



Hydrogen Economy Enabling Technologies: Storage, Infrastructure, and Vehicles

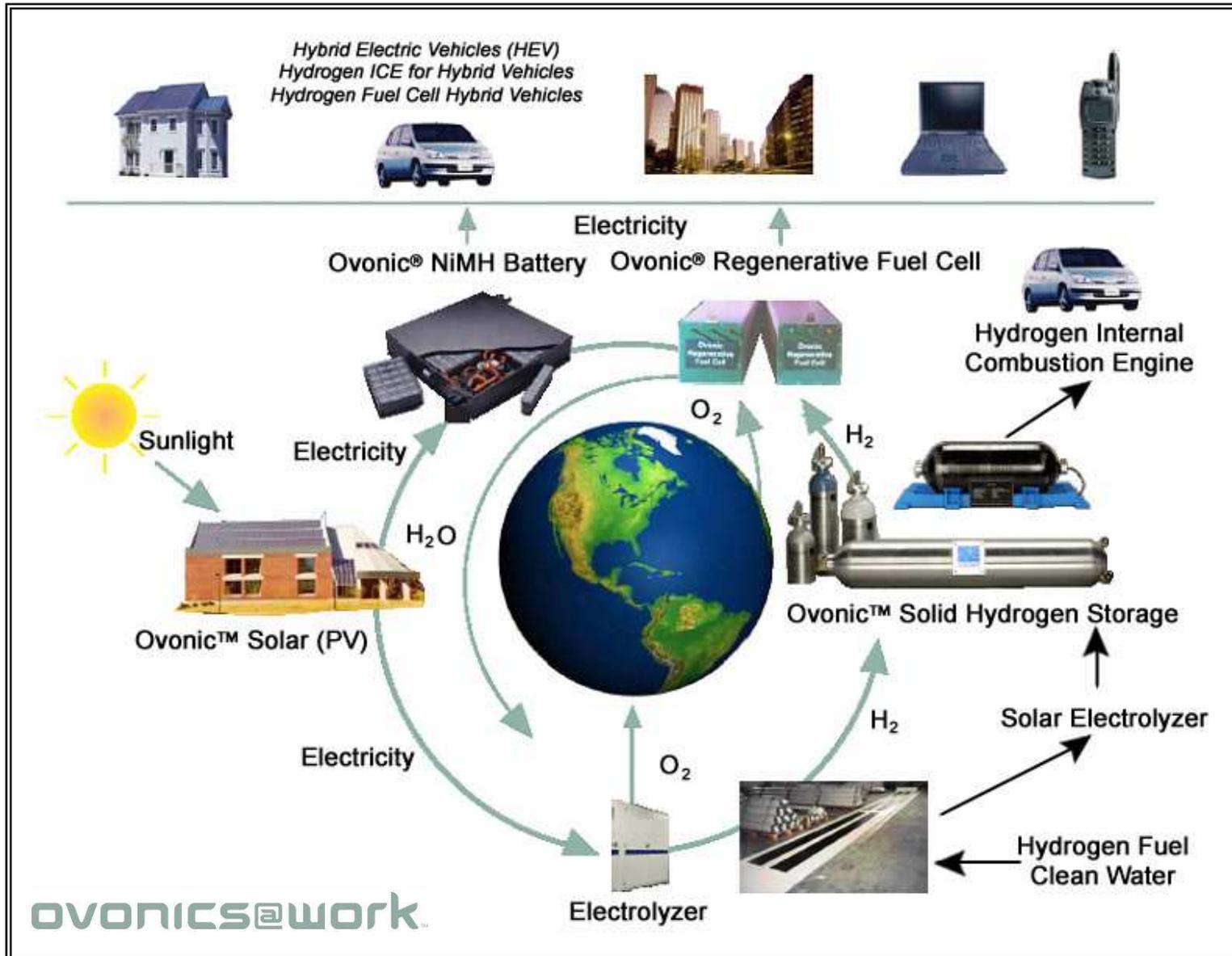
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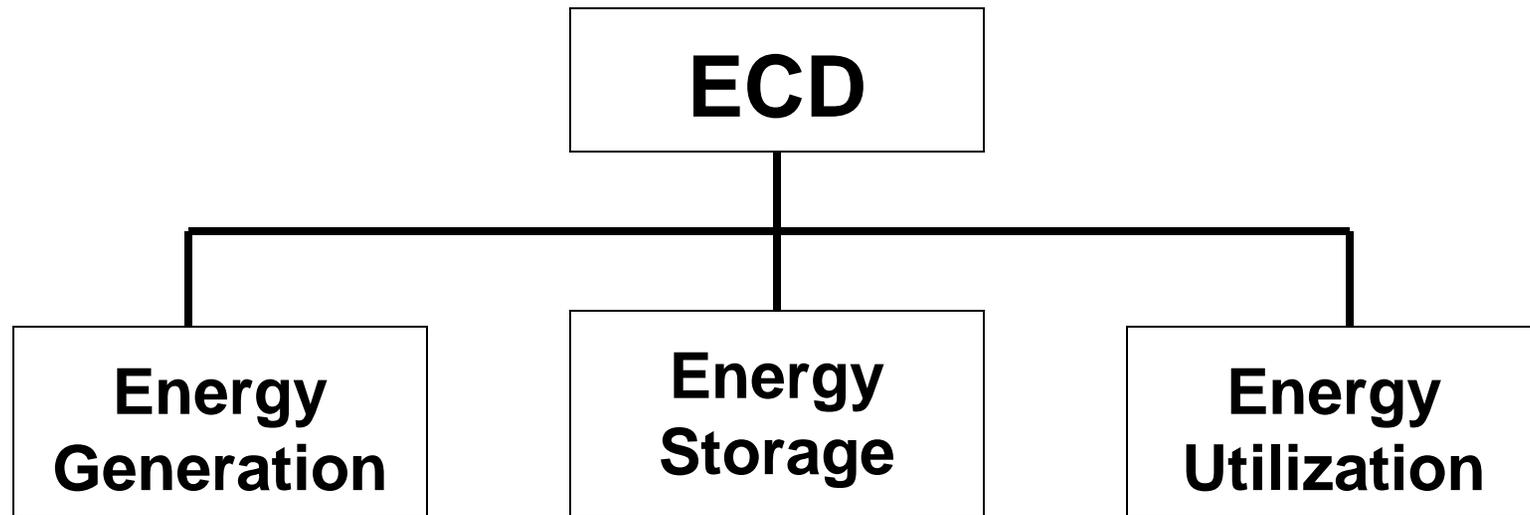
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**CARB ZEV Technology
Symposium – Sept. 2006**

Ovonic Total Energy Solution



Current Technology Status



Photovoltaics

- In Production (Uni-solar)

NiMH Battery

- In Production (Cobasys JV)

Fuel Storage

- Portable – In production with DOT approval
- Bulk – Validation and commercialization 2-3 years
- Transportation - Validation and Commercialization 2-3 years

Industrial/off-road

- Airport utility vehicles, forklifts, UPS -Validation and Commercialization 1-3 years

Transportation on-road

- Passenger Vehicles, Shuttle Vans, Transit Bus – Validation and commercialization 2-3 years



The 30 MW annual capacity photovoltaic manufacturing machine using ECD
Ovonic's proprietary continuous roll-to-roll solar cell deposition process.

ECD/Uni-Solar

Auburn Hills, Michigan, USA





Shade and Charging Shelters



3.5 kW EV Charging Station



10 kW EV Charging Station



12 kW School Lunch Shelter



30 kW Parking Shade Structure

Commercial Applications

On Standing Seam Metal Roofing



148 kW, Australia 2002



300 kW, China 2004



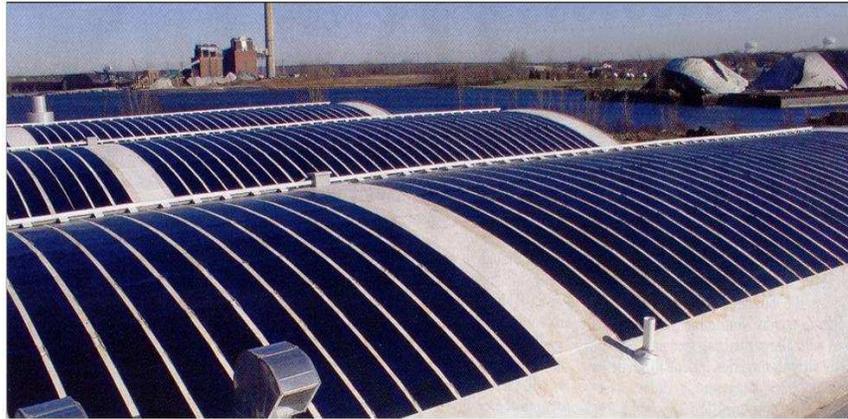
52 kW, Germany 2003



80 kW, Spain 2003

Commercial Applications

On Membrane Roofing



Grand Valley State University, MI



Alwitra, Germany



Sarnafil, Germany



Solar Integrated Technologies, Los Angeles, CA



80 KW School, San Diego



100 kW Instructional Media Center, San Diego



200 KW Hawthorn Machinery, San Diego



340 kW Coca-Cola, Los Angeles

Industrial Roofing Applications



330kW membrane roofing at the Coca Cola plant in Los Angeles, California.



California's First Solar Project to Power Oil Production

UNI-SOLAR
United Solar Ovonics



This 500 kW UNI-SOLAR system is the largest array of flexible, amorphous-silicon solar technology in the world.

OVONICS@work

Reliable Battery System Solutions



HEV

NiMHax.

Looking for high power HEV packs? COBASYS has the solution for you. Start with our HEV modules like the Series 1000 or Series 4500, and we can design a plug and play solution for your needs.



HD HEV

NiMHax.

Start with our high power modules, design a pack to meet your needs, and then combine packs to meet your heavy duty requirements.



42V

NiMHax.

Don't settle for less. Combine the industry's leading NiMH technology with COBASYS' capability to structure a 42V system that is right for you.



EV

NiMHax.

If high energy is your desire, select the Series 9500, the optimum solution for your EV needs. Call us to develop a system for you.

The First Name in Nickel Metal Hydride Battery Solutions



COBASYS

3740 Lapeer Road South
Orion, MI 48359
Tel. 248-620-5700
sales@cobasys.com

www.cobasys.com

OvMH Storage Technology

Special Features

- Reversible
- Compact
- Fast refilling
- Low pressure operation
- Packaging flexibility

Benefits by Market

Portable Power Canisters:

- Transportable
- Long run time
- Lower O&M costs

Vehicles:

- Increased range
- Lower fuel cost
- Less radiator required

Bulk Storage/Infrastructure:

- Directly refilled from an electrolyzer or fuel processor

Storage Products

Portable Power Canisters



Bulk Storage/
Infrastructure



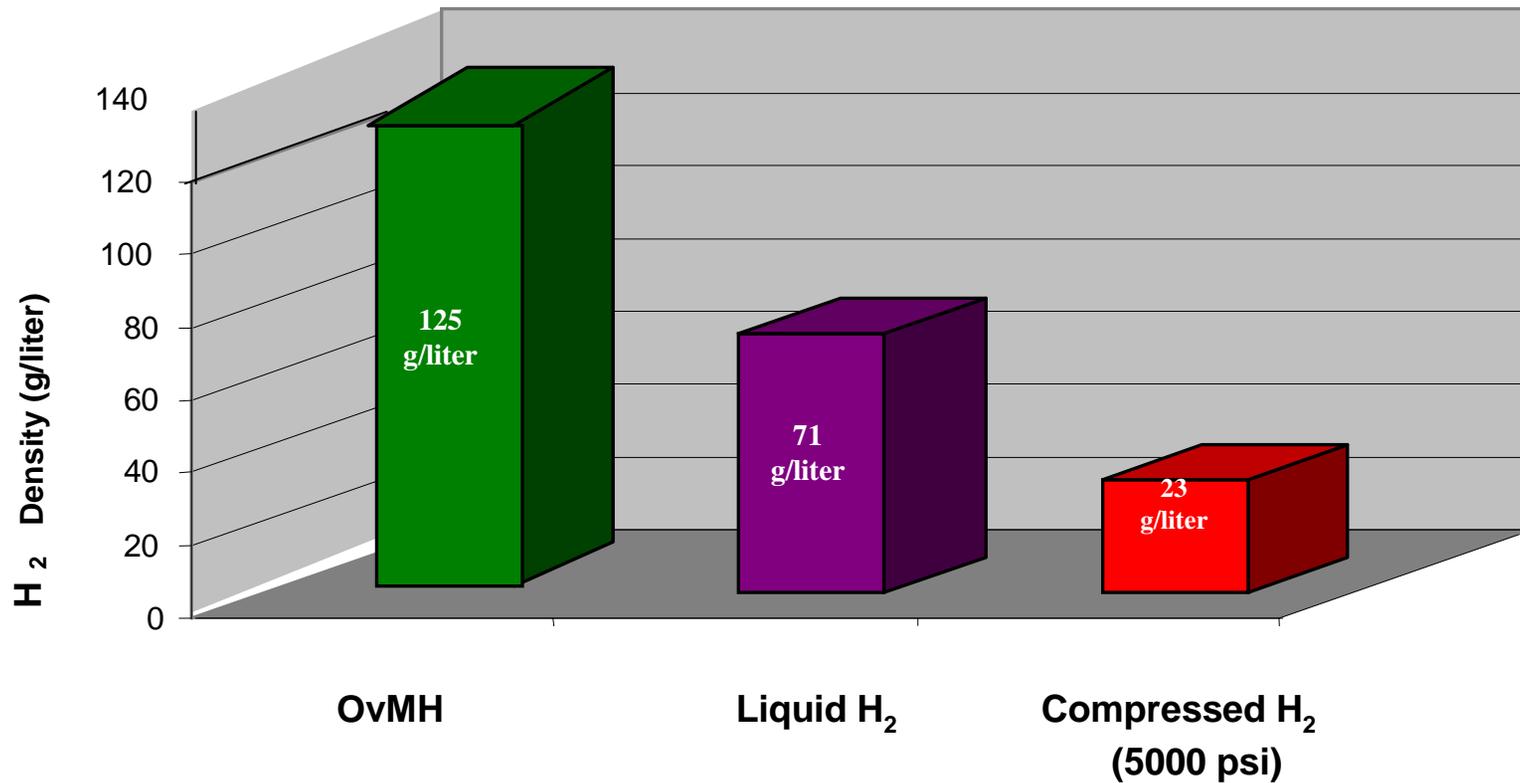
Passenger

Vehicles

Industrial
Truck



Materials



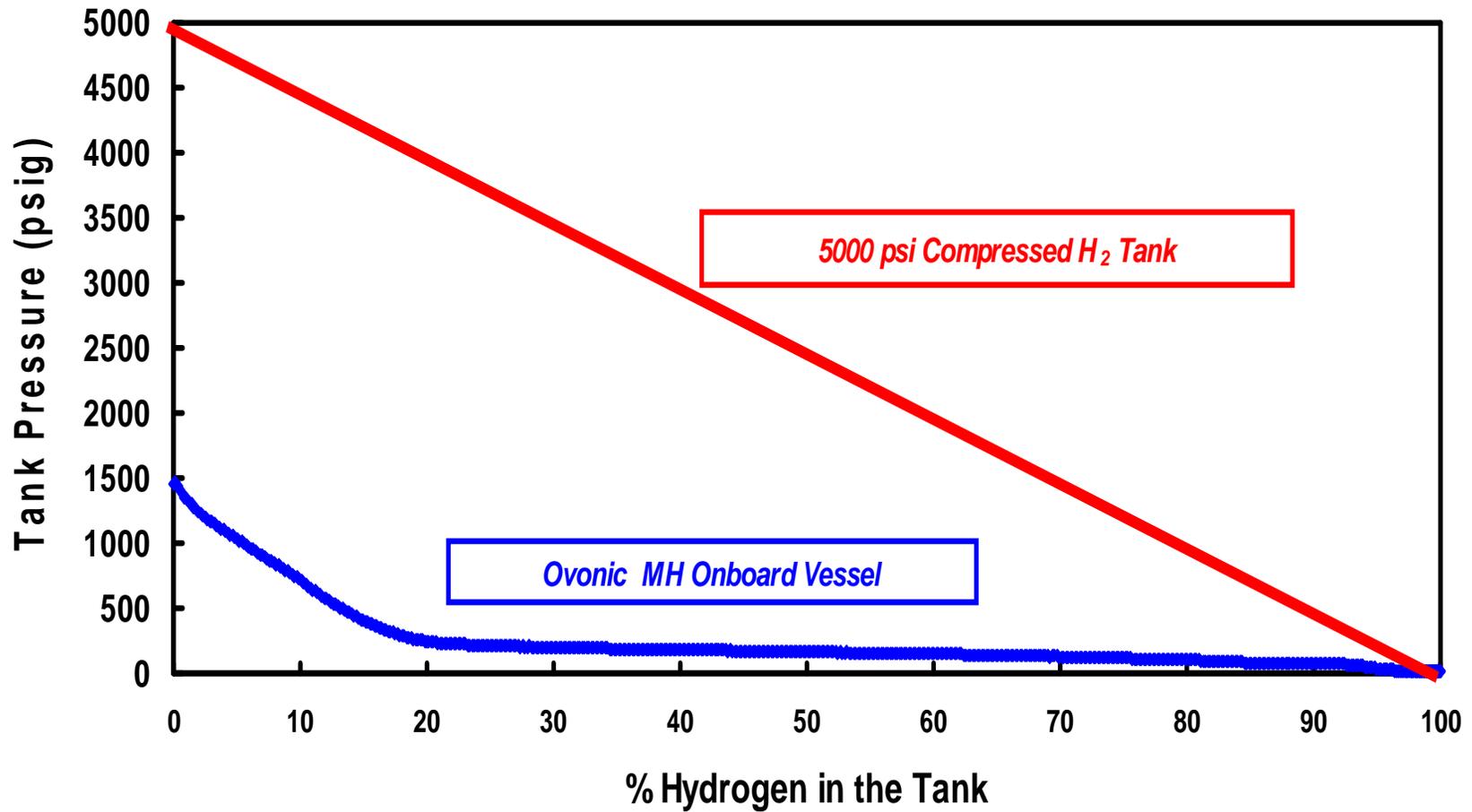
OvMH has up to 5.4x the energy density per liter when compared to the more popular compressed H₂ at 5,000 psi

50 Liter Onboard Vessel (13" dia., 33" long)



	Current Metal Hydride psig	Next Generation Metal Hydride psig	Compressed H ₂ , psig	
	@ 1,500	@ 5,000	@ 5,000	@ 10,000
H ₂ Capacity (kg)	3.0	3.2	1.17	1.96
Total Weight (kg)	190	167	30	56
Weight %	1.58	1.92	4.0	3.5
Volume (g/liter)	60	64	23.4	39.2

Low Pressure



Target Markets & Applications

Portable Power Canisters

- Professional cameras
- Surveillance systems
- Military
- Emergency power



Vehicles

- Industrial trucks
- Buses
- Passenger cars, taxis
- scooters



Bulk Storage/Infrastructure

- Renewable power facilities/generators
- Hydrogen fuel stations
- Emergency & isolated energy storage

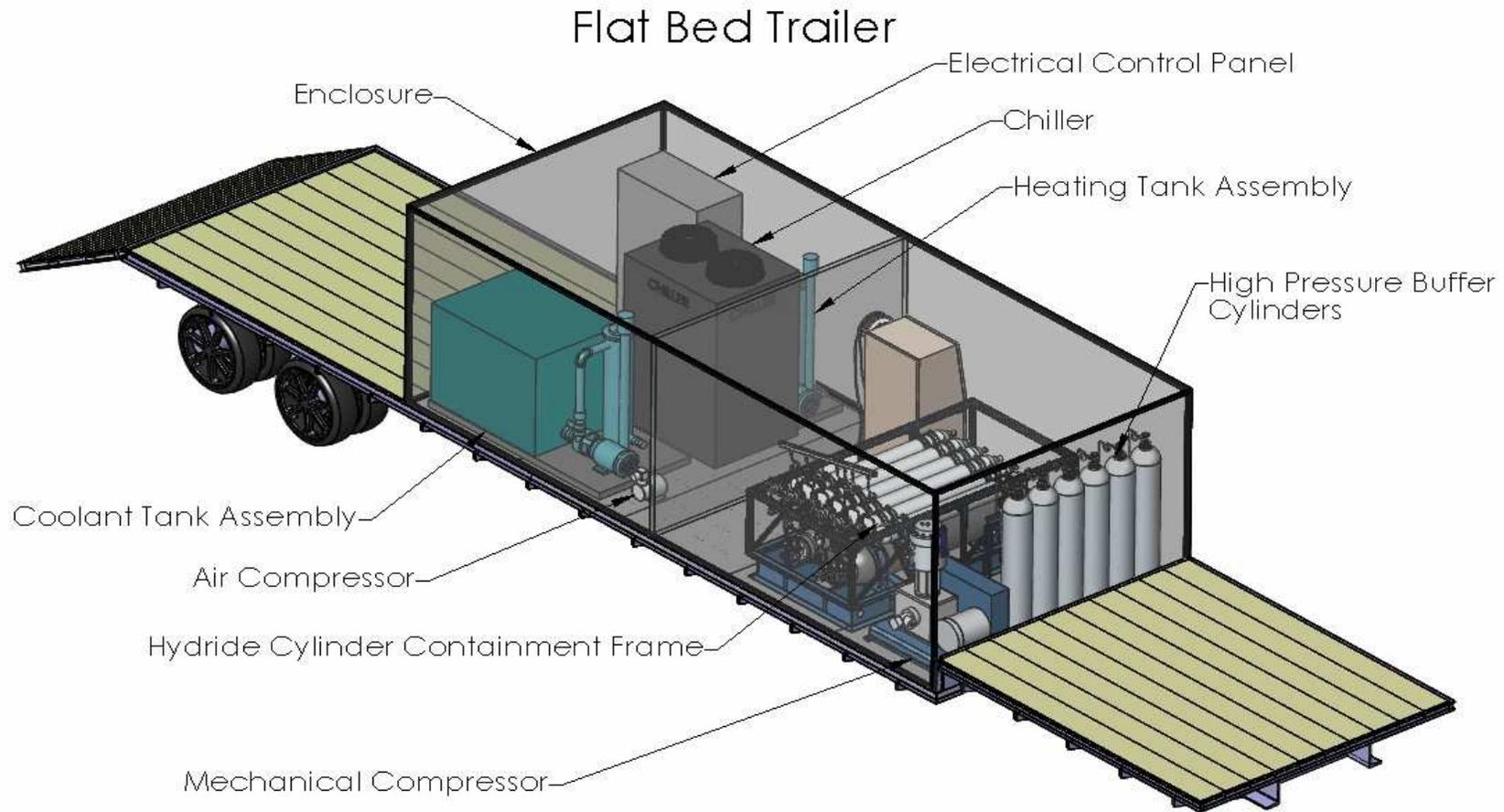


Ballard AirGen





Ovonic MH H₂ Refueling Station





Ovonic MH H₂ Refueling Station



Transportation: Two- and Three-Wheelers



Demonstrations: H2 Vehicles

2004 Model ▼

Ovonic Hydrogen Hybrid



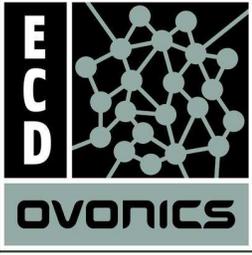
▲ 2005 Model

2002 Model ▼









Energy : Hydrogen – The Ultimate Fuel

OVONICS@work®

**ECD Ovonic,
1960**

