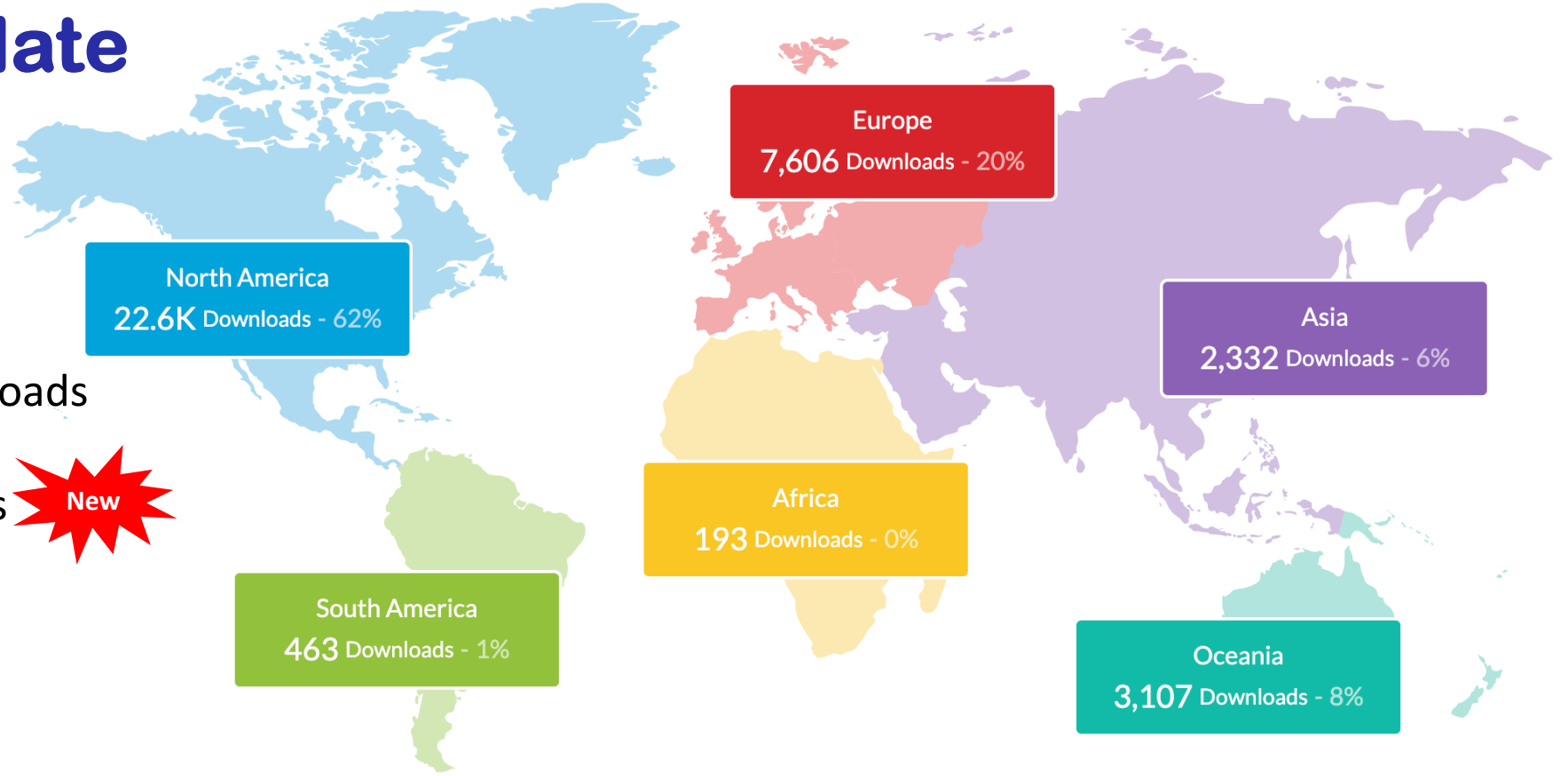




Monthly Meeting 21 November 2023

Podcast Update



The *HydrogenNowCast*

- 78 episodes, 36,300 downloads
- Recent episodes
 - H₂ as a Service for Fleets
 - Accelera by Cummins
 - Hydrogen for Aviation

HydrogenNowCast



Podcast



Everyone – Please subscribe and give us a rating!



Agenda

- News
 - Horizon Educational launches a Foundation
 - Hydrogen equipment donation to CSU
- Hydrogen Hub overview
- CHN Initiatives
 - Hydrogen transportation outlook for the Front Range
 - Underground hydrogen generation
- Future CHN initiatives – Opportunity for stakeholder input

NFPA 2: 8-hr Hydrogen Safety Training

COURSE OVERVIEW

A **comprehensive 8-hr review** of safety requirements for hydrogen **production, storage, transfer, and use.**

Certificate of Completion for CEUs



ATTENDEES

Ideal for **AHJs, safety officers, engineers** (mechanical, fire, chemical), **designers,** and **project managers.**



PROPOSED DATES

December: 15, 18

January: 5, 12, 15, 19

Group Pricing Available



TESTIMONIALS

*“It was a **great** workshop. **EVERYONE** that attended felt it was a great use of their time.”* Trina M., Project Manager, Idaho National Laboratory



Networking Social at Czero

- Wednesday Nov 8
At Czero in Ft. Collins
- Great attendance with over 40 people
- Thank you to Guy Babbitt and Czero for hosting!



News

Horizon Educational

- Horizon Educational develops, produces and distributes hands-on teaching material, STEM kits, curricula and educational programs
 - STEM Kits (Science, Technology, Engineering, Mathematics)
Electrolyzers, hydrogen fuel cells, solar photovoltaics, wind power, thermal power, saltwater batteries, super capacitors, bio-energy and more
- Horizon has created a non-profit “H2GP Foundation”
 - Brian asked to be on the board of directors



H2gp.org (coming soon)

HydrogenNowCast
12/10/21



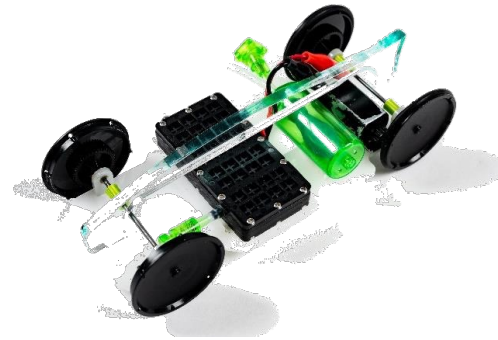
Horizon Educational Foundation

- [H2gp.org](https://www.h2gp.org)
- Nicole Weiss
H2GP Foundation Executive Director





6th-12th Grade
Showcase Events



6th-12th Grade
Showcase Events
Community Events
In School Events



4th-8th Grade
Showcase Events
Community Events
In School Events



GETTING STUDENTS
FAMILIAR WITH IMPROVING
THE "PRODUCT" BASED
ON THE RESULTS/OUTCOME

**BUILD –
MEASURE –
IMPROVE –
COMPETE**

SOLUTION TESTING

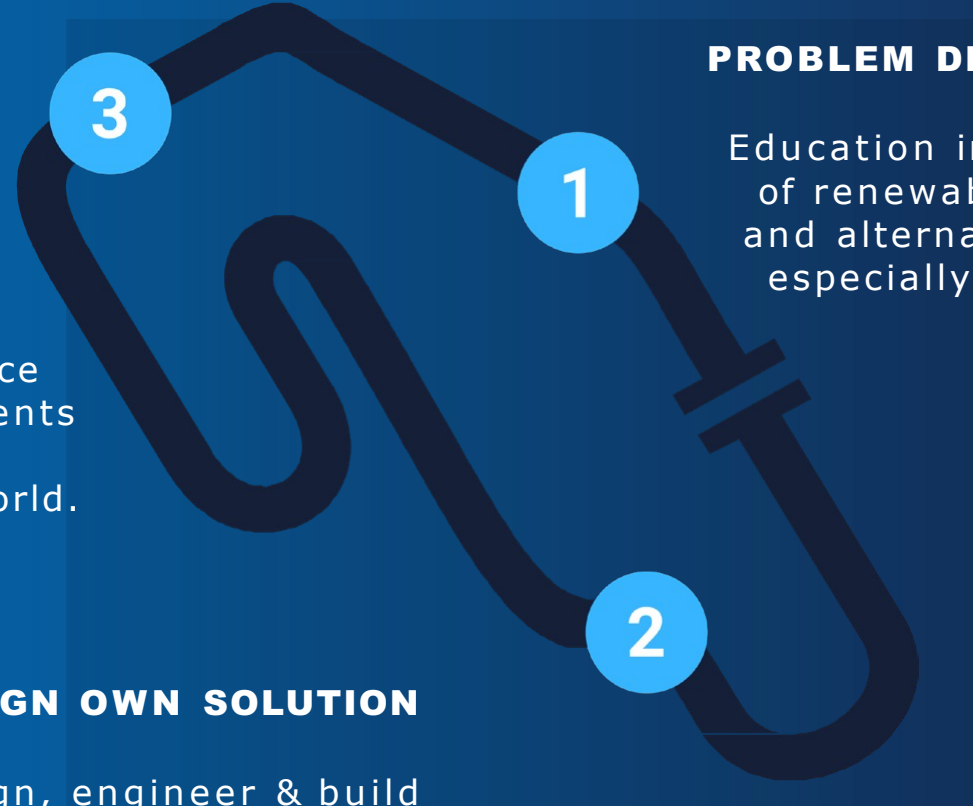
Testing of own solution in endurance race with other students from the region and from the world.

DESIGN OWN SOLUTION

Design, engineer & build a hydrogen powered remote controlled car by using different technologies, such as 3D printing, CNC, laser cutting, vacuum forming, Autodesk software.

PROBLEM DEFINITION

Education in the field of renewable energy and alternative fuels, especially hydrogen fuel cells.



JOIN THE COMMUNITY

WHAT IT TAKES TO START

- 1 FINDING PARTNERS**
- 2 SCHOOLS ON-BOARDING**
- 3 HARDWARE DELIVERY**
- 4 PROGRAM EXECUTION**
- 5 NATIONAL RACES**
- 6 WORLD CHAMPIONSHIP**
- 7 ANNUAL IMPACT REPORT**
- 8 REPEAT AND GROW**

CONSISTENT EFFORT, LONGTERM RESULTS





PARTNERSHIP SERVICE

*Sample calculation for a turnkey solution can be provided upon request.

COOPERATION THAT CAN MAKE A DIFFERENCE

PARTNER PROMOTION

OVER THE YEARS WE HAVE ACHIEVED THE BEST RESULTS WITH PROPOSED PACKAGE*:

1 PRE RACE PROMOTION

- Social Media Promotion (Facebook, LinkedIn)
- Website Presence
- Race Advertisements
- Event Flyer
- Press Release

2 BRAND RECOGNITION

- Banners
- Rollup (cobranded)
- Beach flags (cobranded)
- Wall of Fame with Sponsor logo
- Invitation posters
- Logo on cars
- Logo on team T-Shirt
- Sponsor Presentation
- Product placement

3 PROJECT EVALUATION

- Newsletters
- Event pictures & video
- Outgoing press release
- Student impact report



HARDWARE

Providing products to participating schools:

30 W PEM fuel cell
 1:10 RC car
 PEM electrolyzer
 Metalhydride cartridges



MANAGEMENT

Teachers and students support, client service:

Pre-season training
 Monthly webinars
 Access to learning platform
 Team support assistance



EVENT

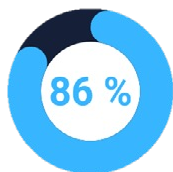
Organizing and promoting the race itself:

Event management
 Event promotion
 Partner promotion
 Photo & Video coverage

LET'S CREATE AN UNIQUE EVENT TOGETHER

BECOME OUR PARTNER

COOPERATION THAT CAN MAKE A DIFFERENCE



STUDENTS,
agreed on better understanding of challenges for 21st century including hydrogen and renewables, developing new skills and becoming more confident in solving complex problems.



TEACHERS,
find our program dangerously engaging for the students and praise its versatility, that allows each student to find its role in the team.



INDUSTRIAL PARTNERS,
see the project as meaningful and are eager to extend the cooperation on a multi-year contract after the first involvement.

THEIR OPINION MATTERS TO US

Martin, student

"I'm really happy that my school decided to go into this program, it's fun to build an RC hydrogen car with my classmates, and we also learn some more about renewable energies and hydrogen."

Anna, teacher

"That program is excellent! It's a good way to teach to our students sciences across a practical activity, they're really implicated in this project due to the race at the end!"

Carla, Principal LAUSD

"This is a type of learning experience that they couldn't get from a textbooks. It's real-world application connecting us directly to the automotive and design industry and we couldn't engage them more then with this project."

Mark, Toyota US

"It's a great way to expose high-school students to opportunities and engineering challenges using math and science so we think that it's a great match!"



ARE YOU WITH US?

ENGAGING STUDENTS



8+ YEARS

H2GP Foundation

www.h2gp.org

**THE TIME FOR HYDROGEN
EDUCATION IS NOW!**

HYDROGEN PRODUCED



100 000
LITERS

CO2 EMISSIONS



0



Hydrogen Equipment Donation to CSU

- Hydrogen tanks and fuel cells donated to CSU
 - **Thank you to Mark Read!** (Hypercube.com)
 - Four 2.5 kW fuel cells and 8.4 kg tanks at 3,000 PSI
- Coincidentally
 - Two Nel electrolyzers and PDC compressor available (different source)
 - Looking for \$59K in donations to acquire
- Planned system
 - Energy back-up system
 - Solar or wind energy storage
 - For student learning
 - Eventually to be donated to some non-profit (Habitat for Humanity, etc).

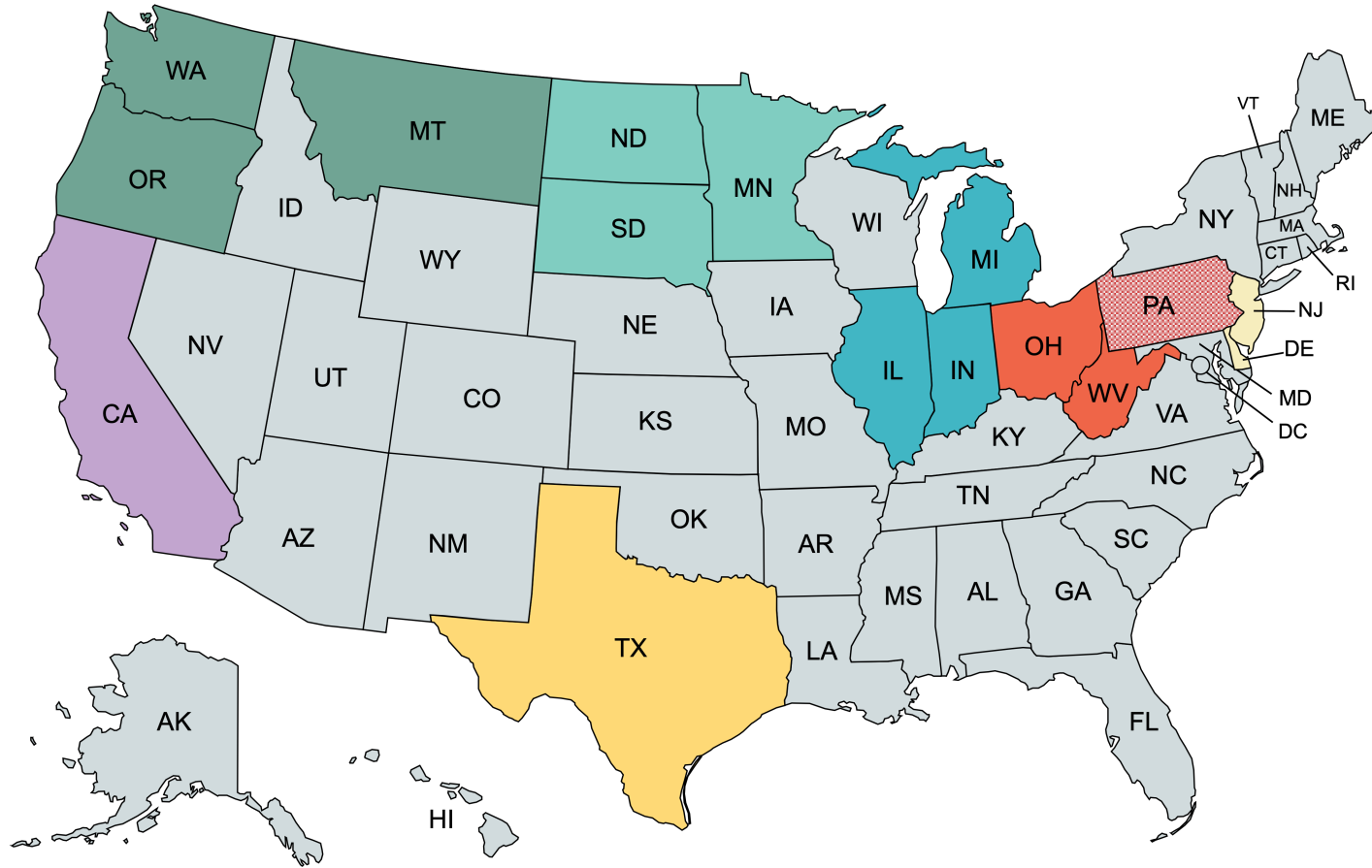


Hydrogen Hub Review

Hydrogen Hub Update

DoE held overview meetings for the 7 hubs

slides Available



- ARCHES \$1.2 B
- Pacific NW \$1 B
- Mid-Atlantic \$750 M
- Appalachian \$925 M
- Appalachian & Mid-Atlantic
- HyVelocity \$1.2 B
- Heartland \$925 M
- Midwest \$1 B

**30% of US area
43% of US population**

Hub Summary

Pacific NW

- Up to 8 projects
- End uses
 - Long-duration energy storage
 - Refineries
 - Heavy-Duty (HD) Trucking
 - Buses
 - Aviation
 - Maritime
 - Light industrial
 - Fertilizer
- Tribal engagement and partnerships

Heartland

- Fertilizer production centric

Midwest

- 4 pillars
 - Core of Nuke, renewable natural gas with CCS
 - Transportation corridor
 - Financially strong project sponsors
 - Quality jobs and entrepreneurship
- Examples
 - Nuke electrolysis
 - LH₂ for midwestern logistics
 - Northern Indiana clean H₂ node – BP
 - H₂ for Mich. Freight and transit
 - H₂ truck stop of the future
 - H₂ fueling station expansion
 - Midwest mobility project
 - H₂ pipeline distribution end-use

Hub Summary (continued)

California

- Develop clean hydrogen market and ecosystem in California and beyond
- Objective to fully-decarbonize the regional economy
- H₂ from electrolysis & biomass
- H₂ transport, storage and pipelines
- Sectors (by 2045)
 - Transportation 59%, Power 23%, Maritime 8.7%, industry 5.6%, ports 3.7%

Mid-Atlantic

- Only solutions that reduce GHG + “criteria pollutants”
- Create union jobs
- Reduce emissions at industrial facilities & transportation (HD trucking, buses, ports, marine, aviation)
- H₂ production via electrolysis from wind, solar and nuke
- Convert large-diameter oil pipeline to H₂ storage (Smartpipe liner, www.smartpipe.com)

Hub Summary (continued)

Appalachian

- Ammonia production
- Electrolysis
- Biomass to H₂
- HD trucking (concrete and port vehicles)
- “Residential fuel cells”
- Food waste (biomass) to H₂
- Plug Power / Amazon
- H₂ production with CCS for SARTA (Stark Area Regional Transit Authority, Ohio)
- Retrofit mining trucks to fuel cell
- NG & RNG to aviation fuel

Gulf Coast

- Not yet available

Continuing the Hydrogen Hub Efforts in the Rockies

- CHN and CCIA are considering continuing the proposed H2 Hub efforts here
- CHN has requested a summary of the WISHH proposal
 - That info may help us connect with other proposal contributors.

Hydrogen Hub Take-Aways - from Hydrogen Forward



1. The hubs pledge to maintain as much open communication as possible throughout the negotiation process
 - Acknowledging concerns around limited information sharing during the bidding process
2. Community benefits are at the center of project development
 - Community Benefits Plans were weighed heavily during the initial application process
3. Labor commitments promise significant workforce benefits
 - Several hubs have already established partnerships with universities, labor unions, federally recognized tribes, and other stakeholders to create pipelines for hydrogen jobs
4. Environmental concerns and GHG reduction remain top of mind
5. Variety of end-uses illustrates hydrogen's broad decarbonization potential across sectors.



Initiatives: Hydrogen Transportation

Hydrogen Trucks Operating in Colorado

- Rising Creek Transportation LLC
Operating west of Colorado Springs
 - Roy Hensler, Head of Customer Validation at Nikola Motor Company
- Nikola trucks
- Hyla Fueling
 - LH₂ mobile fuelers



Creating the Hydrogen Transportation Market

Four components needed

1. Fuel suppliers (and investors)
2. Users (fleets)
3. Commercial fuel cell vehicle sources
4. Vehicle funding support (to achieve parity with gas & diesel)

Hydrogen Transportation Outlook for the Front Range

- Public fuel stations (supply)
 1. New Day Hydrogen
 2. BNG Clean Fuel
 3. CSU
 4. DOT grant proposal (“Charging & Fueling Infrastructure” CFI)
- Users
 - Commercial fleets
 - Captive fleet of light-duty
- Funding resources (vehicle & infrastructure)
 - Colo Energy Office, Clean Transportation Resources Factsheet
tinyurl.com/CEOfactSheet

1. New Day Hydrogen

- One fuel station planned
 - I-70 and I-25 (Washington) (tentative)
 - Modular with on-site hydrogen generation
 - 210 kg per day with growth to 420 kg
 - H35 & H70
- Status
 - Working to close initial funding round
 - Several users (fleets) enlisted
 - Commercial fuel cell vehicle sources identified
 - Partial funding committed
 - Including Colorado OEDIT grant



2. BNG Cleanfuel

- 3 public stations planned
- Using delivered liquid hydrogen (LH₂)
- H35 & H70.



3. CSU Fuel Station

- Complete modular fuel station donated to CSU by Nel Sept 2020
 - Container 1 – Electrolyzer and power electronics
 - Container 2 – Compressor, tanks, chiller and dispenser
- After a 3-year delay obtaining permits, station now in-work
- Container 1 configuration no longer meets fire code
 - Decision was made to relocate electrolyzer and power electronics inside Powerhouse
 - Adding low-pressure (3,000 PSI) storage
 - Powerhouse work largely complete
- Container 2 (dispenser) work
 - Siting and installation of container (outdoors)
 - New high-pressure (1,000 bar) tanks
 - Check-out of compressor, control systems & recommissioning
 - 1-year timeline?



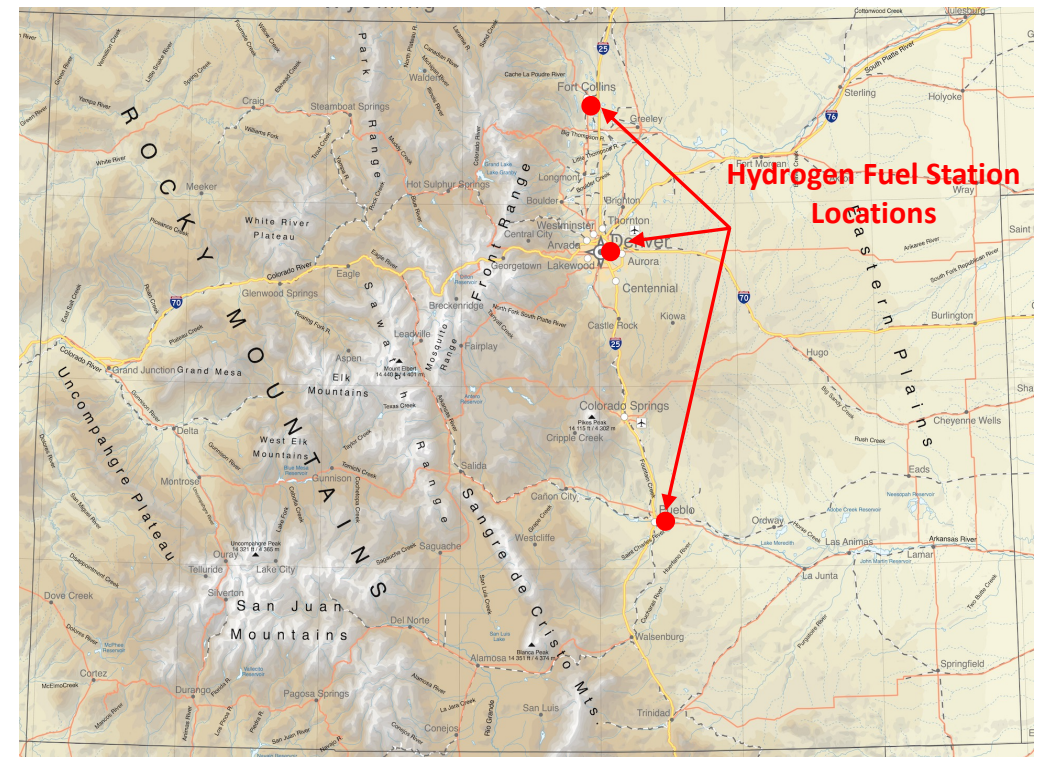
**COLORADO STATE
UNIVERSITY**

4. DOT Proposal

- Charging and Fueling Infrastructure (CFI) grant
 - Opportunity ID: 693JJ323NF00004
- Joint submission between CSU and New Day Hydrogen
 - Proposal submitted May 30, 2023
 - Still awaiting award announcement
- 3 stations: Ft. Collins, Denver, Pueblo.

DOT CFI Grant Proposal

1. Hydrogen fuel stations near three CSU campuses
 - Ft. Collins – CSU Powerhouse
 - Denver – Near CSU Spur campus
 - Pueblo – Industrial park
2. Workforce training
3. Enlisting fleet users for medium-duty vehicles
4. Funding for vehicles (additional sources)
 - To bring H₂ vehicle cost to parity with gas and diesel
 - From State and federal incentives.



User Enlistment - Light Duty “Captive Fleet”

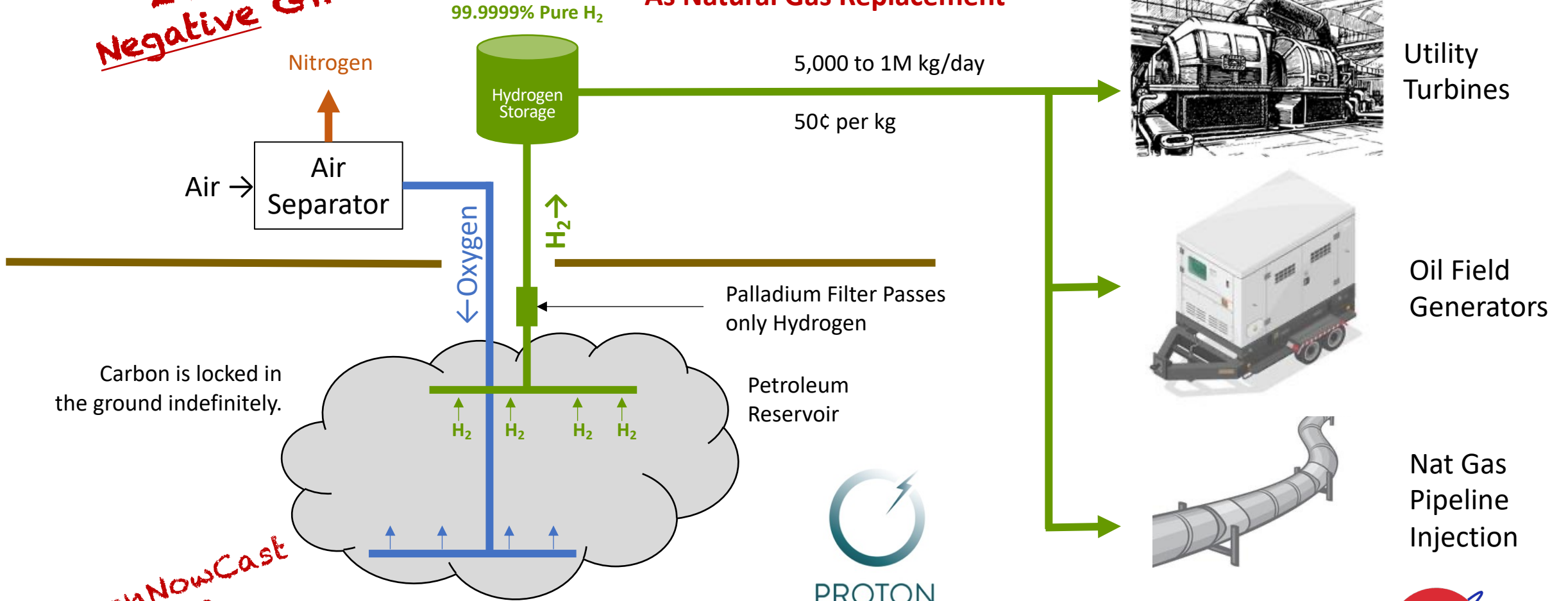
- Concept
 - Enlist local users to operate passenger vehicles (“beta testers”)
 - Fleet deployment in advance of automaker sales and service
 - To promote hydrogen vehicles to public
- Vehicles
 - Lease or purchase by users
 - Applied graphics promoting hydrogen
 - Vehicle hydrogen service performed in California
 - Loaner vehicle available during servicing.

Initiatives: Underground Hydrogen Generation

Underground H₂ Generation

Zero to Negative GHG

**High-Volume Low-Cost Hydrogen
As Natural Gas Replacement**



*HydrogenNowCast
12/23/22*



PROTON
TECHNOLOGIES

<https://proton.energy>



For Group Discussion

- Background – Current role of CHN
 - A communications hub linking shareholders
 - Education through monthly meetings, newsletter and podcast
 - Influencer with state and federal agencies
 - Project initiatives
 - Fueling stations, underground hydrogen generation, user enlistment
 - Hydrogen advocacy through speaking engagements
 - Networked to other hydrogen advocacy organizations
 - FCHEA, RHA, CHBC, Stationary Fuel Cell Collaborative, CTE, GHC, US H₂ Alliance
- What do the CHN Stakeholders need from the organization?
 - A “Trade organization”?
 - Increase scope of CHN by increasing budget through corporate sponsorship
 - Lobbying?
 - Help with Grant Applications?



HydrogenNowCast



Podcast