



*Cooler By Design.®*

# Chart Industries Enabling Zero-Emission with LH<sub>2</sub> systems

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LISW25

# Chart Industries

\$ **4.16B USD**  
Revenue in 2024

 **NYSE: GTLS**

 **11,500**  
Global team members

 **64**  
Manufacturing sites globally



**Global leader in liquid hydrogen tanks**  
**> 900 large-volume LH<sub>2</sub> tanks built**



**Bunkering**

**LH<sub>2</sub> Value Chain**  
Form Source to Consumption

**Propulsion**

**Transport**

**Liquefaction**

**Enabling Zero-Emission Oceans**



**Engineering**



**Manufacturing**



**After-Sales Service**

# Onboard Vessel Bunkering System to Storage

## ✓ Key Attributes

- Safety
- Efficiency
- Scalability

## ✚ Chart's Bunkering Systems

- Design: Vacuum-insulated bunkering lines with quick couplings and break-away devices
- Operation: LH<sub>2</sub> is transferred from shore or ship-to-ship via pressure or cryogenic pump systems
- Integration: Modular and compliant with class society standards

VJ Flexible hoses



Bunker tower



Bunker pump



Dry Disconnect Coupling



Gas regulating Valves





# Onboard LH<sub>2</sub> Storage

**Technology:** Horizontal, double-walled cryogenic tanks with multi-layer vacuum insulation

**Capacity:** Scalable from 40 m<sup>3</sup> to over 1700 m<sup>3</sup>

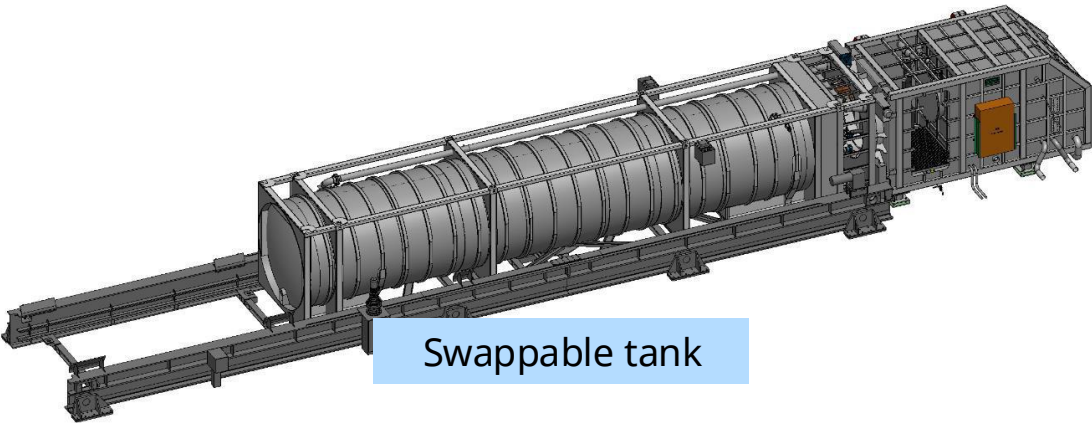
**Safety:** Equipped with pressure relief valves, vent systems, and boil-off gas management

**Materials:**

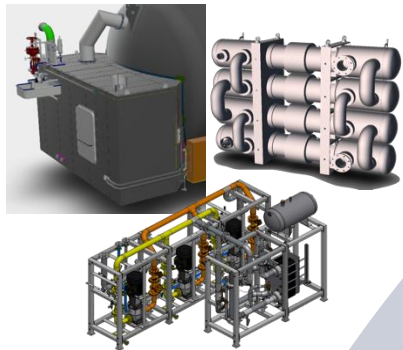
- Inner Pressure Vessel: high-grade stainless steel (e.g., 316/316L)
- Outer Jacket: stainless steel (e.g., 304/304L)

PARAMETER	UNIT	VALUE
Gross volume	m3	40 - 1700
Maximum allowable pressure PS (for meeting 15 days holding time)	barg	5 – 9.9
LH2 mass contents at filling limit 98% at Maximum allowable pressure PS	kg	1,700 – 98,000
Usable LH2 tank mass at operating pressure (@ 5% heel)	kg	1,300 – 83,000
Operating pressure (assumed 3 barg FC supply pressure)	barg	4 - 5

Fixed tank



# From Vaporisation to Consumer



**Secure Transfer:** Double-walled insulated conduits ensure safe and efficient hydrogen delivery to fuel cells.

**Smart Monitoring:** PLC systems track flow and pressure in real time, detecting anomalies to maintain safety and performance.

**Purpose:** Converts liquid hydrogen into gas for fuel cell use.

**Components:** Product and PBU vaporizers located in the Tank Connection Space (TCS).

**Support System:** Heat Transfer Fluid (HTF) ensures efficient and stable vaporisation.



Supports clean propulsion by aligning hydrogen systems with IMO decarbonisation goals, enabling zero-emission marine transport.





# Projects



# Debunking LH<sub>2</sub> Myths & Call to Action



1. Hydrogen is unsafe
2. Storage is inefficient
3. Hydrogen isn't scalable for shipping
4. LH<sub>2</sub> is inefficient
5. Infrastructure is lacking
6. Fuel cells aren't ready



1. Proven safe in aerospace & industry with proper design
2. Chart insulation achieves >99% boil-off reduction
3. Containerized & swappable storage + bunkering networks enable global scale
4. Competitive delivery costs
5. Certified modular systems
6. PEM fuel cells already tested in maritime pilots



- Join the LH<sub>2</sub> transition
- Collaborate on infrastructure and standards
- Align with regulatory bodies
- Drive maritime decarbonization together



[www.chartindustries.com](http://www.chartindustries.com)

