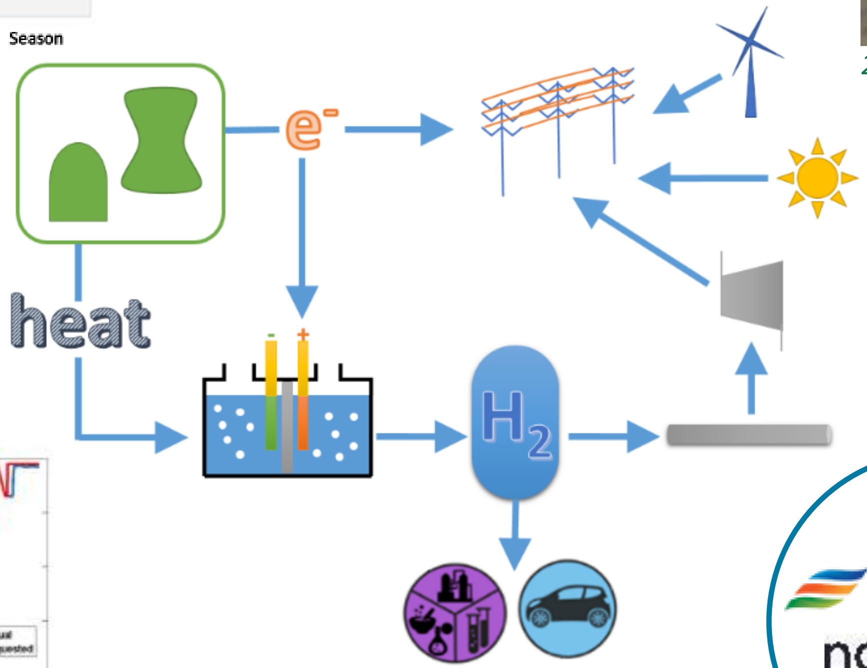


H_2 energy storage

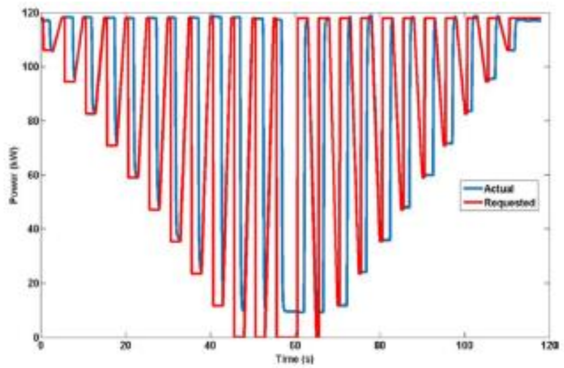
Increased opportunities for nuclear and hydrogen

25 kW high-temperature electrolysis @ INL Energy Systems Laboratory

Thermal Integration



Dynamic response



Dynamic electrolyzer response – INL & NREL

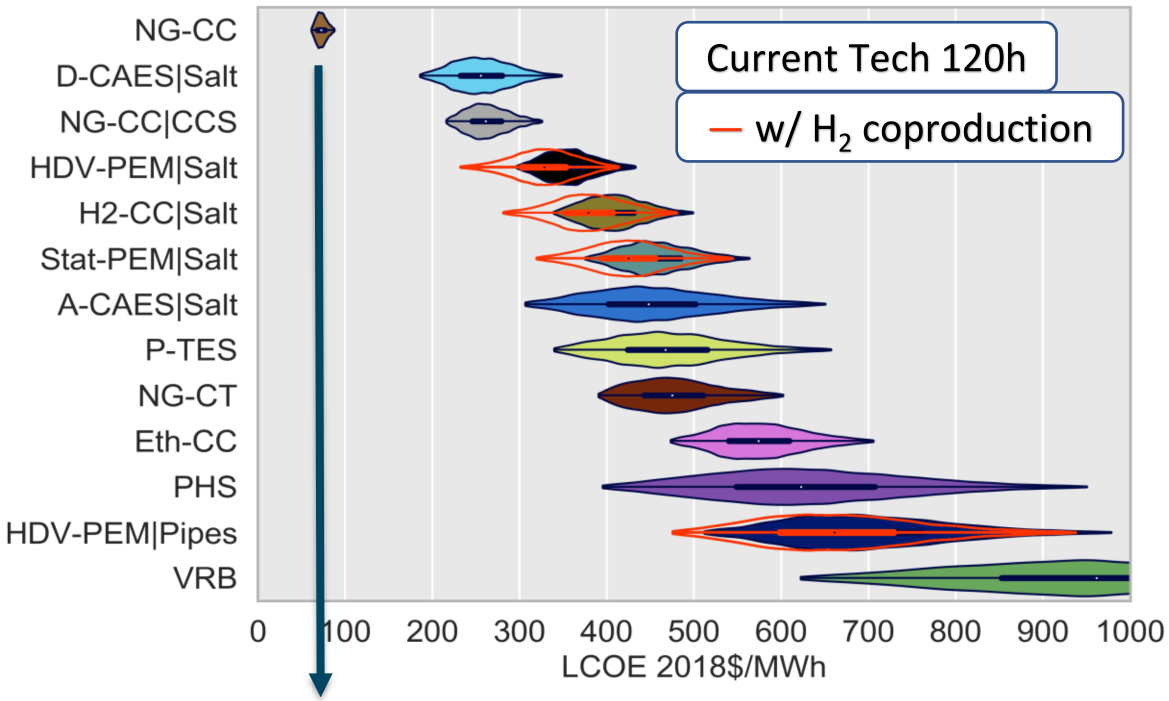
DOE Industry demos

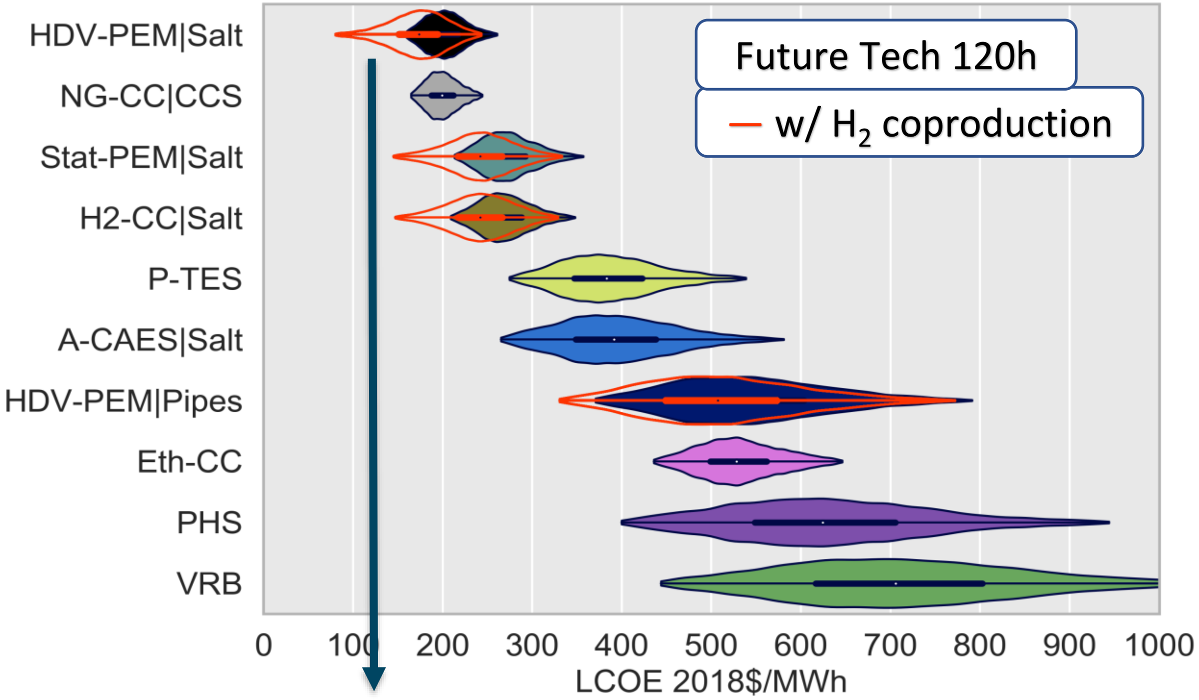
Recently announced demonstrations

Multiple end use applications

Long Duration Energy Storage and Flexible Power Generation Analysis

NREL's Techno-Economic Analysis of Long Duration Energy Storage- Preliminary Results across Technologies





Natural gas combined cycle (NG-CC) is the lowest cost option today
Wide Range of Costs for Various Technologies $200 to >$1,000/MWh

Future Scenario: Shows PEM fuel cells (for Heavy Duty Vehicle market), salt caverns + co-production of H_2 may be most economically competitive for 120 h storage

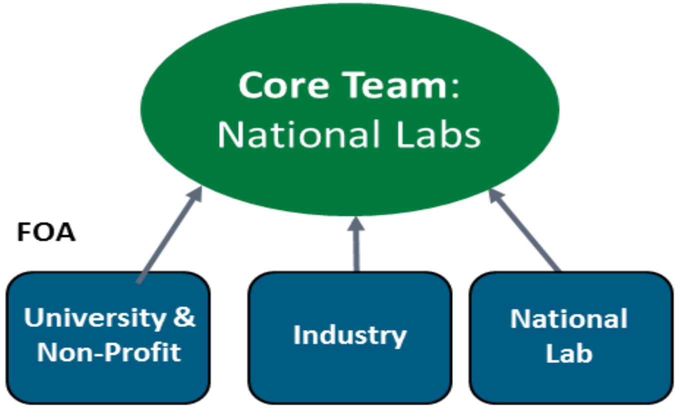
Source: Hunter, et. al., 2020, NREL- publication in process

Cost Reduction Efforts Underway

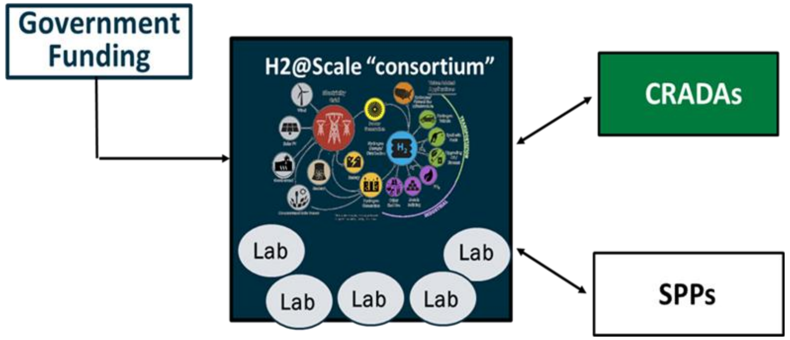
Key Programmatic Areas

<u>Includes early stage R&D</u>: Funding Opportunity Announcements (FOAs) for industry, universities and national labs, including consortia

<u>And includes later stage RD&D</u>: Leverages private sector for large-scale demonstrations and cost-shared RD&D. Demos in TX, FL, Midwest, CA and more



2 New Lab Consortia Just Announced: H2NEW and Million Mile Fuel Cell Truck Consortium



HydroGEN Advanced Water Splitting Materials

ElectroCat Electrocatalysis Consortium

HyMARC Hydrogen Materials Advanced Research Consortium

H-Mat™ Hydrogen Materials Compatibility Consortium

CRADA = Cooperative Research and Development Agreement
SPP- Strategic Partnership Project ('Work for Others')

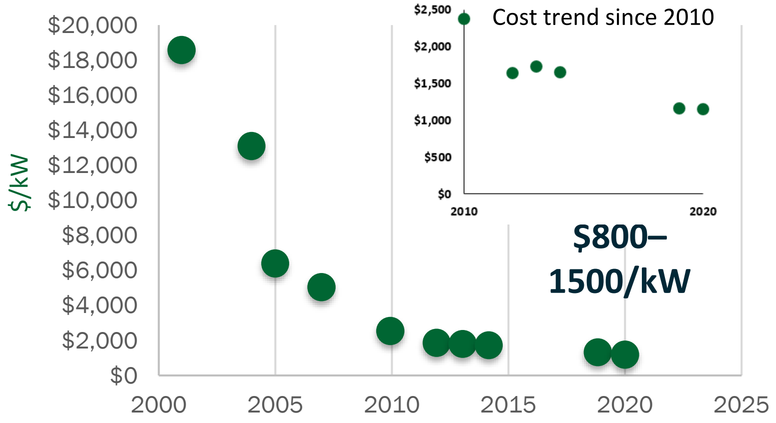
Over 25 CRADA projects with private sector

Recent round of H2@Scale projects announced (July 2020):
$64M for 18 projects including R&D and demonstrations at ports and datacenters, and a workforce development program . Includes collaboration with Advanced Manufacturing Office and Vehicles Office in EERE

DOE funded progress in cost reduction and what more is needed

Hydrogen Production
(PEM electrolyzer- low volume)

Cut cost by 90% since 2005

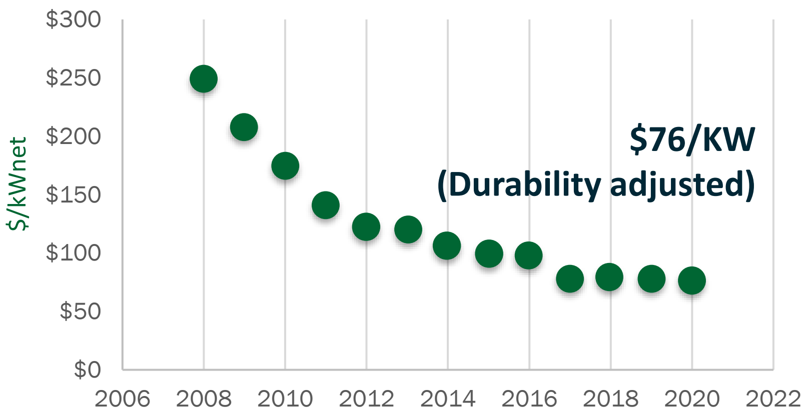


Note: 2010 to 2018-zero/limited HFTO funding on electrolysis
PEM: Polymer Electrolyte Membrane

Need 3 to 5X cost reduction to $250-$300/kW

Fuel Cells
(Automotive PEM fuel cell system- 100K/yr)

Cut cost by 70% since 2008

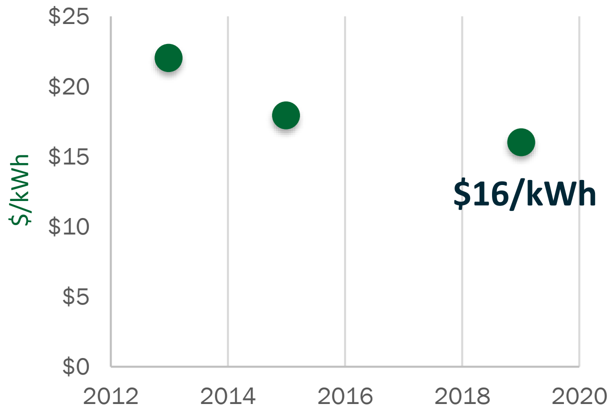


Note: At 100k systems/year

Need >2X cost reduction to $80/kW for HD Trucks

Hydrogen Storage
(Carbon fiber 700 bar tanks- 100K/yr)

Cut cost by 30% since 2013

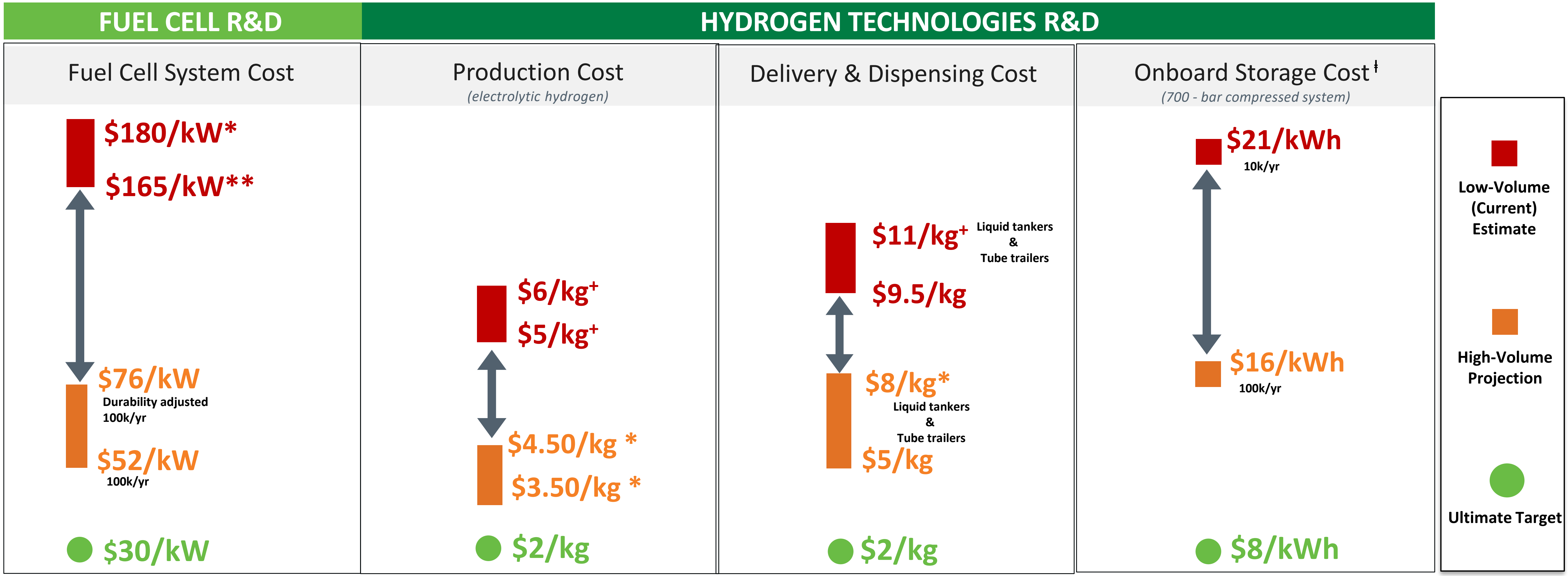


Note: At 100k units/year

Need ≥ 2X cost reduction to $8/kWh

R&D focus is on Affordability and Performance: DOE Targets Guide R&D

Key Goals: Reduce the cost of fuel cells and hydrogen production, delivery, storage, and meet performance and durability requirements – guided by applications specific targets



*Based on state of the art technology

** Based on commercially available fuel cell cars at 3,000 systems/year

ǂ 5 to 7 cents/kWh, 90% capacity factor at $1500/kW

*5 to 7 cents/kWh, 90% capacity factor at $460/kW

[+]For range: Delivery and dispensing at today's (2020) stations with capacity ~450 kg/day

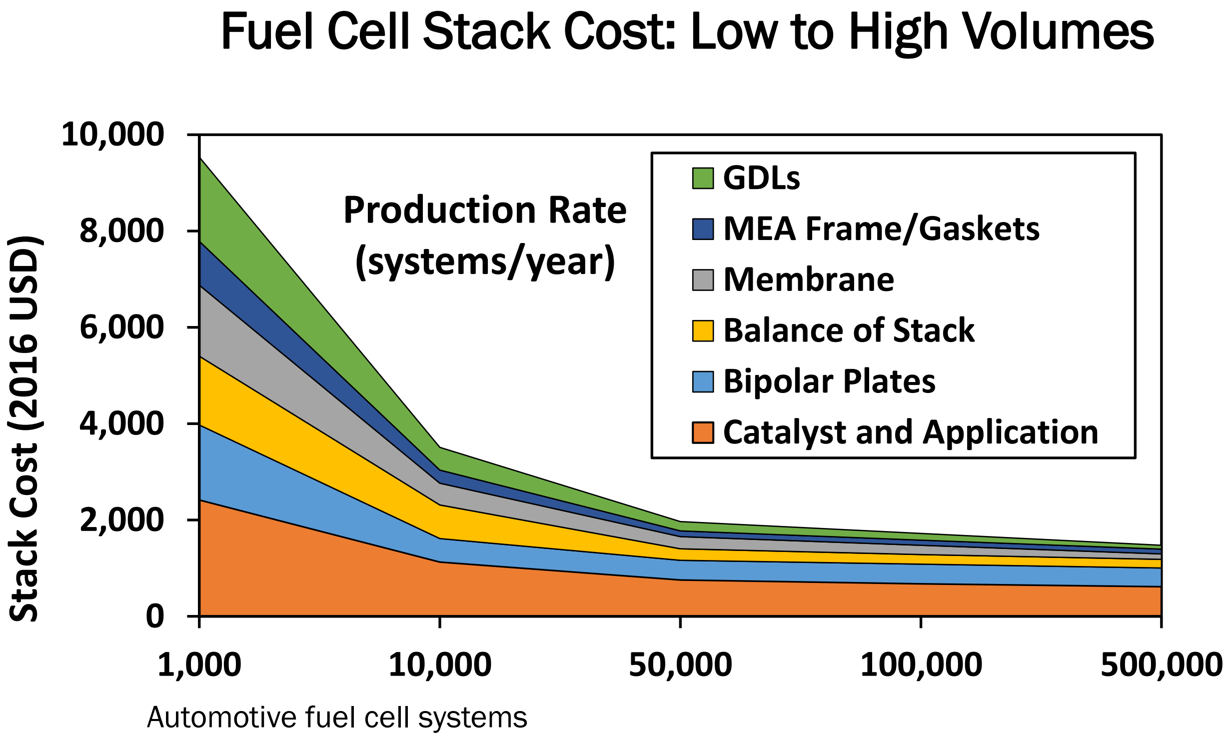
*For range: Delivery and dispensing at today's (2020) stations with capacity 450-1,000 kg/day at high volume manufacturing

ǂ Storage costs based on 2019 storage cost record

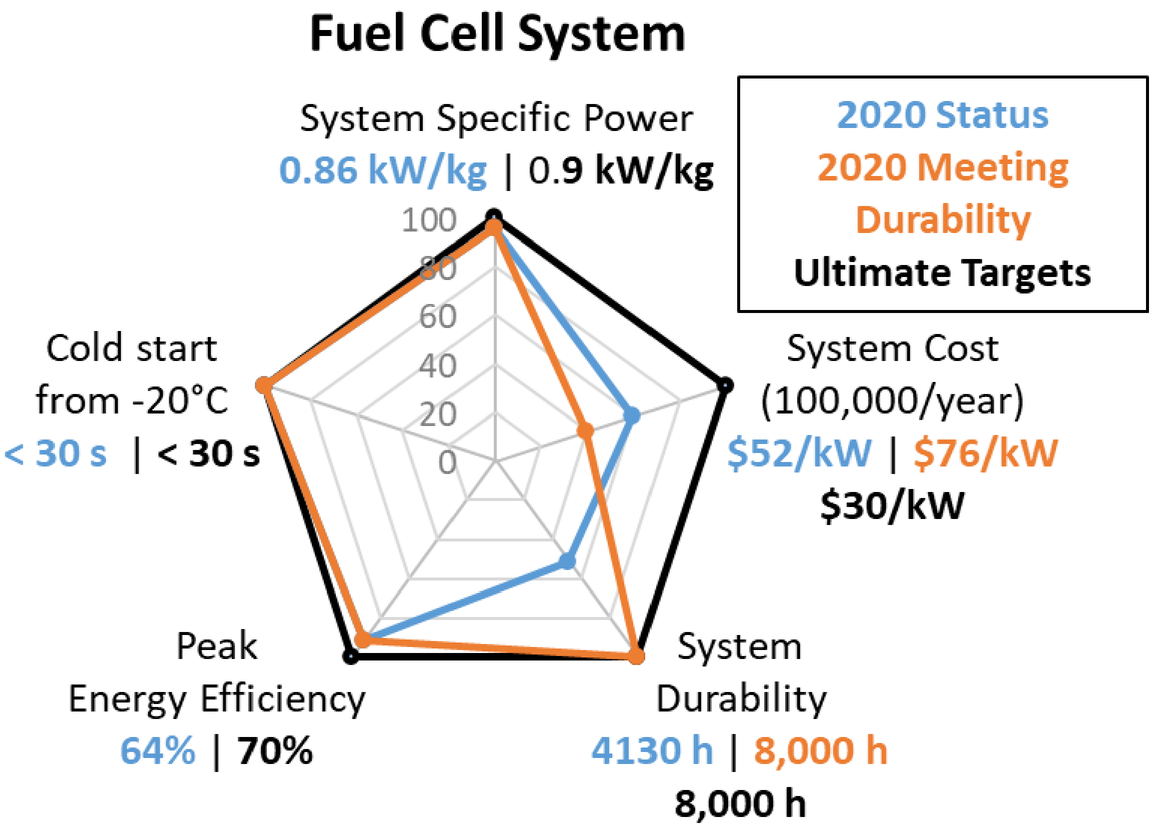
All costs based on $2016

Note: Graph is not at scale. For illustrative purposes only

Fuel Cell Status vs Targets



*GDLs: Gas Diffusion Layers



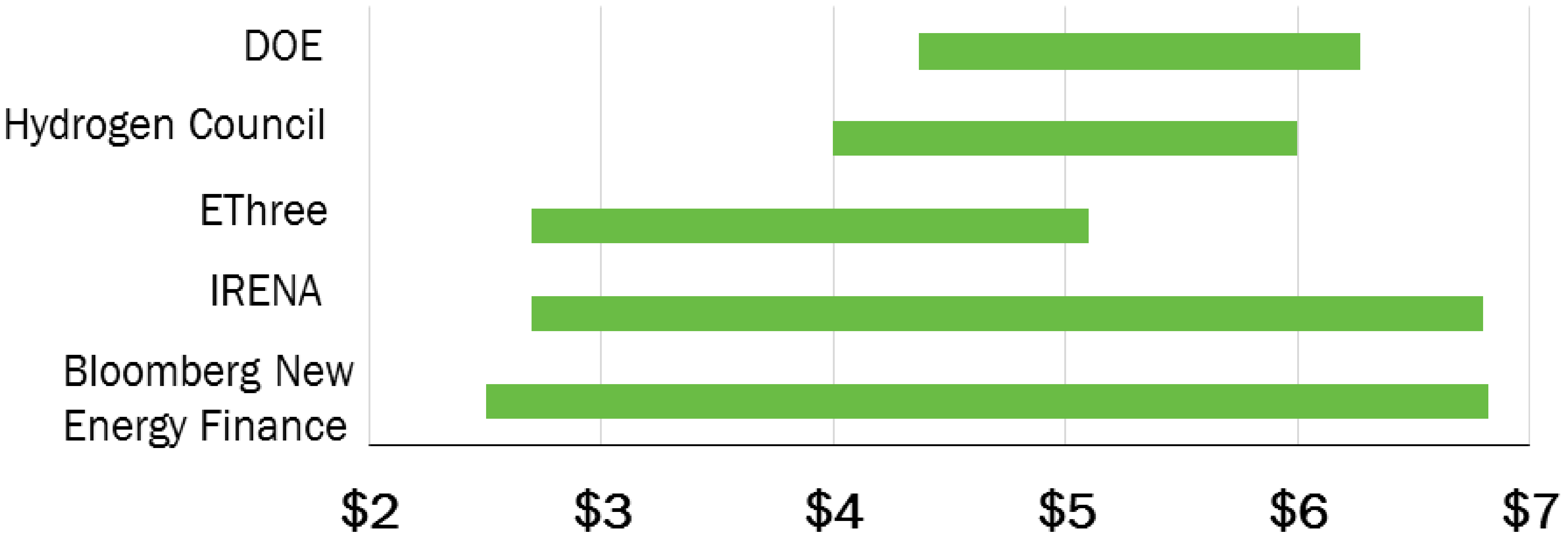
Program focus is heavy duty applications

Long Haul Truck Targets: $80/kW, 25,000 hour durability, 68% efficiency by 2030

Cost of Hydrogen from PEM Electrolysis

Multiple studies show H_2 from PEM electrolysis can be much less than \$7/kg.
Example - \$5 to \$6/kg at \$0.05 to \$.07/kWh

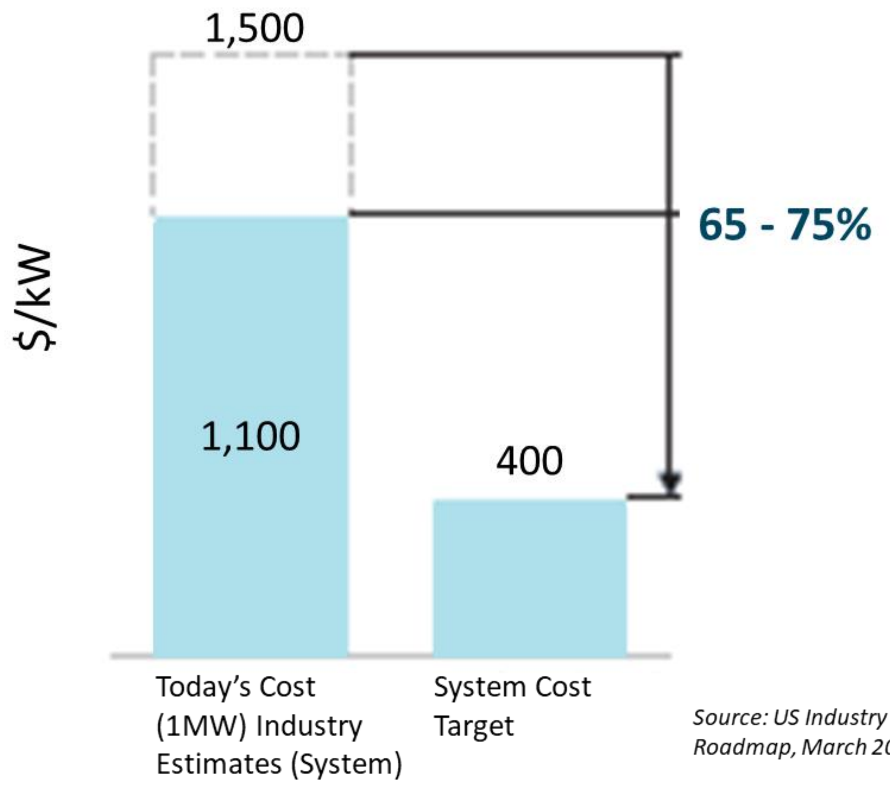
Current PEM Electrolyzer Hydrogen Production Cost Estimates ($/kg)



Source: DOE Record 20004

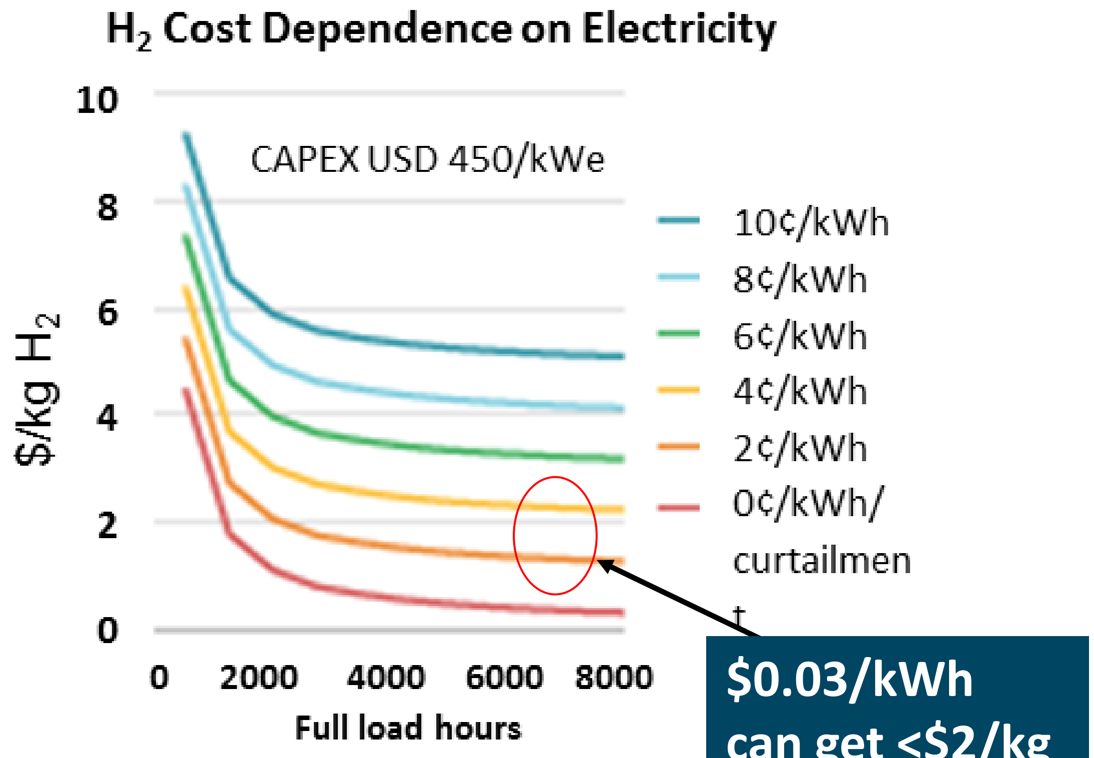
Electrolysis Cost – Recent Independent Analyses

Today's Polymer Electrolyte Membrane (PEM) electrolyzers require 65% - 75% cost



Source: US Industry H2 Roadmap, March 2020

$2/kg H2 is achievable at about $0.03/kWh electricity cost and high utilization



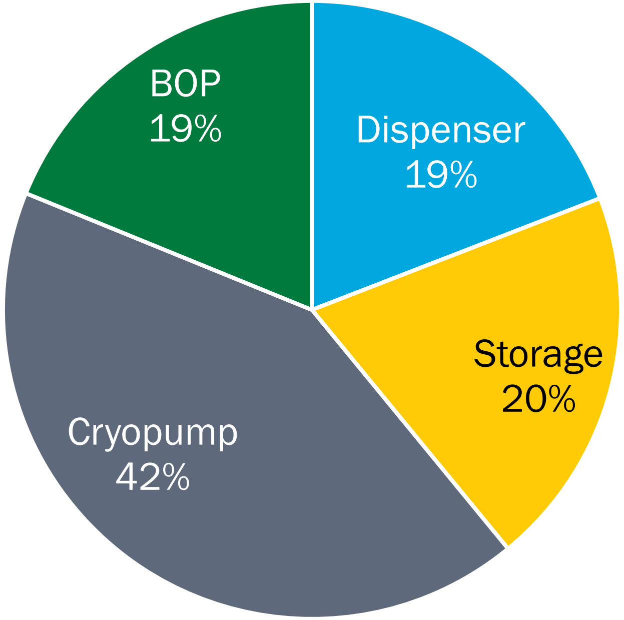
Source: IEA Hydrogen Future Report 2019

HFTO Strategy

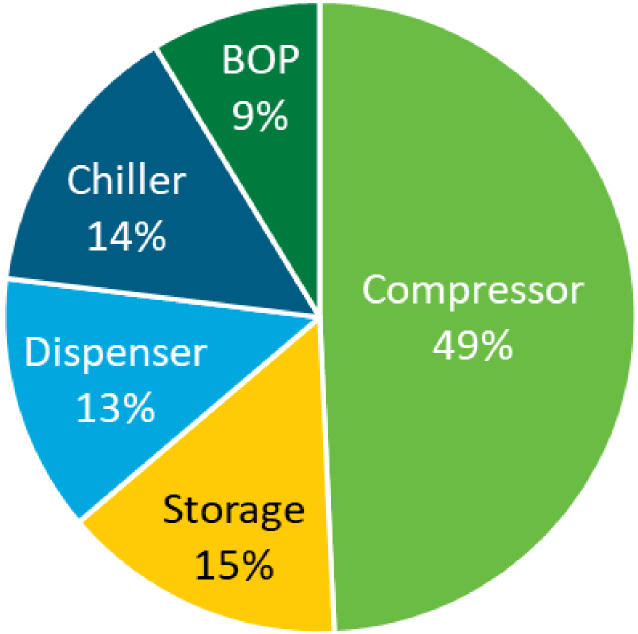
- Launch H2NEW consortium on electrolysis to achieve <$2/kg ($100/kW stack target)
- De-risk deployment through systems integration
- Ramp up scale through demonstrations – co-locate production and end use

Fueling Station Cost Breakdown Scenarios (Gaseous vs. Liquid)

Hydrogen Fueling Station Cost
(700 Bar, 800 kg/day Station, Liquid Supply)[1]



Hydrogen Fueling Station Cost
(700 Bar, 800 kg/day Station, Gaseous Supply)[1]



Capital Cost of Equipment, Uninstalled: ~$2M, assuming stations designed for high utilization. Key components of stations modeled include: 1) 4 dispensers each, 2) cascade storage), 3) 2 compressors (if station supplied by gaseous hydrogen), 4) 1 high-pressure cryopump (if station supplied by liquid hydrogen).

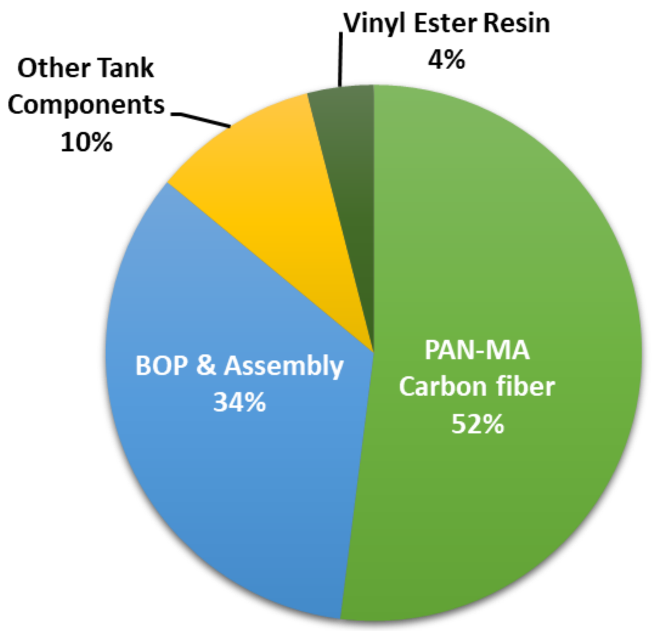
1. Source: Argonne National Laboratory, Hydrogen Delivery Scenario Analysis Model
2. Source: Applications to the California Energy Commission Grant Funding Opportunity 19-602

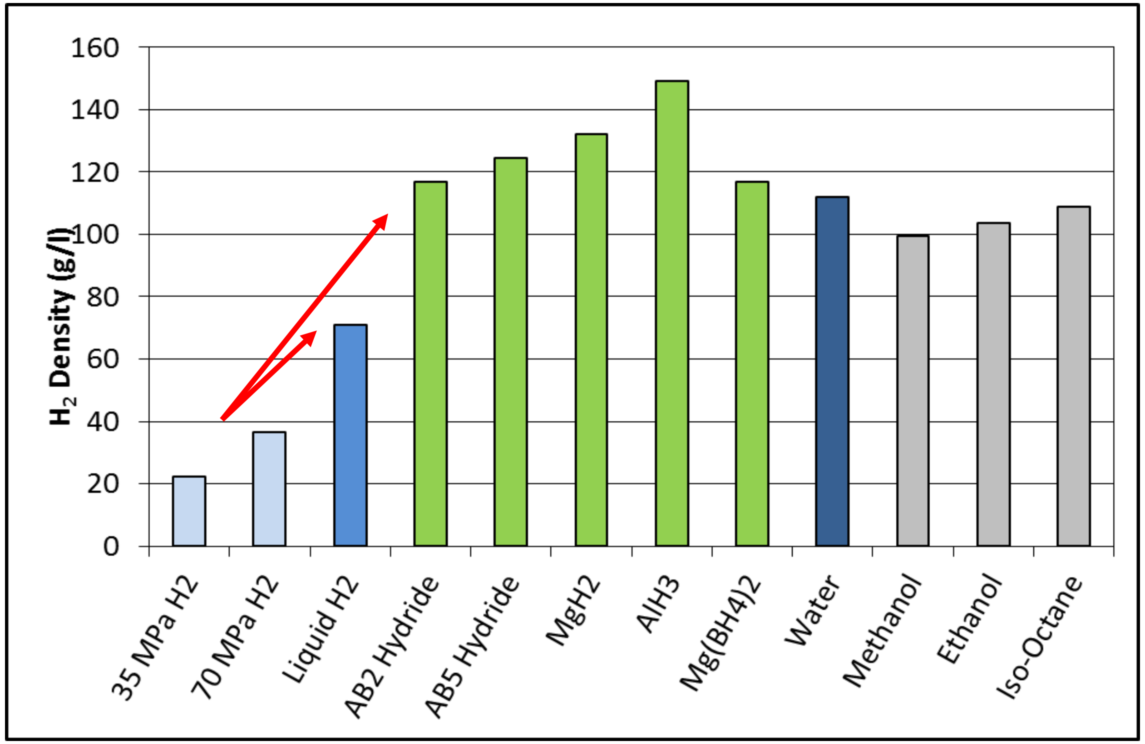
Hydrogen Storage: Tanks and materials-based storage

Storage Goals: \$8/kWh, 1.7 kWh/l, 2.2 kWh/kg
Current Status: \$14-21/kWh, 0.8 kWh/L, 1.5 kWh/kg

Liquid H_2 and materials-based options offer higher energy densities at low pressure

Hydrogen Storage Cost (700 bar Type IV system)*





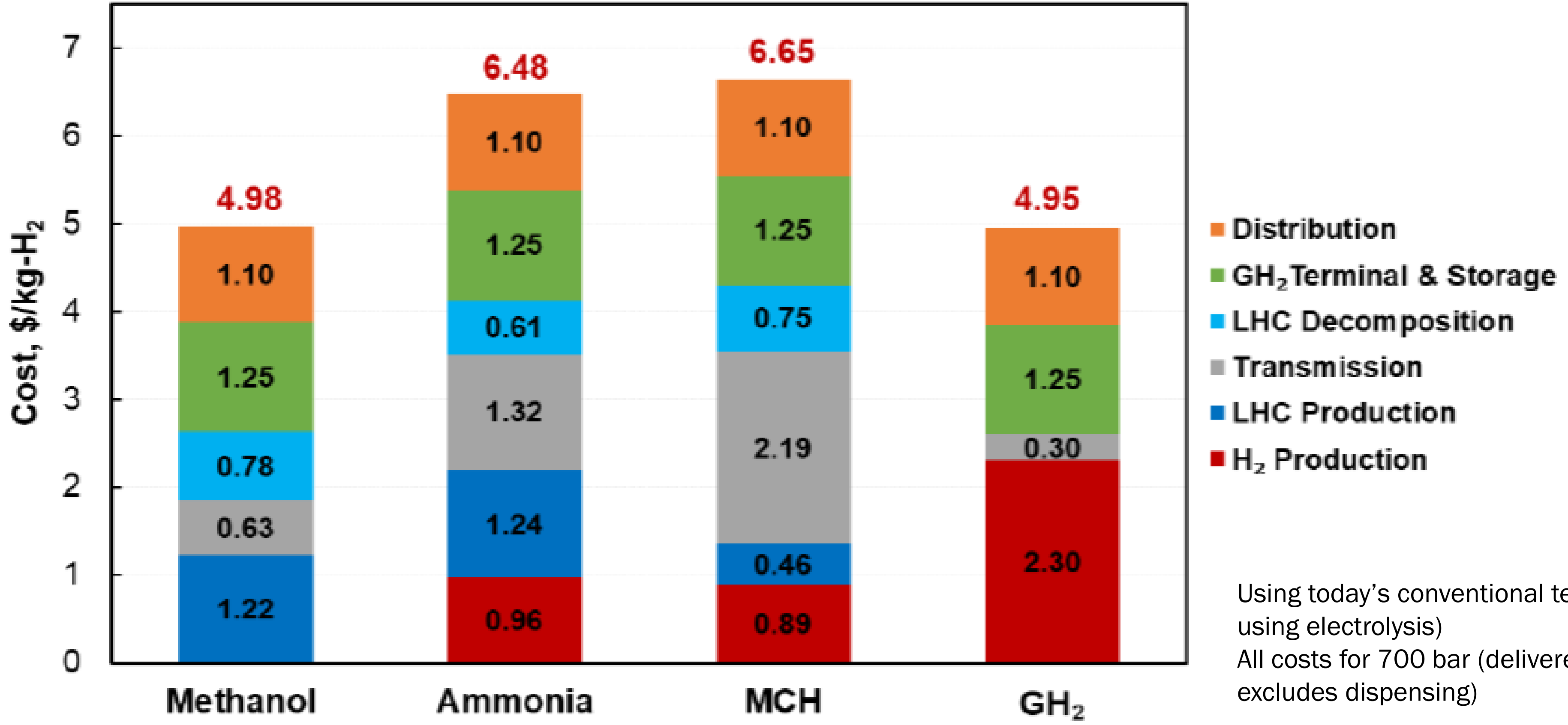
*At 100k units/yr for on-board

Strategy:
Near term: Lower C fiber cost to enable high pressure tanks
Long term: materials-based approaches for high density, low pressure storage

Example of Preliminary Analysis: Comparison of Hydrogen Carriers

Baseline levelized cost of H_2 at 50,000 kg per day

Argonne NATIONAL LABORATORY

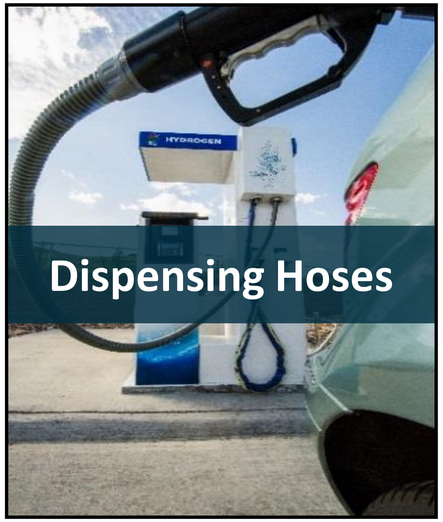


Using today's conventional technology (not using electrolysis)
All costs for 700 bar (delivered to station; excludes dispensing)

- At 50,000 kg H_2 per day, methanol produced at high volume in the gulf coast area, and transport to California can be cost competitive with "locally" produced gaseous hydrogen.
- Ammonia and methylcyclohexane have a cost premium over "locally" produced gaseous hydrogen

H-Mat Hydrogen Materials Compatibility Consortium

H-Mat Consortium conducts R&D on hydrogen effects on polymers and metals



- **Enabling the safe use of hydrogen across applications and the development of harmonized codes and standards**
- **Addressing hydrogen blending with natural gas, reducing expansion of seals, improving life of vessels through improved understanding of crack nucleation, enhancing fracture toughness of high-strength steels, and more**
- **Over 40 partners with industry, labs, universities**

Sandia National Laboratories | Pacific Northwest National Laboratory | Oak Ridge National Laboratory | Savannah River National Laboratory (Operated by Savannah River Nuclear Solutions) | Argonne National Laboratory

For More Information

- **Website: h-mat.org**
- **Email: h-matinfo@pnnl.gov**

20% hydrogen blends could enable a doubling[1] of U.S. renewables consumption

% H_2/NG blends vary widely from <1% to 30%. Up to 15% may be feasible without significant modification to existing infrastructure

“HyBlend”: R&D project to enable H_2 blending and address challenges

1. U.S. Projected Renewable Energy Consumption in Power Generation in 2019: ~703 TWh (Source: AEO 2020)
20% hydrogen blend in the U.S. by volume could enable 900 TWh of clean electricity to produce hydrogen via electrolysis.
(Source: Elgowainy, et al, ANL, 2020)

Budget and Focus Areas

Hydrogen and Fuel Cell Technologies Office Funding FY 2021

EERE HFTO Subprograms	FY 2021
Fuel Cell Technologies	$25M
Hydrogen Technologies	$71M
Systems Development & Integration (Tech Acceleration)	$51M
Data, Modeling and Analysis	$3M
Total	**$150M**

- **Production:** Water splitting – electrolysis (high and low temperature), PhotoElectroChemical (PEC), SolarThermoCHemical (STCH), biomass/biological
- **Infrastructure:** Materials, delivery, components & systems
- **Storage**: materials-based, carriers, tanks, liquid
- **Fuel Cells (FCs)**: materials, components, systems, reversible FC
- **Systems Development & Integration:** Tech Acceleration includes hybrid/grid integration, new markets, heavy duty, energy storage, manufacturing industrial applications (e.g. steel) safety, codes, standard, workforce development

Coordination with additional activities in DOE Offices of Fossil Energy, Nuclear Energy, ARPA-E, Electricity, and Science

**Will be moved under Hydrogen Fuel R&D in FY 2021*

Note: Office of Fossil Energy covers fossil fuels to H_2


Collaboration

“No one can whistle a symphony. It takes a whole orchestra to play it.”

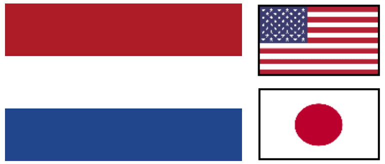
- H. Luccock

Examples of Global Collaboration

Coordinating across global partnerships: IPHE, Ministerials, Mission Innovation, IEA, etc.
Global Center for Hydrogen Safety established to share best practices, training resources and information

The International Partnership for Hydrogen and Fuel Cells in the Economy

Enabling the global adoption of hydrogen and fuel cells in the economy



New Chair: Dec 2020: The Netherlands

Vice Chairs: U.S. Japan

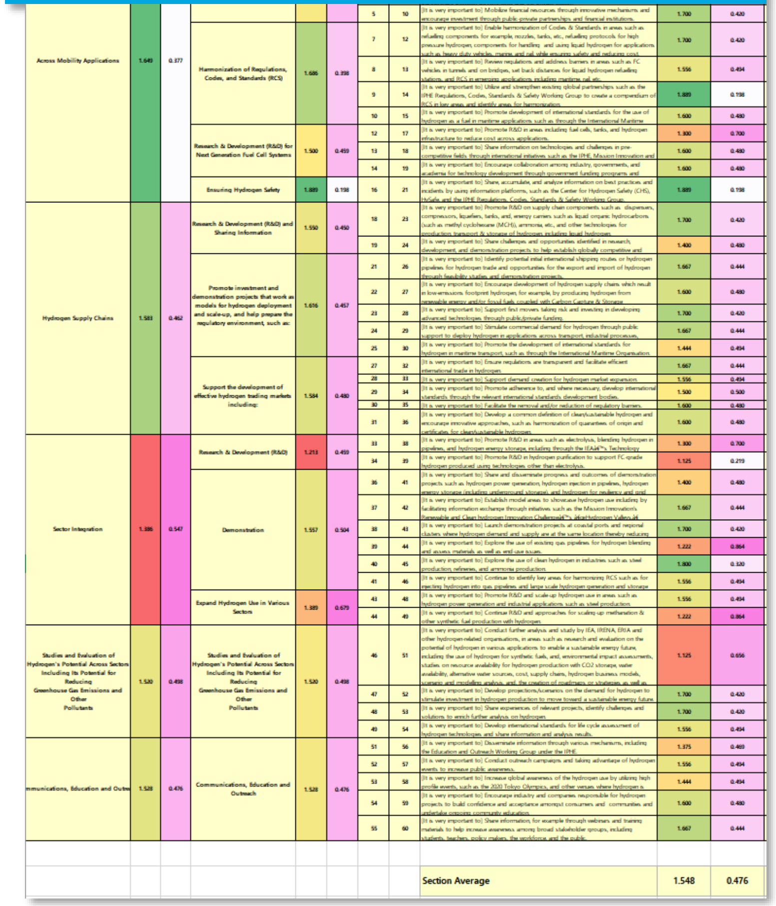
www.IPHE.net

Key Activities: Harmonization of codes & standards, Information sharing on safety, policies, regulations, analysis, education.

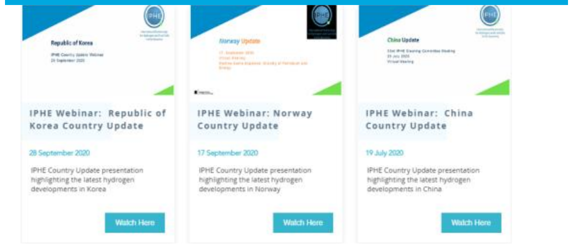
Task force on developing H_2 production analysis methodology to facilitate international trade, global RD&D monitoring

Hydrogen and Clean Energy Ministerials | **Mission Innovation Hydrogen Challenge** | **International Energy Agency**

GAA priorities/IPHE areas mapping

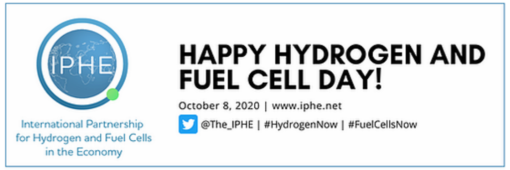


Webinars



Resources by Country

International H2 Day Campaign



Hydrogen Production Analysis Task Force (H2PA TF)

Addressing Priority from Industry and Governments

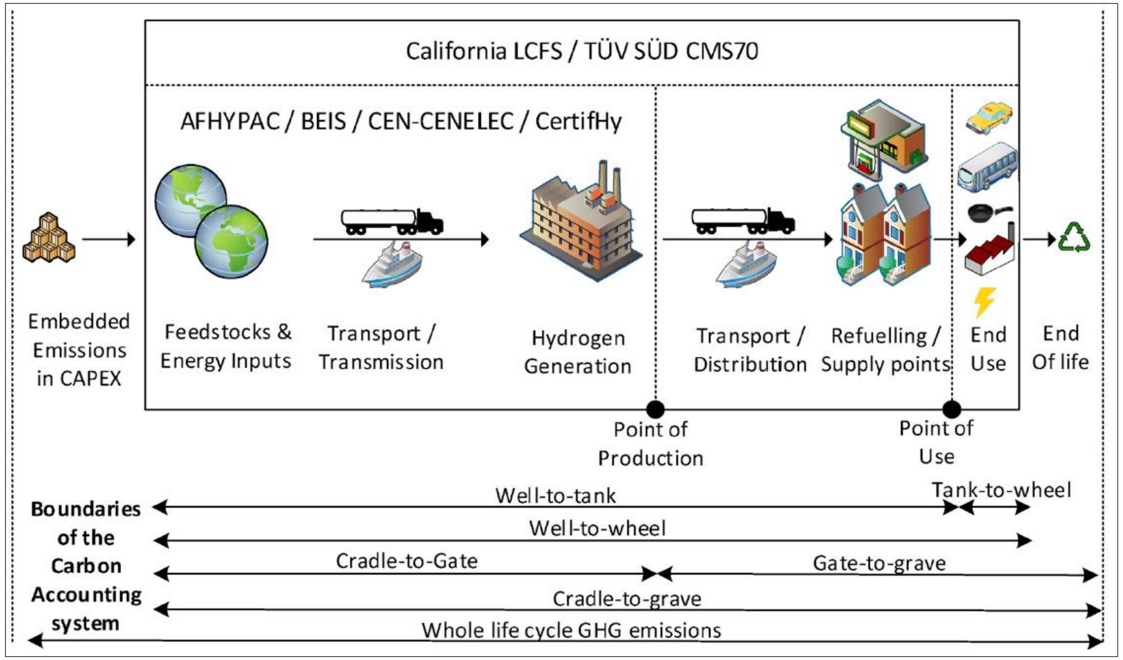
- Harmonize approach and develop framework to facilitate global trade of hydrogen

Scope

- Develop a mutually agreed upon analytical methodology for determining greenhouse gas (GHG) and other emissions associated with H2 production.

Next Steps and Engagement

- Continue to engage stakeholders, industry and experts to develop framework for methodology



(Source: Abad et al., Energy policy 138 (2020) 111300)

Application of methodology will help facilitate market valuation and global trade in 'clean' hydrogen by recommending a common approach with adoption not mandatory and subject to each member's discretion and circumstance.

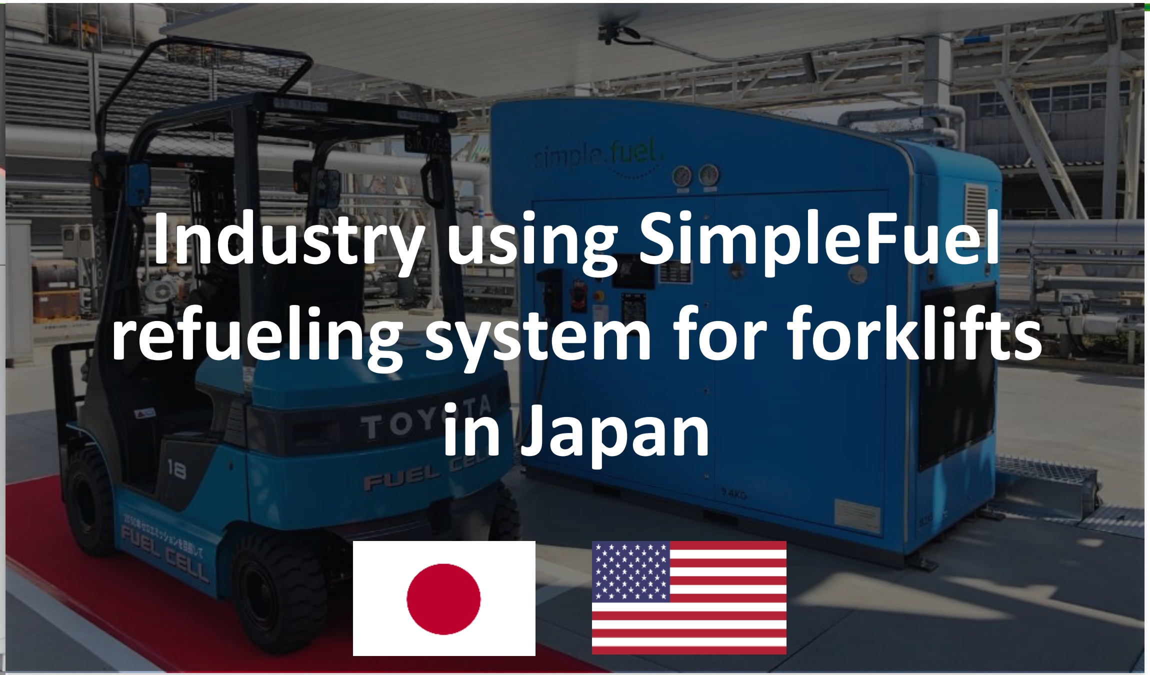
U.S. – Japan Collaborations

The U.S. and Japan have been collaborating on hydrogen and fuel cells for many years

- **Engagement through international partnerships and initiatives including:**
  - IPHE (Japan and US are vice chairs)
  - Hydrogen Energy Ministerial (HEM)
  - Clean Energy Ministerial (CEM)
  - Mission Innovation (MI)
  - International Energy Agency (IEA) Technology Collaboration Programs
- **Collaboration with DOE National Labs**
  - Examples: HySUT, NEDO, data collection with Toyota, Honda and Nissan, fueling models with Kyushu University and more!
- **Joint research including on materials compatibility and safety codes and standards**
  - Carbon-Neutral Energy Research (I2CNER) at Kyushu University

29th IPHE Steering Committee Meeting
Friday May 11, 2018 Kobe, JAPAN

Complementing retail stations: H2Refuel H-prize



simple.fuel.™

Ivys Energy Solutions (MA)
McPhya Energy (MA)
PDC Machines (PA)

Email:
connect@ivysinc.com

More info:
www.teamsimplefuel.com

H2refuel
U.S. Department of Energy

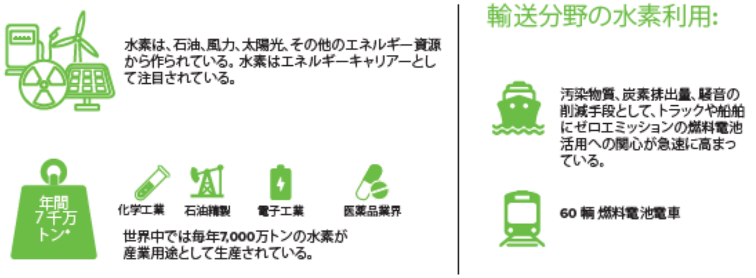
- Small scale H_2 fueling system now available
- $1M H-Prize Winner: SimpleFuel
- 5 to 20 kg unit
- 700 bar fueling

Example of Collaboration: Global Center for H_2 Safety (CHS)

IPHE Steering Committee action: Increase awareness of safety and partnerships
Promotes safe operation, handling and use of hydrogen across all applications.

Includes over 40 partners from industry, government and academia

Access to >110 countries, 60,000 members



www.aiche.org/CHS

Information to be available in multiple languages

What can you do?

Get involved!

Follow @the_iphe

IPHE E&O Working Group Early Career Network

- **Established by IPHE's Education & Outreach (E&O) Working Group** to promote international H_2 and fuel cell awareness and launch a platform for the next generation of H_2 and fuel cell leaders
- **Open to students, post-docs and early career** professionals

Stephanie Azubike
Chair

Learn more: iphe.net/early-career-chapter

Membership form: https://forms.gle/gUnWyV7gU4QqoHLm7

Priya Buddhavarapu
Co-Chair

#HydrogenNow

#FuelCellsNow

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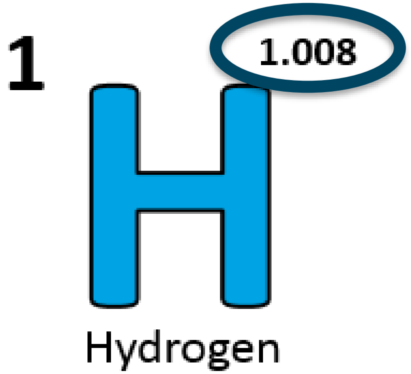
Resources and Events

Save the Date

Week of June 7, 2021 Annual Merit Review and Peer Evaluation Meeting for the Hydrogen and Fuel Cells Program in Arlington, VA

Oct 8 - Hydrogen and Fuel Cells Day

(Held on its very own atomic weight-day)



Resources

INCREASE YOUR H2IQ

Join Monthly
H2IQ Hour Webinars

energy.gov/eere/fuelcells/fuel-cell-technologies-office-webinars

Download
H2IQ For Free

energy.gov/eere/fuelcells/downloads/increase-your-h2iq-training-resource

Visit H2tools.Org For Hydrogen Safety And Lessons Learned
https://h2tools.org/

Learn more: **Sign up to receive hydrogen and fuel cell updates**
www.energy.gov/eere/fuelcells/fuel-cell-technologies-office-newsletter

Learn more at: energy.gov/eere/fuelcells AND www.hydrogen.energy.gov

Thank You

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www.hydrogen.energy.gov

Looking for more info?

#H2IQ

hydrogen.energy.gov