The Energy Venture Investment Summit

THURSDAY, FEBRUARY 17 10:50 AM (MT)

HYDROSTAR USA













GARY CLIMATE SOLUTIONS





HYDROSTAR

Large scale, Low Cost & Carbon-Free Hydrogen Production

Overview for Investors

January 2022

Achieving a Carbon Free Future by Unlocking the Hydrogen Economy

HydroStar Proprietary Confidential Information

"Green" Hydrogen: The ultimate de-carbonization tool

Net-zero carbon economy cannot be achieved without green hydrogen!



Renewable energy and e-vehicles mitigate less than 40% of global greenhouse gas emissions

Industry and agriculture account for ~45% of emissions – rapidly becoming the next battleground for de-carbonization

Source: epa.gov

2022.

1. "Carbonomics: The Green Hydrogen Revolution." Goldman Sachs Group Group, Inc., February

January 2022

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The Color of Hydrogen



HYDROSTAR is a Green Zero Carbon Hydrogen Company

- Grey hydrogen 90% of the current hydrogen is produced by steam methane reforming (SMR) with very high carbon emissions
- Blue hydrogen is Gray hydrogen with carbon capture and sequestration (CCS), technologies that are very costly and not mature
- Turquoise hydrogen is hydrogen produced from methane pyrolysis, with solid carbon waste requiring sequestration
- Green hydrogen uses electrolysis with renewable energy to produce the lowest (zero) carbon form of hydrogen

Technology for Green Hydrogen

Electrolysis for Hydrogen – electricity is used to decompose water into oxygen and hydrogen gas

Conventional Electrolysis

Alkaline

- Cost per megawatt, \$0.8M USD/MW
- Purity: 99.999% pure H₂
- Least expensive, most time-tested, and currently more efficient than the other commercial electrolysis technologies

PEM (Proton Exchange Membrane)

- Cost per megawatt, \$1M USD/MW
- Purity: 99.999% pure H₂
- Allows higher pressures to develop without dangerous mixing of hydrogen and oxygen within the cell



Water

0,

HydroStar Disruptive Membraneless Electrolysis



Membran

 $H_2 \triangleleft$

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Disruptive Membraneless Technology

Joule CellPress

Membraneless Electrolyzer for Low-Cost Hydrogen Production in a Renewable Energy Future Daniel V. Esposito

Joule 1, 651–658, December 20, 2017 Elsevier Inc.

Due to their potential for simple construction and high current densities, membraneless electrolyzers represent a promising approach to driving down capital costs to the levels required for water electrolysis to compete with steam methane reforming. This article highlights the challenges and opportunities for membraneless electrolyzers to become a <u>disruptive technology</u> in a renewable energy future.

Membraneless electrolyzers have several potential advantages over conventional devices:

- Buoyancy forces are used to separate the O2 and H2 products before they can cross over to the opposing electrode
- Eliminating the membrane creates the opportunity to decrease capital costs by reducing device complexity, material costs, and assembly costs
- Potential to be durable devices with long operating lifetimes, high tolerance to impurities, and greater resilience to extreme operating conditions that would harm a membrane
- Impurity-tolerant electrocatalysts can operate on tap water, thereby eliminating the cost of a water purification unit while enabling lower-cost materials in balance of system components



Simplified Membraneless Electrolyzer (Flow-by Electrodes Type)

HydroStar Breakthrough Low-Cost Electrolysis

Electrolyzer Cost Dominated by Cost of Stack Materials

Conventional Technologies Limited by Expensive Components and Platinum Group metals - <u>\$400K per MW Material Costs</u>

> Alkaline O_2 DC generator Q_2 Q_2 Q_2

Alkaline





Source: IRENA Green Hydrogen Cost Reduction – Scaling up electrolyzers to meet the 1.5°C climate goal, 2020, Fig. 5

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HYDROSTAR Material Costs <\$40K per MW



NO Membranes NO Platinum Group Metals Green B9 Electrolyte

Hydrogen Under \$2.00/kg Today

Current Electrolyzer Core Will Produce Hydrogen under \$2.00/kg

Energy Cost = \$1.10 (Montana Wind Power) OPEX = \$0.33 Amortized CAPEX = \$0.49 (50% capacity factor) Total Cost = \$1.93/kg





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Market Driven Hydrogen Purity

- 95% Hydrogen Purity is Sufficient for Over 90% of Hydrogen Market
- <u>HydroStar currently at 97% Purity</u>, Planned Target 99.9%
- Niche Markets for Fuel Cells require 99.999% Purity
- HydroStar Can Address Niche Markets with Low-cost External Membrane or Balance of Plant Process



Lowest Cost

HYDROSTAR



Technology **Policy Drivers**

2021 Infrastructure Investment and Jobs Act

"Congress finds that hydrogen plays a critical part in the comprehensive energy portfolio of the United States"



funding

Electrolyzer Demand

Jefferies November 2021 report "Plugging into the Hydrogen Ecosystem"

- 'There won't be enough electrolysers to meet green hydrogen demand in 2030' ... even in the lowest demand scenario Jefferies
- International Energy Agency expects to see 180GW of electrolysers in use by 2030 Jefferies
- Supply "could sit somewhere in the 30-40GW range" *Jefferies*



- "We see the nearest use cases as those industrial applications that already use hydrogen: oil refining, methanol, ammonia, steel making," Jefferies
- "Beyond that, we believe that there is scope for heavy vehicles and stationary power" Jefferies
- Regarding Blue Hydrogen, "In our view, CCS doesn't work at scale," Jefferies

Investment and Commercial Path



- Disruptive technology
- As simple as it gets
- Low-Cost DNA
- Proprietary IP
- IoT for Carbon Credits
- Learning Curve Winner

- Uniquely suited to Contract Manufacturing
- Cloud based functionality
- Uniquely suited to high speed automation
- Low cost fast set up

- Easily Configurable to input energy sources
- Ease of systems integration
- Modular to largest needed scale
- Fast delivery and installation
- Minimal O&M and service requirements
- Accelerate into market opportunities with global operations
- Meet demand with global Virtual Giga Factory presence

\$12M Raise

Cash Flow Positive

Alternative Financing for Growth

Achieve Cost Parity Blue & Gray H2

HydroStar 2022

Commercial Path

Electrolyzer Cores Final Engineering Electrolyzer Multi-Core Configuration Engineering



HydroPods



Manufacturing

Engineering &

Contract Manufacturing

Engagement



Contract Manufacturing

Kickoff



Months

Scale Manufacturing

2023-2024

Virtual Giga Factory

Virtual Giga Factory

HydroStar Electrolyzer Core







Conventional Electrolyzer Core



Penetrate Strategic Sectors

Industrial, Heavy Haul, Heavy Marine, Energy, Storage 2024-2027

Sales Projection

HydroStar is positioned to scale marketing, manufacturing and product support around the world



Monetize Technology & Markets Innovation, Efficiency, Growth

HydroStar Pipeline

2025-20XX

	SREA SPV						
	Stranded Wind Asset Inventory	Number of Projects	Capacity MW	Nominal H2 Production (ton/yr)	Nominal NH3 Production (ton/yr)	Avoided CO2 Emissions (ton/yr)	
	South Dakota	3	740	55,500	333,000	500,500	
	Oklahoma	16	2,700	202,500	1,215,000	1,822,500	
	Nebraska	11	2,700	202,500	SREA SPV Stranded Wind to	o H2	
	Kansas	18	3,600	270,0	Capital Stack - 1	0 year program	
	Total	48	9,740	7? 04 \$5,400	OM Un-stranded	d Wind Projects	ot
Wind to H2 t Wind & Solar	o Ammonia, Metl to H2 to Agricult	hanol :ure		03 \$1,79	2M Hydro	Financing ogen Electrolysis Pr	ojects
Hydro Power and Urban Er	to H2 to Hydroge nergy Infrastructu	en HUB, Marir Ire	ie	\$8N 02 SREA	I F SPV	ront End Engineerin FEED) and Secured Initial 4 of 14 FEED	ig & Design H2 Off-take Projects

\$2M

SREA SPV

• Renewables to H2 to Industry At-Large

HydroPod Demonstration Project De-risk Technology for Prospective H2 Off-takers

January 2022

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Competitive Analysis

- With the creation of **proprietary electrolyte** B9, HydroStar is positioned to rewrite the rules in the hydrogen generation market
 - Allows use of 304 SS as anode and cathode and a few plastic parts
 - No moving parts, no pumps
 - No expensive precious metals
 - No expensive membrane to degrade and clog
 - Lower capital cost
 - Lower power conditioning cost
 - No high purity water
 - Reduced maintenance costs
- B9 electrolyte is <u>safe</u> to handle and use and safe to manage and in disposal
- All of the above simplification leads to rapid development and scaling

	ITM	Cummins	NEL	Proton	<u>HydroStar</u>
Туре	PEM	PEM	Alkaline	PEM	Membraneless
Cost/KW	\$1000	\$1000	\$800	\$1000	\$250
Gas Purity	99.999%	99.999%	99.999%	99.999%	97%*—99.999%
Water - High Purity	Required	Required	Required	Required	Not Required
Membrane	Yes	Yes	Yes	Yes	None
Precious Metals	Yes	Yes	Yes	Yes	None
Electrolyte	Common	Common	КОН	Common	Proprietary

* Current Stage

Our Executive Team



Chairman & Chief Technology Officer Darrel Smith, P.E. Mechanical Engineer Founder 43 years of professional experience in Process Engineering and Manufacturing, HydroStar hydrogen electrolysis inventor,

Licensed Professional Engineer



Chief Executive Officer Mark Allen, P.E. Civil Engineer

45 years of professional experience in Executive and Operations Management, Technology Start-ups, Systems Engineering and Integration, Energy Transition, Decarbonization, Licensed Professional Engineer

Chief Financial Officer

Cassio Conceicao Electrical Engineer

35 years of professional experience and leadership roles in Global Operations, Engineering and Product Development, Supply Chain, Services, and Business General Management with multi-billion-dollar organizations, midsize public and private companies, and start-ups



Chief Marketing Officer Bill Croyle

44 years of professional experience in Information Technology, Sales & Marketing, Private Equity, Technology Start-ups, Energy Project Development, and Energy Transition



EVP Strategic Systems Integration Blake Putney

Electrical Engineer

45 years of professional experience in Engineering, Risk Analysis/ Systems Thinking, Modeling Complex Systems, Systems Integration



Vice President Manufacturing EcoSystem Joel Butler Naval Architecture/Marine Engineering

35 years of professional experience in Business and Operations Management, Technology Start-ups, Global Manufacturing & Supply Chain Systems and Operations, Software & Technology Integration with Business Processes, fund raising & alliance/partnership development



- HydroStar's Electrolyzer demonstrates an 80% reduction in material stack cost compared to competing technology
- The necessary scientific discovery, B9 Electrolyte, has been made and demonstrated, and is patent pending
- HydroStar has a first-class engineering and commercialization team
- Productization is a straightforward engineering process
- Commercial production planned within 2 years
- The HydroStar's Electrolyzer system is a model of simplicity and can be easily manufactured and serviced at the local level
- Modular designs allow for rapid learning and sustainable competitive advantage as production ramps

THANK YOU

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