

# Why Hydrogen? Why Now?

Danielle McLean

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# HYSKY Team

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# About HYSKY Society

501c3 non-profit, launched January 2023 - Happy Birthday, we just turned one!

**HYSKY's Mission: to decarbonize aviation with hydrogen**

HYSKY is a spinoff of the Vertical Flight Society (formerly American Helicopter Society, founded in 1943) [see press release](#)

Danielle served as the Hydrogen Advisor at VFS and co-founded the H2eVTOL Council [see press release](#)



# Why Hydrogen?

# H2's Role in Decarbonizing Aviation

- Zero carbon emissions
- Is the only fuel that can decarbonize aviation
- Batteries are too heavy, SAF not carbon-free



# Different Ways to Use Hydrogen

## INTERNAL COMBUSTION



NO CO<sub>2</sub>  
EMISSIONS



NO<sub>x</sub> EMISSIONS



**NOT ELECTRIC**

## FUEL CELLS



NO EMISSIONS  
OTHER THAN H<sub>2</sub>O

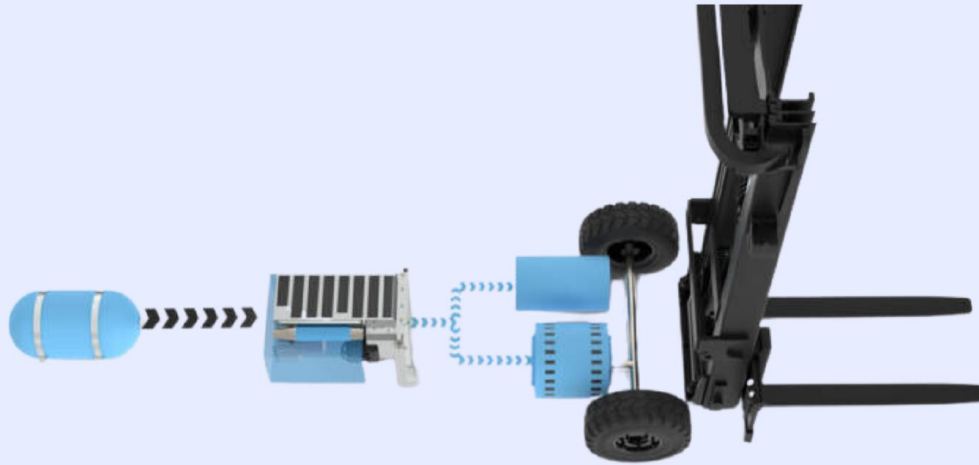


GREEN H<sub>2</sub> EXPENSIVE



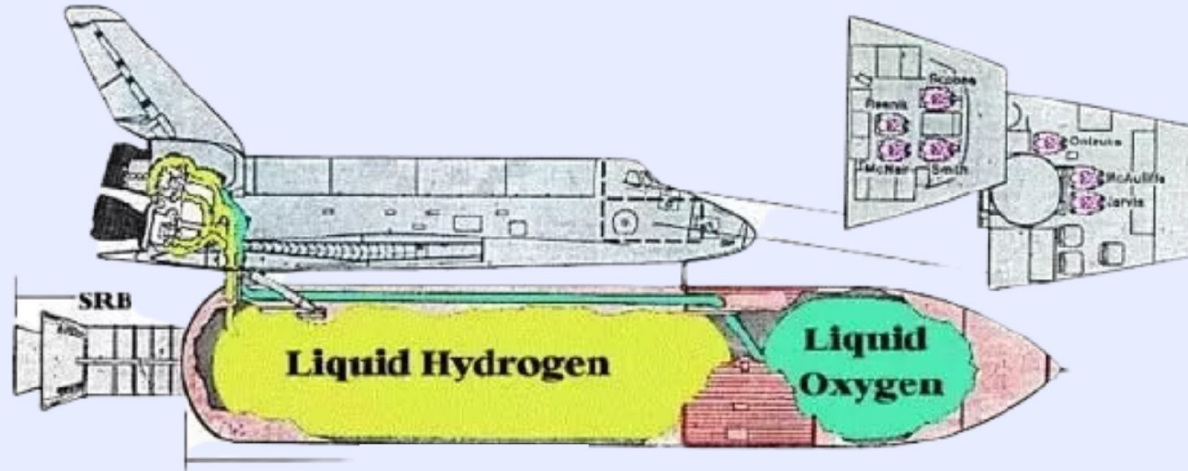
**ELECTRIC**

# Example of Fuel Cell (electric)



**ELECTRIC HYDROGEN FUEL CELLS ARE BEING  
USED IN OTHER INDUSTRIES LIKE FORKLIFTS**

# Example of Combustion (not electric)



**HYDROGEN HAS EVEN BEEN USED AS A FUEL  
SUCCESSFULLY IN AEROSPACE FOR DECADES**



# Specific Energy & Energy Density

Specific energy and energy density are two important, **but different**, properties used to describe the energy content of fuels and batteries.

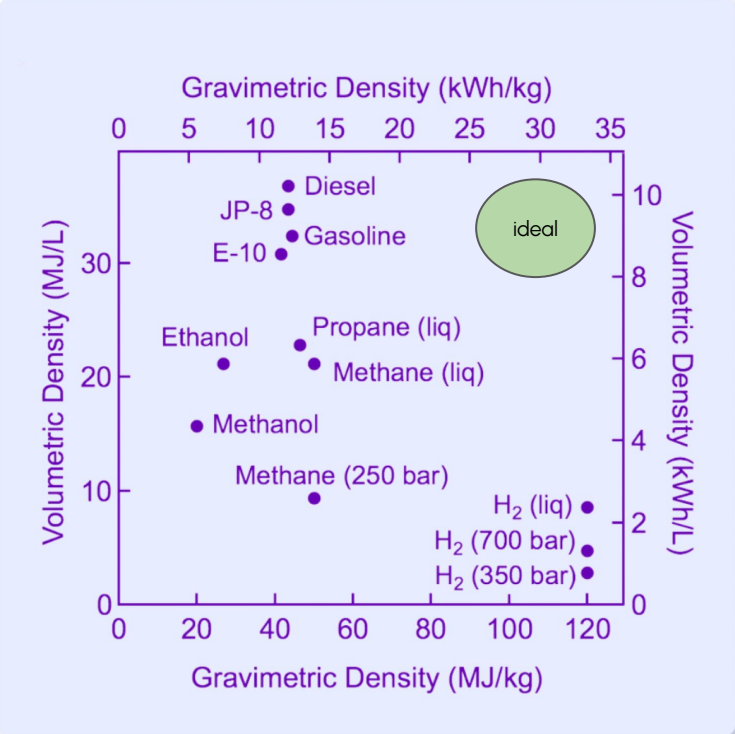
Specific Energy aka Gravimetric Density (Hydrogen is **HIGH** compared to jet fuel):

- The amount of energy stored per unit **mass**.
- Units measured in watt-hours per kilogram (Wh/kg) or joules per kilogram (J/kg).
- This is important when the **weight** of the energy storage system matters, such as in aviation
- Higher specific energy means more energy for the same **weight**.

Energy Density aka Volumetric Density (Hydrogen is **LOW** compared to jet fuel):

- The amount of energy stored per unit **volume**.
- Units measured in watt-hours per liter (Wh/L) or joules per liter (J/L).
- This is crucial when the **size** of the energy storage matters, such as in aviation
- Higher energy density means more energy for the same **volume**.

# Compared to Jet Fuel



3x more energy per kilogram



# What Does it All Mean?

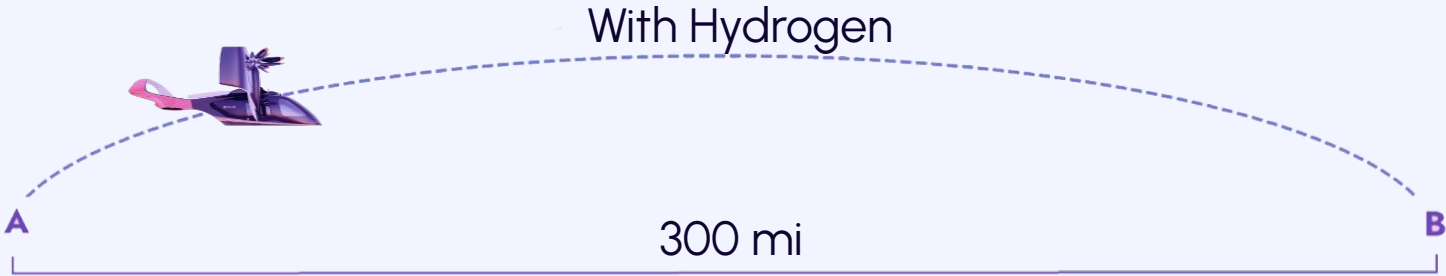
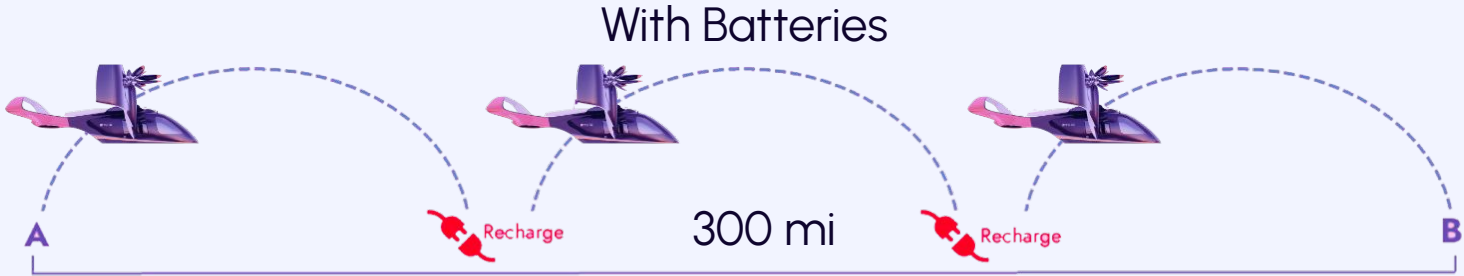
Hydrogen is an excellent fuel for aviation but it takes more space to store it than jet fuel.

**Don't say hydrogen has high energy density.** That's technically incorrect.

Say it has high:

- Energy per kg
- Specific energy
- Gravimetric density

# Compared to Batteries



# Advanced Hydrogen Aerospace Technologies and Design – Online Short Course (Starts 8 October 2024)

8 October - 7 November 2024

Online

Register Now



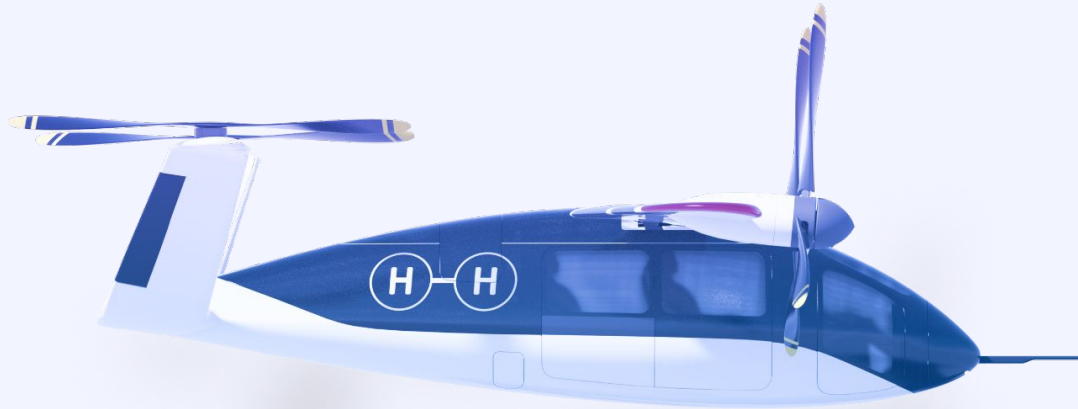
Instructed by experts from the HYSKY Society

- ✓ From 8 October – 7 November (5 Weeks, 10 Lectures/Classes, 20 Total Hours)
- ✓ Every Tuesday and Thursday at 1–3 p.m. ET USA (all sessions will be recorded and available for replay; course notes will be available for download)



# Long-Range, Zero-Emissions

Hydrogen is the only way to do long-range, zero-emission flight



# Current State of H2 in Aviation





Is Hydrogen Safe?!



# Hindenburg Oh the Humanity!

1937



COTTON, RUBBER, ALUMINUM  
POOR PLANNING  
VIDEO CAMERAS

VS

TODAY



CARBON FIBER  
FIREPROOF MATERIAL  
QUICK PRESSURE RELEASE

# Auto-Ignition

**HYDROGEN**

575°F



**GASOLINE**

500°F



**KEROSENE**

428°F



**DIESEL**

345°F



**HYDROGEN LESS LIKELY TO AUTO-IGNITE**

# Dispersion

**14X** LIGHTER THAN AIR



DISPERSES TO  
ATMOSPHERE FASTER



LOWER CHANCE  
OF EXPLOSION

**HYDROGEN SAFER THAN OTHER FUELS**



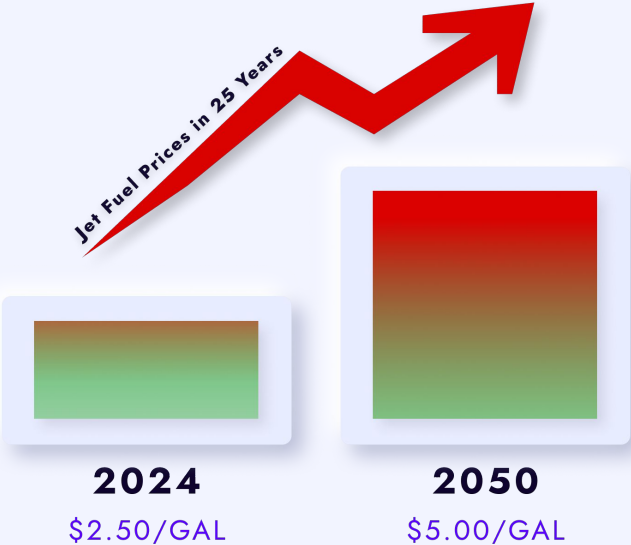
**“HYDROGEN DID NOT CAUSE THE  
HINDENBURG TO EXPLODE”**

Why Now?



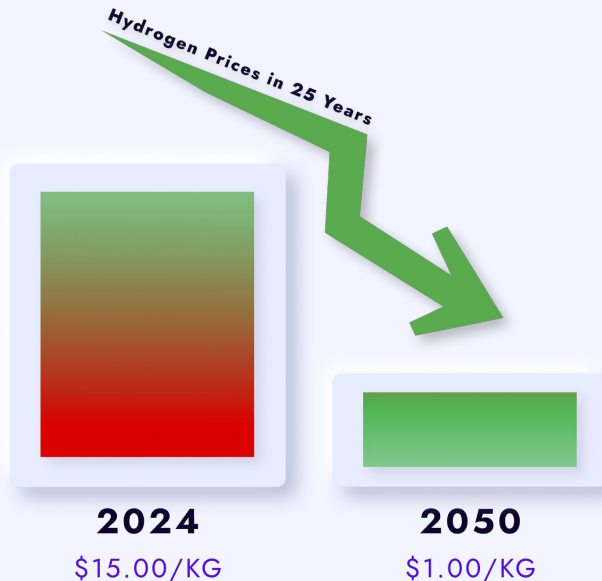
# The Rising Cost of Jet Fuel

The cost of jet fuel is projected to **double in the next 25 years**, posing a significant risk to the aviation industry's financial stability.



# Clean H2: A Cost-Effective Alternative

The cost of hydrogen is expected to decline and **reach \$1.00/kg**, making it a cost-effective alternative.



# 20% of Global Energy Will Be H2 by 2050

As countries work to diversify energy sources and lower emissions, H2 creates a massive opportunity of ~\$2.5 trillion in revenue by 2050 [source](#)

**H2** \$2.5T IN  
REVENUE  
**2050**



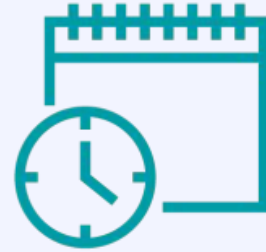
# The Hydrogen Shot “1,1,1”



1 Dollar



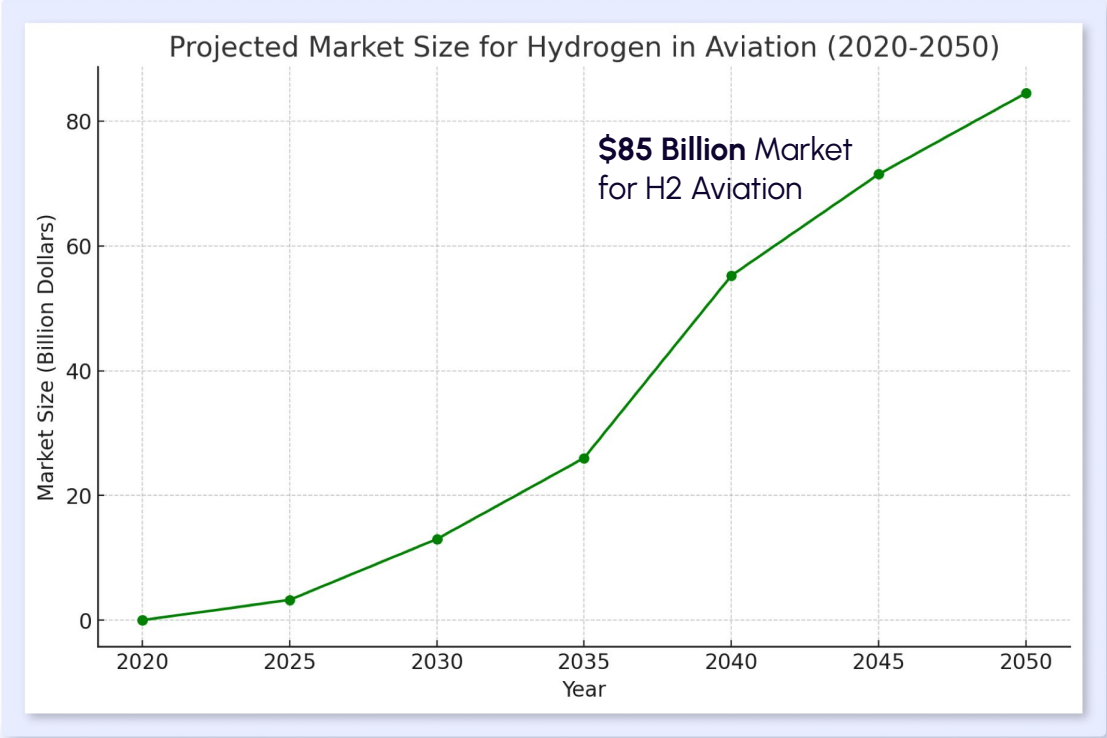
1 Kilogram



1 Decade

[Image source: DEO](#)

# Creates a Lucrative Market for H2 Aviation



# Federal Investment in Hydrogen

The federal government is investing heavily in hydrogen, with **\$8 billion** already allocated to seven hydrogen hubs. [source](#)



H2Hub Summit: Meet the  
Winners past webinar \$30





GET INVOLVED  
IN H2 AVIATION



# Upcoming Events

**Get your phones out! QR scanning time :)**

HYSKY Monthly: free H2 aviation webinars every month

HYSKY Pod: monthly podcast on YouTube

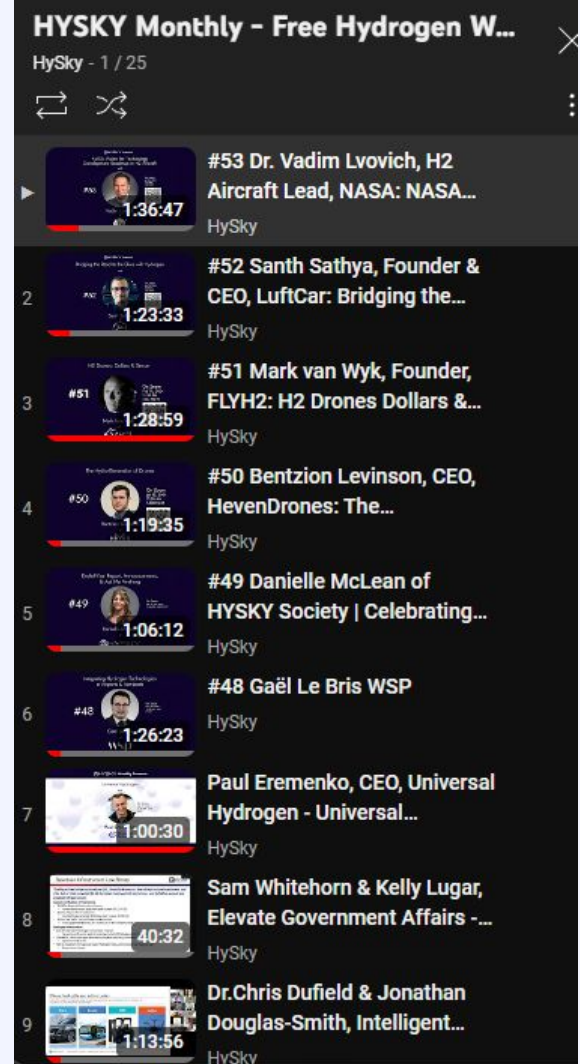
FLYING HY: save the date! Sept 4-5, 2024 in Las Vegas



# HYSKY Monthly

- Free monthly hydrogen aviation webinars
- Past webinars on YouTube
- Go subscribe now!
- All 50 episodes of HYSKY Monthly are on YouTube
- Largest collection of H2 aviation material in existence
- It helps us keep our material free

[https://www.youtube.com/@hy-sky?sub\\_confirmation=1](https://www.youtube.com/@hy-sky?sub_confirmation=1)



# HYSKY Monthly

*Free Hydrogen Aviation Webinars*



Register  
now for our  
Free H<sub>2</sub>  
Aviation  
Webinars!



**Learn from  
industry experts.**

**PAST SPEAKERS INCLUDE :**

PAUL EREMENKO, CEO OF UNIVERSAL HYDROGEN  
VAL MIFTAKHOV, CEO OF ZEROAVIA  
AND MANY MORE !



[www.hysky.org](http://www.hysky.org)



# FLYING HY

- World's largest hydrogen aviation event
- Las Vegas Caesars Forum
- Hydrogen Aviation Course Sept 3, 2024 \$895
- FLYING HY Sept 4 & 5, 2024 \$495 (no charge for speakers)
- Attendees: 3750
- Networking events and more





# CO-LOCATION ANNOUNCEMENT

COMMERCIAL  
UAV EXPO



HYSKY



HYSKY Society is bringing the **FLYING HY Conference** and  
**Hydrogen Aviation Course** to Commercial UAV Expo

SEPTEMBER 3-5, 2024 / CAESARS FORUM / LAS VEGAS



# FLYING HY 2024 in Las Vegas

## HYDROGEN AVIATION COURSE

TUESDAY, SEPTEMBER 3 | 9AM - 12PM & 1PM - 5PM

\$ 895

Hydrogen Aviation Course

Exhibit Hall

Keynotes

Outdoor Flying Demonstrations

Pilot Training

Exhibitor Showcase

Tuesday Lunch

Networking Receptions

## FLYING HY CONFERENCE

WEDNESDAY, SEPTEMBER 4 - THURSDAY SEPTEMBER 5

\$ 495

FLYING HY Conference

Exhibit Hall

Keynotes

Outdoor Flying Demonstrations

Select Workshops

Pilot Training

Exhibitor Showcase

Breakfast & Lunch (Wednesday & Thursday)

Networking Receptions



# Participation

Speakers: Email Angea Thuman [angela@hy-sky.net](mailto:angela@hy-sky.net)

Exhibit: Kat McDonald [KMcDonald@divcom.com](mailto:KMcDonald@divcom.com)

Sponsor: Danielle McLean [d@hy-sky.net](mailto:d@hy-sky.net)



# HYSKY Pod

- The only hydrogen aviation podcast
- Interviews with Dr. Martine Rothblatt, John Piasecki, and many more



# Closing Remarks

Thanks to SAE!

Attend HYSKY Monthly Free

See you in Vegas Sept 3-5, 2024

Register for Advanced Hydrogen Aerospace Technologies and Design –  
Online Short Course (Starts 8 October 2024)



**Thank You**

