# The Production Processes of Hydrogen Fuel

June 3, 2025







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## What You Should Know

## Q&A

Submit your questions to the host using the Q&A box in the upper right-hand corner

## Recording

A recording of today's webinar will be available on runonless.com

## **Technical Issues**

Contact Stephane Babcock at sbabcock@trccompanies.com





## **Today's Bootcamp Speakers**

## **The Production Processes of Hydrogen Fuel**



**Omar Chaudhary** Sales and Business Development Manager – USA Accelera by Cummins



**Connor Dolan** Vice President of External Affairs Fuel Cell & Hydrogen Energy Association



**Rick Mihelic** Director of Emerging Technologies NACFE





Run on Less Messy Middle Bootcamp



NORTH AMERICAN COUNCIL FOR FREIGHT EFFICIENCY

## The Hydrogen Spectrum

Rick Mihelic June 3, 2025



## About Hydrogen



Carries Energy From Where it's produced



To Where it's needed

Hydrogen is like a powerline



## Many Ways To Produce Hydrogen

#### **Key Hydrogen Questions**

- How is H<sub>2</sub> produced?
- Where is H<sub>2</sub> produced?
- How is H<sub>2</sub> transported?
- What is H<sub>2</sub> carbon intensity?
- Why use H<sub>2</sub>?





.. . . . .

## The Hydrogen System



## **Carbon Intensity**



# What net amount of CO<sub>2</sub> is emitted from production to end use



- Producing
- Storing
- Transporting
- Compressing
- Dispensing

# Each requires significant energy





## **Used to move HD Trucks**

#### Vehicle Equipment

- Storage Tanks & Lines
- Cooling Systems
- Leak Detection Systems

#### Powertrain Equipment

- Fuel Cells/Batteries
- HICE Engine



2. Hydrogen passes through a fuel cell stack that uses a chemical reaction to convert the hydrogen and ambient oxygen into electricity. **3.** The electricity flows through a battery, which powers an electrical motor that spins the wheels and runs the vehicle.\*



**4.** Water vapor is emitted through the tailpipe.

\* In some hydrogen fuel cell vehicles, the electricity generated by the fuel cell directly powers the electric motor and does not pass through a battery.

SOURCE USA TODAY research Karl Gelles/USA TODAY



https://www.cummins.com/news/2022/06/13/hydrogen-engine-insights-truck-and-busmanufacturers

https://casstrucking.com/hydrogen-trucks-promise-zero-emissions/



## **Plants & Stations – Size Examples**



Oakland NorCal Zero Station 4 dispensers 4,000 kg/day ~50long haul trucks/day Or up to 200 shorter haul ones



Demonstration fueling station 80kg of hydrogen per day ~ one truck/day Example Hydrogen Plant Producing Fuel for 100 Semi Trucks per Day

https://www.h2-view.com/wp-content/files/View3PMH-scaledhttps://www.toyota.com.au/news/toyota-unveils-victoriaiganst-hydrogen-production-and-refuelling-facility-at-centre-of-excellence https://www.truckinginfo.com/10220986/high-capacity-hydrogen-truck-fueling-station-opens-in-oakland-california



## **Hydrogen Hubs and Corridor Initiatives**

## U.S.



https://www.fchea.org/transitions/2022/4/4/low-carbon-hydrogen-production-inthe-us

## Canada



https://natural-resources.canada.ca/our-natural-resources/energy-sourcesdistribution/producing-hydrogn-canada/23151



### **US Hubs**



Source: Wood Mackenzie Q4 2023 Hydrogen Market Tracker, DOE Office of Clean Energy Demonstrations

Figure 4-2. Map of LCI H2 Project Announcements and DOE H2 Hubs





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## **Electrolyzer Business**

Q3 2025 - Public presentation Omar Chaudhary - Sales and Business Development Manager - USA

www.accelerazero.c



#### \*as of Dec. 31, 2024

### **Experience + agility**

#### Accelera<sup>™</sup> by Cummins is the zero-emissions business segment launched by Cummins Inc. in March 2023.

With a focus on accelerating the shift to zero emissions, Accelera aims to provide zero-emission power solutions and products for various industries, including commercial and industrial applications.

### **1.5B +**

miles driven by electric vehicles with eMobility products

## 600 +

Electrolyzers deployed in the field

1,800 +

of the world's brightest minds focused on decarbonizing technologies



countries and territories in our distribution and support network

years of hydrogen innovation and experience

## 3,000 +

Fuel cells deployed in the field



Hydrogen produced from renewable power enables the transition to a cleaner future across all energy sectors and applications.

#### **Renewable Hydrogen in the Energy Transition**



#### Hydrogen from (and to) water



In: H2 and O2 Out : water & electricity



Hydrogen fuel cell

### Who uses hydrogen today?

It's a building brick, it has unique properties, and it's a fuel..

- Crude oil upgrade\*
- Ammonia production\*\*
- Methanol production
- Industrial processes
- Fuel

 $H_{2} + crude = lighter fuel$   $H_{2} + N2 = NH3$   $H_{2} + CO (or + CO_{2}) = CH_{3}OH$   $H_{2} to protect, to react, to reduce, to cool..$   $H_{2} + O_{2} = ENERGY !$ 

(\*) 33% of all hydrogen is used in the refinery industry for oil upgrade and desulfurisation

(\*\*) 27% of all hydrogen is used for the production of ammonia, which is primarily used for fertilizer production

## **Electrolyzer product line**



HyLYZER®-500

HyLYZER®-1000



### HyLYZER<sup>®</sup> - selection of project references



#### **Current Policy Position**

- 1. Oil and Gas companies are lobbying to maintain production tax credit for 45V They are also seeking to level the playing field for blue/green
- 2. The large amount of funding from the IRA is not for hydrogen
- 3. Republicans may improve strict guidelines for 45V funds are majority flowing to republican districts
- 4. House has passed a bill to eliminate 45V effectively gutting the green hydrogen market in the US

# When the dust settles, blue hydrogen will likely become more attractive to investors, and Section 45V is likely to endure

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## Blue Hydrogen and US Policy Status

June 2025

#### Fuel Cell and Hydrogen Industry Association



### The Industry Association for Hydrogen in the United States Based in Washington, DC

- Advocating for Hydrogen and Fuel Cell technology for 35 years.
- Representing over 100 leading companies, organizations, and partners that are advancing the *production*, *distribution*, and *use* of Hydrogen.
- **Providing** a consistent industry voice to regulators and policymakers at both *Federal and State* levels.
- Educating about the *environmental, economic* and *societal* benefits of Hydrogen as a key contributor to decarbonization

#### **Fuel Cell and Hydrogen Industry Association**



**FCHEA** 

#### Benefits of Hydrogen







**Reducing Emissions** 

Global Competitiveness



#### Uses of Hydrogen

### Power generation and grid balancing

Centralized power (including storage) and distributed power (offgrid, backup power)

Hydrogen as an energy carrier and storage medium

**Feedstock** for industry (ammonia, methanol, refineries, steel) and long-distance transport (aviation, marine)



**Transportation** fuel (including material handlings, lightand heavy- duty vehicles, captive fleets, rail, and aviation)

Fuel for **residential and commercial buildings** (including blending into the gas grid, combined heat and power)

#### Context – Industry Base and Growth

#### **FCHEA**



#### 11.4 m metric tons

currently consumed annually in the US market

~\$17.6 bn total value of H<sub>2</sub> in the US 77% steam methane reforming 23% by-product H<sub>2</sub> from refining

#### **Growth Potential** 63 Additional upside from other uses Million metric tons per year Synthetic jet fuel Ammonia as fuel for shipping New feedstock 14%+ Power generation and grid balancing of US energy demand could Fuel for industry be from hydrogen in 2050 Fuel for residential and commercial buildings 20 14 Transportation fuel 11 Existing feedstock Base Ambitious Base Ambitious 2030 Today 2050 Demand excluding feedstock, based on IEA final energy demand for the US

Assuming that 20% of jet fuel demand is met from synthetic fuel and 20% of marine bunker fuel from ammonia



Hydrogen generated with low- and zero- carbon produced



FCHEA supports a **pathway agnostic** approach to advancing clean hydrogen production





Hydrogen generated with low- and zero- carbon produced



FCHEA supports a **pathway agnostic** approach to advancing clean hydrogen production



#### Why Blue Hydrogen?

- Energy Independence and Economic Growth
  - Blue Hydrogen utilizes domestic natural gas and contributes to greater energy security while creating jobs in manufacturing, construction, and operations
- Emissions Reduction
  - Blue Hydrogen offers significant reductions in emissions compared to Grey Hydrogen, which can be compounded further with low-CI natural gas and RNG utilization
- Clean Up Existing Facilities
  - Retrofitting existing facilities can immediately reduce CI of our existing hydrogen production capacity
  - These facilities are often already co-located with heavy industries like refineries and petrochemical plants
- Appeal to Global Markets Seeking Low-Carbon Options
  - Blue Hydrogen can be used to generate a variety of low-carbon derivatives like ammonia and methanol that are highly desires around the globe
- Lower Cost
  - Green Hydrogen today is much more expensive (\$4-7/kg) than Blue Hydrogen (\$1.60/kg)
- Bridge Option while Green Hydrogen Scales
  - While Green Hydrogen reduces costs and scales, Blue Hydrogen adoption can be utilized more immediately and help develop necessary infrastructure for storage and distribution that will be needed



Figure 20: Achieving \$1/kg using electrolyzers requires lower electricity cost, significantly lower capital costs, improvement in efficiency and durability, and higher utilization.

#### **Hydrogen Production Simplified**





Steam Methane Reformer (SMR) Image: US DOE

Input: CH4 Output: CO2 and H2



Early Electrolyzer - Norsk Hydro, Rjukan Norway Image: NEL

Input H<sub>2</sub>O and Electricity Output: O2 and H2

8-10 Kg CO2 per Kg H2

0 Kg CO2 per Kg H2

#### Air Products Louisiana Facility

#### \$4.5 Billion investment



#### ExxonMobil Baytown Facility

#### \$10 Billion investment

Plans to produce 1 billion cubic feet per day of low-carbon hydrogen which will be used both for refinery operations in the US and to generate blue ammonia for export opportunities



#### Section 45V – Credit for Production of Clean Hydrogen

- The Inflation Reduction Act of 2022 created a new Section 45V ten-year tax credit for facilities that produce clean hydrogen that begin construction before 1/1/2033.
- Provides up to \$3/ kg clean H2 calculated based on carbon intensity of H2 production process.

Kg of CO2 per kg of H2	Credit Value (\$)
4 - 2.5 kg CO2	\$0.60 / kg of H2
2.5 - 1.5 kg CO2	\$0.75 / kg of H2
1.5 - 0.45 kg CO2	\$1.00 / kg of H2
0.45 - 0 kg CO2	\$3.00 / kg of H2

- Lifecycle analysis definition only calculates emissions "through the point of production" and specifies the GREET model as means of analysis.
- Electricity generated from facilities taking the PTC for renewable electricity or zero-emission nuclear power credit can still take the clean hydrogen PTC. Facilities must choose between the carbon capture and sequestration credit and the clean hydrogen production credit.
- Clarification of the applicability of Renewable Energy Credits or Environmental Attributes was included in the legislative record through colloquy.
- To obtain full value of credit, the taxpayer must meet prevailing wage and apprenticeship requirements. The credit does not include domestic content requirements.



# 45V Status Today

- Final regulations for several credits were issued at tail end of Biden regime, Section 45V only issued on January 3
- FCHEA initiated and coordinated an initial Defend 45V letter signed on by nearly 120 participants and issued on February 18 and a House-focused letter last week with over 100+ organizations as well
- Since December, FCHEA coordinated and participated in 80+ meetings with Congressional offices. The efforts have been directed to Republican leaders in the House and Senate, key committees and caucuses, and members with hydrogen and fuel cell interests.
- In April, FCHEA led advocacy for a Texas 45V Republican Sign-On letter to Chairman Smith that obtained signatures from 11 members of Congress
- The House Markup last week unfortunately proposed to terminate 45V as of January 1, 2026 with a new begin construction date instituted as of December 31, 2025
- Other clean energy credits will be facing a phase down starting in 2028 and terminating by 2031
- Our focus now is shifting to the US Senate that will be taking up next steps for this OBBB



## Hydrogen Hub Status

- On January 17 the Biden Administration signed the contracts for the last two Hubs for the Mid-Atlantic Clean Hydrogen Hub (MACH2) and the Heartland Hydrogen Hub (HH2H)
- At the end of March, leaks from the Department of Energy indicated that the Trump Administration was planning cuts to potentially four out of the seven Hydrogen Hubs
- In May, Secretary Wright testified before House Appropriations EWD to discuss the budget for DOE. During this hearing Wright was grilled by both Rep. Mrvan (D-IN) and Rep. Levin (D-CA) regarding the status of Hub funding.
- Secretary Wright indicated that DOE is still reviewing all DOE grant programs, including the Hydrogen Hubs, and will be making decisions by the end of the Summer. Stated that reviews are apolitical, and focused technical / economic viability, and offtake agreements



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# Thank You



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