DESTINATION STARTUP

OMC Hydrogen

One-Sentence Summary of What You Do: OMC Hydrogen creates renewable hydrogen to decarbonize fuels and chemicals using a thermochemical process with significant cost advantages over electrolysis.

Affiliated Institution: University of Colorado Boulder

Have you formed a company yet? Yes

Funding/Financing: Direct/Indirect University Support

Please describe your company and the problem you are trying to solve: Hydrogen has the potential to decarbonize many industries that simply cannot be electrified. However, the production of renewable (green) hydrogen has been stymied by the inability to be produced both cleanly and economically. The current method of producing green hydrogen, electrolysis, suffers from limited adoption due to high CAPEX, high OPEX, limits to scaling, and compression losses.

OMC Hydrogen seeks to commercialize a means of green, emissions-free hydrogen production that answers the issues limiting the growth of electrolysis with a thermochemical water splitting (TCWS) technology developed by CU Boulder.

In the TCWS process, a patent-pending metal oxide is first subjected to a reducing environment, where it loses some of its oxygen. Steam is then flowed over the reduced metal oxide, which takes oxygen from the steam to create a product stream of hydrogen and steam. CO2 and steam can also be fed over the reduced metal oxide to make syngas (CO + H2), which can be upgraded into valuable hydrocarbons such as gasoil, middle distillates, lubes, and waxes.

Although variants of TCWS have been researched for many years, CU Boulder's advances now deliver the promise of economic viability due to several key breakthroughs. The first is use of hybrid or even pure electric heating (vs. purely solar thermal) which raises capacity factors and lowers unit CAPEX. The second is the discovery of a novel metal oxide active material that can produce greater yields than other state of the art materials, is durable through hundreds of process cycles, is inexpensive, and can be operated in isothermal conditions vs. the 800+ °C temperature swing between oxidation and reduction needed by other materials. The combined ability to operate isothermally and using electric heat results in a configuration with far greater efficiencies than previously realized which promises low operational costs. OMC Hydrogen has the exclusive license to the use of the novel active material from CU Boulder.

These advancements lead to the potential for hydrogen production, using just heat and water, with dramatically lower construction and operating costs than electrolysis while producing the same clean, pure green hydrogen product. Initial projections suggest the process will be cost-competitive with highly polluting steam methane reforming before any subsidies are applied, although significant subsidies exist. This makes unit economics of the OMC Hydrogen process superior to both steam methane reforming and electrolysis.

What is your go-to market strategy? The first market for commercialization is the California transportation fuels market. California has had a Low Carbon Fuels Standard (LCFS) in place since 2012, which provides incremental benefit for reductions in carbon intensity of transportation fuels via a carbon trading regime.

Two possible configurations exist for the California markets. The first is a small, modular unit for dedicated production to service Fuel Cell Electric Vehicles (FCEVs). These would in the 500,000 kg of H2 per year production range. The California Air Resources Board predicts and has funding mechanisms for FCEV refueling stations to grow from 62 stations with a total capacity of 12.4 million kg/year to 176 stations by 2026-2027 with a total capacity of 53.5 million kg/year. Minimum renewable hydrogen content in these stations is legislated at 30%.

If FCEVs adopt successfully, the market will continue beyond the 176 stations, albeit without direct funding from California. The Hydrogen Council predicts a 57% CAGR for FCEV applications worldwide through 2030, growing to a $420 billion.

The second configuration is co-sited with an existing petroleum refinery. This allows much larger units (17.5 million kg/year and up) along with a myriad of other benefits. The ability to share labor, utilities, and scavenge waste heat will drive OPEX down even further. California refineries use at least 660 million kg/year of hydrogen in the production of gasoline, diesel, and jet fuels from crude oil. These fuels already have existing supply chains, no shipping challenges, and a large market. They are also eligible for LCFS credits for reductions in carbon intensity, so the zero carbon intensity possible with OMC Hydrogen made from renewable electricity would be directly monetizable in this configuration. A refinery offtake agreement for hydrogen will be used to finance the first commercial project.

Of note, natural gas, which is currently used in these refineries, has seen high price volatility from 2020-2021, more than doubling in price. Future forecasts suggest continued volatility. At the same time, electricity and water have varied less than 5%. The OMC Hydrogen process would be an attractive way to hedge natural gas volatility.

OMC Hydrogen will work with hydrogen fueling station companies and owners of oil refineries to partner in commercialization. It is our intent to concentrate on the production technology and not to own the entire vertical.

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Partnerships are being sought with FCEV refueling station developers such as First Element, Element Markets, Plug Power, and Linde. Refinery partnerships will be sought with California refiners such as Chevron, Marathon, Valero, PBF, Alon, Phillips 66, et al. Renewable diesel producers, which use more hydrogen than conventional refiners per gallon of fuel produced and understand the value of reducing carbon intensity, are also ideal partners. We were told in initial discussions with renewable fuels producers that, “We will buy everything you can produce.”

How will you generate revenue? OMC Hydrogen will partner with FCEV refueling station developers or oil refiners to sell hydrogen for use directly in FCEVs or in refining crude oil into transportation fuels. OMC Hydrogen will register the production pathway with CARB to generate LCFS credits, which will also be sold to obligated parties.

At commercial scale, CAPEX and OPEX are predicted to be competitive with steam methane reforming, and substantially lower than any form of electrolysis. Adding in the LCFS credits at the current price of carbon for an additional $4.75/kg in an FCEV application, and $1.91/kg in the conventional refining scenario leads to margins substantially higher (>61%) than all competitors.

How will this showcase benefits your company or technology? This showcase will help us socialize with many potential strategic partners and backers in a far quicker amount of time than if each interaction were sought individually. Our current highest need is to raise funds to reach commercialization and work towards forming the strategic partnerships necessary to go to market efficiently.

Describe your team to include potential strategic partners
The CEO and founder of OMC Hydrogen is Britt Boughey. Britt has over a decade of experience in R&D and energy technology maturation at DARPA, ONR, NRL, AFRL, the Department of Navy, and many others. A licensed Professional Engineer with a master’s in mechanical engineering and an MBA, Britt has deep experience with many different conventional and renewable power and energy technologies.

Britt has also spent much of the last 12 years deeply involved in renewable fuels markets, including development of conversion technologies, economic and technology feasibility work, grant applications, capital raises from both sides of the table, project management, and overseeing the purchase and use of over 230 million gallons of naval distillate fuel that contained up to 30% renewable content and its use in the fleets of 31 countries.

Britt retired from the US Navy with 20 years of service, including combat deployment in Iraq. He is proven under pressure with nearly 2,000 hours of flight time in the F/A-18 E/F Super Hornet and 252 carrier landings (153 night).

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CU Boulder chemical engineering personnel, who have spent nearly 20 years developing this process, will be conducting the upcoming pre-pilot work and ensuring its success. The PI has spun multiple companies from his lab and spent 16 years with Dow before entering academia. CU Boulder facilities are some of the best in the world for high temperature process research and work on solar thermal processes.

Dr. Sean Wells is the co-founder and business development advisor. He owns six business ventures across multiple industries and has a successful history founding, leading, and exiting.

Andrew Sherman, JD, is general counsel and business development advisor. He has provided legal and strategic advice to dozens of Fortune 500 companies. He has decades of experience developing licensing, IP, and fundraising strategies. He has published multiple books on mergers and acquisitions and fundraising.