



Essential Technology for the Clean Hydrogen Economy

September 2024

GEN H₂
DISCOVER HYDROGEN

GenH2 Overview

Company

- Founded in November 2020.
- Headquartered in Titusville, FL with 60,000 sq. feet (5,600 sq. meters) of office and manufacturing facilities for production of hydrogen liquefiers and storage solutions.
- Experienced Management Team with unparalleled expertise in liquid hydrogen technology.
- Globally recognized as leaders in cryogenic engineering.
- **NASA Hall of Fame Inventors** on staff.

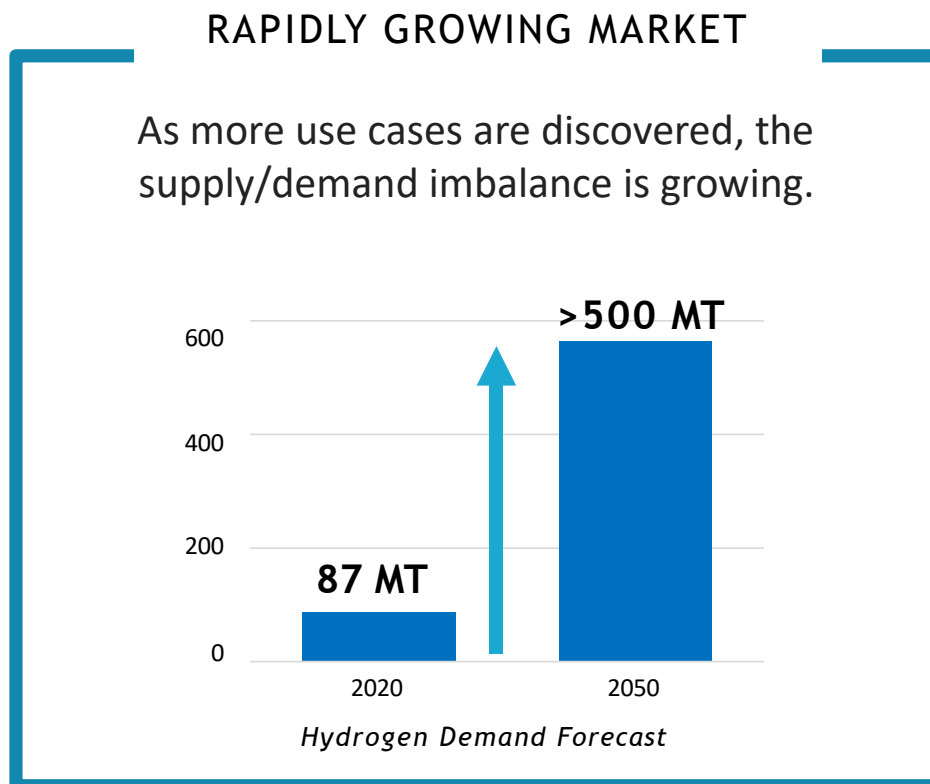
Key Technology Highlights

- Advanced Technology for modular, distributed hydrogen liquefaction systems:
 - Closed loop helium cooled systems without LN2 pre-cooling.
 - Provides control over cost and supply chain.
- Revolutionary Controlled Storage for liquid hydrogen:
 - Active cryogenic refrigeration allows constant control of fluid state.
 - Eliminates substantially all loss of hydrogen during tanker transfer, storage, and dispensing which can exceed **20%** (per transfer) in conventional storage systems.



Market View: Global Hydrogen Adoption

Hydrogen is increasingly recognized as the key to reaching NetZero because it is very versatile as a zero-emissions fuel and offers unlimited duration energy storage.



The Hydrogen market has been rapidly growing in the past 5 years, but the passing of the Inflation Reduction Act has accelerated it even further. As more companies produce Hydrogen, storing and transporting becomes the biggest obstacle for the Hydrogen economy.

Sources: S&P Global Commodities Insights Report - *Hydrogen Supply and Demand Outlook, 2020-2050*: ScienceDirect, global hydrogen production is expected to increase to over 500 million metric tons by 2050 with nearly all of it relying on advanced technology that uses less carbon.
McKinsey, clean hydrogen demand could account for 73-100% of total hydrogen demand by 2050

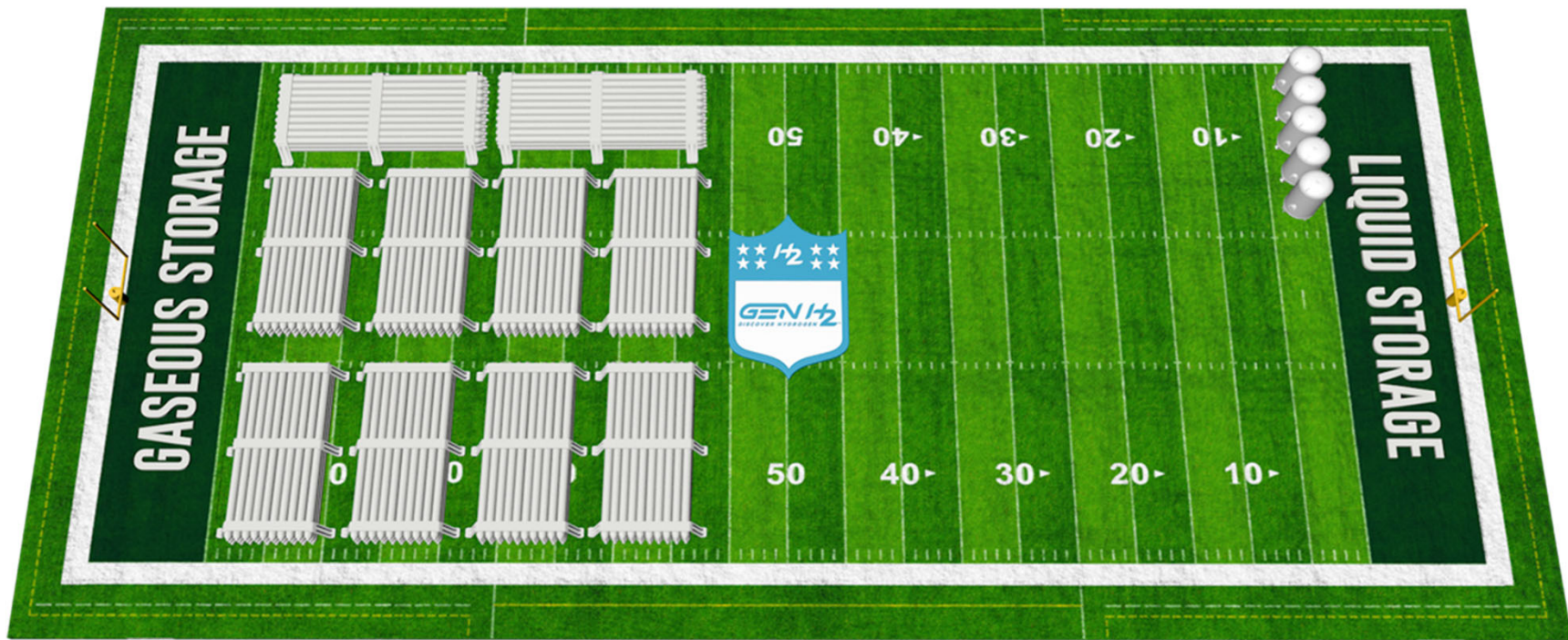
Addressable Hydrogen Mobility Market Summary: 2024-2031

Summary of the Total Addressable Market for Mobility applications with GenH2 projected penetration (in \$billions)

End-use Case	Total Addressable Market
Heavy Duty Trucking (North America)	9.1
Heavy Duty Trucking (Europe)	12.6
Mass Transit (North America)	2.2
Mass Transit (Europe)	4.3
Closed Circuit Ferry Vessel Marine (Global excl China)	6.6
Rail (North America + Europe)	8.1
Backup Power	8.8
	51.7

GASEOUS VS LIQUID HYDROGEN STORAGE

Footprint to store and dispense equal amounts of GH2 vs. LH2



Liquid Hydrogen Advantages

Higher Density than Gaseous



Higher density = Improved Logistics

Liquid Hydrogen

Compressed Hydrogen Gas

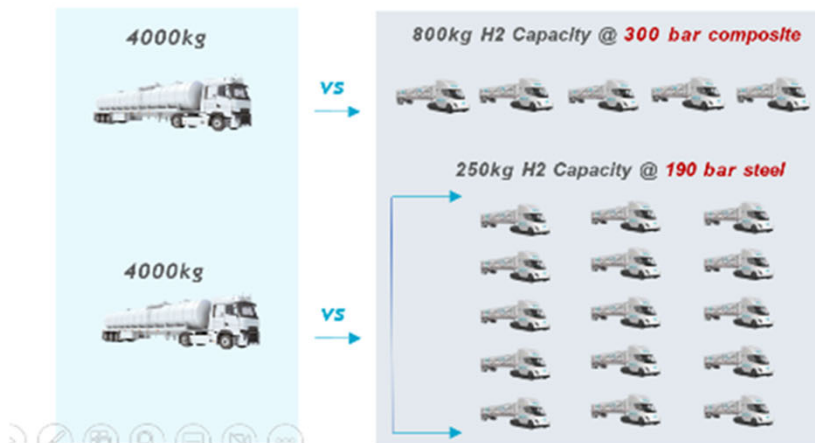
Due to its **higher volumetric energy density**, LH₂ solutions require **minimal physical footprint and cost**, enabling hydrogen infrastructures to be more **flexible** and **scalable** across more industry verticals.

Safer than Gaseous



- Average 1-2 Bar of pressure in storage tanks reduces the likelihood of fatigue-induced structural failures and reduces weight.
- When liquid hydrogen becomes gaseous, it quickly dissipates, avoiding possibility of combustion
- Requires temperatures far below combustion temperature and provides very low potential burst energy

Increased Range***



The Need for Reliable Supply and Logistics

Hydrogen cannot be a viable energy source until the reliability of supply improves and cost decreases. Reliability of supply will not be addressed by a handful of regional hydrogen hubs, and costs will not be competitive until **zero-loss transfer and storage** is widespread.



The Estevan mine has potential to be a significant source of hydrogen supply



GenH2 is uniquely positioned to prevent hydrogen losses due to storage and transfer which is necessary for economic viability of projects such as Estevan

Hydrogen Liquefaction & Storage Solutions

GENH2 PRODUCT PORTFOLIO

Hydrogen Liquefaction

- Small (20 - 200 kg/day)
- Regional Industrial (1000 – 5000 kg/day)
- Industrial (5 TPD – 30 TPD)
- Mega scale (Up to 100 TPD)

Zero-Loss Storage and Transfer

- Integrated Refrigeration and Storage
- Stand-alone Storage Powered by Turbo-Refrigeration
- Zero-loss Transfer and Zero-Boiloff

On-board fuel tanks for ground and aviation applications

- Sub-cooled LH2 with dynamic evaporator
- Cryo-adsorption



GenH2 Proprietary Technology

Over 60 patents, provisional patents, NASA exclusive patent licenses, and patents to be filed...



Heat Exchanger technologies for LH2 tanks



Helium Refrigeration, H2 liquefier and cold box structures



Cryostats Test Simulation Platform Instrumentation



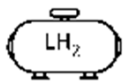
SMART Refrigeration for Active Pressure Control



Advanced LH2 Thermal Materials/ Systems and Cryogen Storage



Monitoring systems for standalone storage and transfer



Modern LH2 transfer system



Controlled refrigeration and transfer components



Small scale liquefaction plants-cryocooler (LS20 to LS50)



Small scale liquefaction plants-reverse Brayton (LS100 to LS1000)

GenH2 Technology

[Click to View Zero-Loss Video](#)



Existing Liquid Hydrogen Value Chain



GenH2 Liquid Hydrogen Value Chain



Sample Economics: GenH2 Rate of Return (Heavy Duty Trucking)

Heavy Duty Truck Refueling Depots (\$ in MM\$)

Capex		
Standard Fuel Station Capex (dispenser + insulated tank)	Incremental Cost of GenH2 Controlled Storage (RS1500)	Total Station Capex
\$3.6	\$2.3	\$5.9
61%	39%	100%

LH2 Loss Prevention	
Number of Storage Tank Fills from Tanker per Year	Annual Cost Savings ¹
360	\$2.6

Return on Investment			
RoR before US Infrastructure Tax Credit (ITC)	Payback Period in Months	RoR with 30% US ITC	Payback Period in Months
116%	10	166%	7

¹ Annual Cost savings is based on preventing average loss of 20% hydrogen during Storage Tank Fill at an average cost of \$9.50/kg and \$.011/kwh for power

NASA Ground Operations Demonstration Unit for Liquid Hydrogen (GODU LH2 Project)

Project objective: Utilize active refrigeration to eliminate the loss of liquid hydrogen during transfer and storage.

NASA historically had experienced LH2 losses of approximately 50% during ground operations due to continuous heat leak, transient chill down of warm cryogenic equipment, and venting.

The project concluded with demonstrations at Kennedy Space Center in 2015 (Senior Principal Investigator – James Fesmire, Chief Architect GenH2)

Project results confirmed zero-loss tanker transfer at 33%, 67% and 100% fill levels utilizing Cryogenic Controlled Storage technology.



Cryogenics Test Laboratory at NASA Kennedy Space Center, Florida.

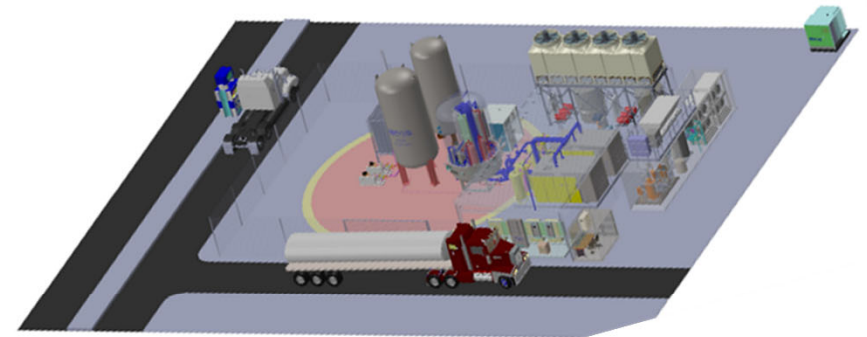
GenH2 Commercial Product Applications



LH2 storage and dispensing for Truckstop operations



LH2 storage and dispensing for passenger cars



1-5 tpd hydrogen liquefaction production facility



LH2 storage and dispensing at mass transit dispatch centers



Mega scale LH2 storage



Marine transport



On-board fuel tender car for locomotives

GenH2 Commercial Product Applications



Link to GenH2 Zero-loss transfer videos

Bus Use Case video link:
<https://vimeo.com/945373486?share=copy>

Truck Use Case video link:
<https://vimeo.com/945376651?share=copy>



On-board LH2 fuel tanks for aviation
Link to GenH2 liquid on-board video

UAV video link: <https://vimeo.com/945487596?share=copy>



Multi-simulation LH2 testing platform



Mobile hydrogen liquefaction and dispensing

Customers and Partners



Estevan Project: A Great Opportunity

Estevan is in a position to take a leadership role in the global clean energy initiative:

- An opportunity to supply a significant amount of clean energy for industrial and mobility applications
- An opportunity to make a material contribution to the achievement of net-zero carbon emissions targets
- An opportunity for meaningful collaboration between public and private industry
- An opportunity for effective repurposing of regional attributes:
 - Natural Resources
 - Human Resources
 - Infrastructure
 - Capital

Estevan – Reinventing the Community, Reinventing Energy Production

Thank you!

Questions?

www.GenH2.com



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