Project Spotlight: H2B2

H2B2

Electrolysis Technologies

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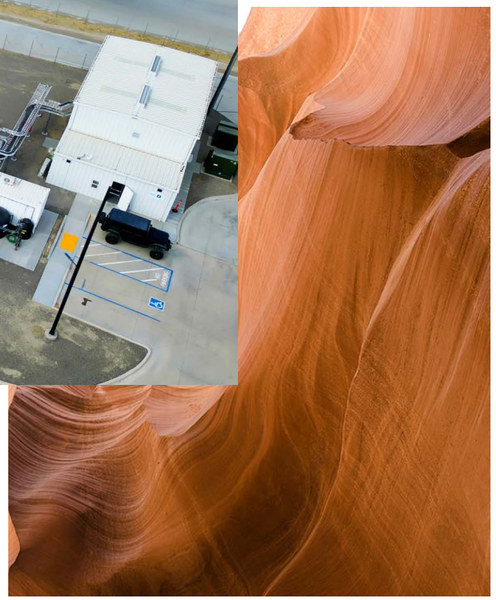
Summary

H2B2, a U.S. company based in Delaware, is a prominent player in the North American hydrogen industry. With its proton exchange membrane (PEM) electrolyzers, H2B2 has brought to life one of the largest operational renewable hydrogen production facilities in North America – the SoHyCal project located in Fresno, California. Backed by a US$3.96 million grant from the California Energy Commission (CEC) Clean Transportation Program, the project will fuel a transit bus fleet operated by the local transportation authority.

The SoHyCal project began commercial production on September 7, 2023, with an initial capacity of 1.2 metric tonnes (MT) per day using approximately 85.6 million British thermal units (MMBtu) of biogas as feedstock. The biogas is converted into electricity and subsequently into hydrogen through electrolysis. H2B2 is currently in the process of expanding the facility by installing photovoltaic (PV) panels. The combined use of biogas and PV solar panels to generate clean electricity will be capable of producing 15 megawatts (MW) of power and 3 MT per day of renewable hydrogen – enough to fuel up to 210,000 cars in a year or 30,000 city buses.

H2B2's SoHyCal Plant in Fresno, California



> In line with our mission to democratize hydrogen and support local economic growth, the SoHyCal project embodies our commitment to delivering tailored solutions for diverse industries. By addressing the needs of key stakeholders such as private fleets and public transit agencies, we are not only advancing renewable hydrogen in transportation applications, but we are also charting a new path for broader applications of low-carbon hydrogen, decarbonizing industries beyond transportation, such as steel, iron, and chemicals. This CA-LCFS pathway certification cements our role as a leader in the clean hydrogen economy.
>
> - Pedro Pajares, H2B2 Country Manager in the U.S.

Background

Hydrogen is an exciting new energy carrier that could have a big impact in decarbonizing energy-intensive industries such as steel and cement manufacturing, chemical production (i.e., ammonia), oil refining, and shipping. Hydrogen also offers a potential solution to decarbonize transportation applications, such as heavy-duty vehicles, long-distance freight, and buses, where the use of battery-powered vehicles is not optimal.

Conventional hydrogen production relies on fossil feedstock and steam methane reforming (SMR), a normal feature in many refining operations. H2B2, however, employs a modular approach for producing hydrogen through electrolysis powered by renewable energy. This ensures that the hydrogen it produces gets a negative carbon footprint under California's Low Carbon Fuel Standard (CA-LCFS).

Policy incentives at both the U.S. federal and state levels support the adoption of clean hydrogen technology and research into more efficient and scalable production, storage, and utilization methods.

California's LCFS, for example, assigns credits based on the carbon intensity (CI) scores of transportation fuels, which is a measure of the total greenhouse gases (GHG) emitted throughout the lifecycle of a fuel from production to use. There are currently 130 pathways for hydrogen production registered under the CA-LCFS,[1] with the majority of them using a biogenic source of methane such as captured landfill gas. However, a few pathways such as the one employed by H2B2 use methane that would otherwise have been emitted by manure lagoons at animal feedlots. As a result, the CI of these pathways is typically in the negative territory since they prevent methane emissions from happening.

The U.S. Department of Energy's (DOE) Regional Clean Hydrogen Hubs (H2Hubs)[2] and the Inflation Reduction Act's (IRA) Section 45V tax credit[3] are examples of federal programs helping catalyze hydrogen development by providing financial incentives tied to the CI of hydrogen.

Launched in October 2023, the DOE's H2Hubs aims to accelerate the commercial-scale deployment of hydrogen production and infrastructure within seven hubs spanning 16 states. Funded by $7 billion from the Bipartisan Infrastructure Law (BIL), the hubs are expected to collectively produce 3 million MT of hydrogen annually and reduce 25 million MT of CO_2 emissions from end-uses annually – an amount roughly equivalent to the combined emissions of 5.5 million gasoline-powered automobiles. H2B2's SoHyCal project has also been classified as a Tier 2 project within the U.S. West portion of the H2Hub in California, known as the Alliance for Renewable Clean Hydrogen Energy Systems (ARCHES).

IRA Section 45V provides up to $3 per kilogram (kg) of hydrogen produced with reduced GHG emissions. The tax credit can be claimed for 10 years on hydrogen sold or used. The level of the credit is based on CI, up to a maximum of 4 kg of carbon dioxide equivalent (kg CO_2e). The credit provides a varying, four-tier incentive depending on the CI of the hydrogen production pathway, and whether the project meets prevailing wage and apprenticeship requirements.

The U.S. Renewable Fuel Standard (RFS)[4] is another federal opportunity that could

[1] *LCFS Pathway Certified Carbon Intensities*
[2] *DOE Clean Hydrogen Hubs*
[3] *Clean Hydrogen Production Tax Credit (45V) Resources*
[4] *USEPA Renewable Fuel Standard Program*

support low-carbon hydrogen when used in the transportation sector. To date, the program has not approved any hydrogen to generate Renewable Identification Numbers (RINs); however, it is expected that the U.S. Environmental Protection Agency (USEPA) will allow these fuels to participate soon. The value of the fuel in this program will depend on the feedstock source.

These state and federal incentives are specifically intended to support the growth of clean fuels as the industry scales up production, which will ultimately bring the cost down and increase accessibility.

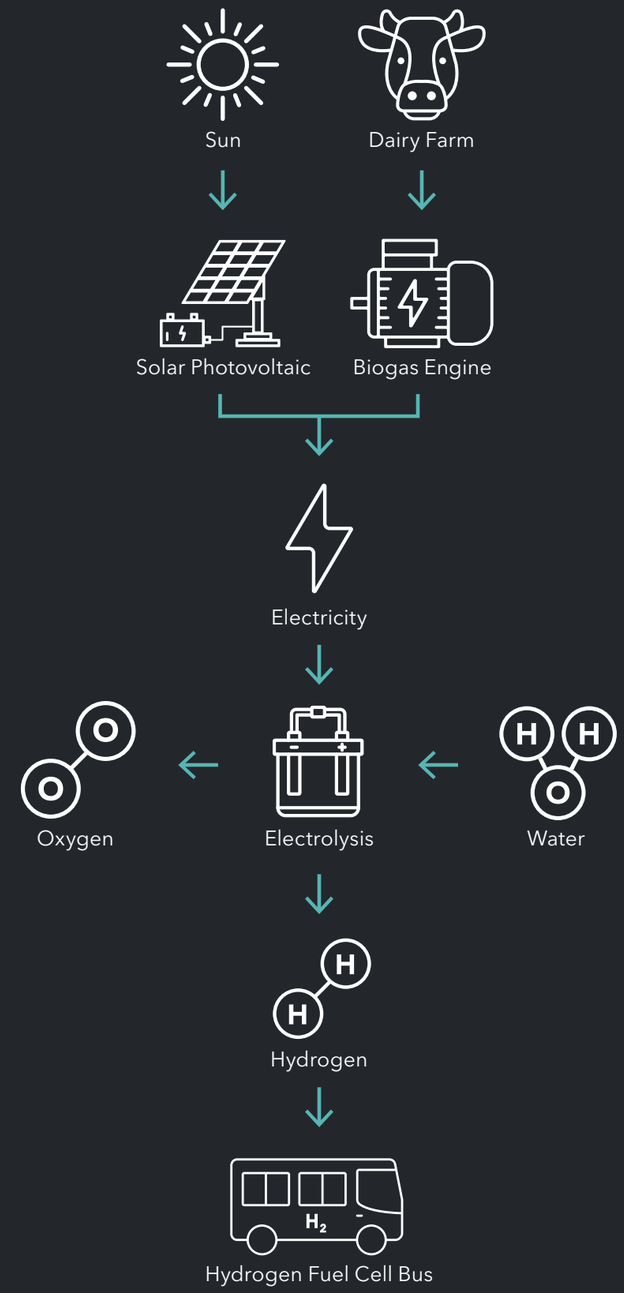
Incentives for clean hydrogen production and demand for clean energy solutions make investments in the production and use of hydrogen an exciting opportunity. Yet, accessing these investments requires a solid grasp of the regulatory requirements, specific program requirements, accurate CI calculations, and a sophisticated data management platform.

H2B2's SoHyCal project is unique in its use of biogas produced from animal manure – and soon, PV solar panels – to generate zero-CI hydrogen via electrolysis. Bar 20, a 7,000-cow dairy farm owner where the facility is located, leases the land to H2B2 for the SoHyCal facility and the co-located biogas engine. CalBio operates the digester for Bar 20 and supplies SoHyCal with biogas via pipeline at a CI of -150 grams of CO_2 equivalent per megajoule (g CO_2e/MJ) under the CA-LCFS program. This arrangement is governed by a long-term service agreement and a long-term lease for the supply of biogas. The proximity to biogas feedstock allows for an immediate and efficient direct source of supply, reducing operational costs and helping contribute to lowering the overall CI of the hydrogen.

H2B2 needed to enroll SoHyCal in the CA-LCFS program, which is administered by the California Air Resources Board (CARB), within a tight timeframe. This added urgency to the project, as CA-LCFS credits are a significant economic driver for H2B2. The project faced further complexity because of the needed integration with the joint pathway filed by CalBio/Bar 20 in concert with H2B2.

Eco's expertise in conducting life-cycle assessments (LCAs), determining project eligibility to enter various carbon markets, managing regulatory complexity, and selecting the right technology helped H2B2 successfully launch its project in September 2023.

Overview of H2B2's Electrolysis Process



Solution

H2B2 was unfamiliar with the nuances of complex regulations like the CA-LCFS, the IRA, and the RFS. H2B2 enlisted EcoEngineers (Eco) as its guide on the journey towards being a commercially successful clean hydrogen producer in California. Eco's expertise in conducting life-cycle assessments (LCAs), determining project eligibility to enter various carbon markets, managing regulatory complexity, and selecting the right technology helped H2B2 successfully launch its project in September 2023. The project's implementation involved Eco helping build and manage an ecosystem of partners that included Bar 20, CalBio, as well as the CEC to deliver a complete and robust application.

Navigating the complex application and registration process under the CA-LCFS program, particularly under a tight timeline, required a comprehensive understanding of the requirements and certainty that the information submitted met CARB rules. Eco's LCA team worked with all the stakeholders to develop the CA-LCFS pathway application for H2B2, allowing the company the opportunity to generate CA-LCFS credits for its low-carbon hydrogen.

Using the California Greenhouse Gases, Regulated Emissions, and Energy use in Technologies (GREET3.0) model,[5] Eco's LCA team analyzed H2B2's fuel production facility, demonstrating that its production process, including chemicals, feedstock, co-products, and distribution, resulted in a negative CI score. Eco submitted the model to CARB for review as a Tier 2 CA-LCFS pathway application on behalf of H2B2 through the Alternative Fuel Portal (AFP) system.

To develop an LCA, the Eco LCA team analyzed the H2B2 facility's carbon emissions, fuel and chemical inputs and outputs, and byproducts of the production process to derive a scientific, data-intensive assessment of the facility's environmental impact. Eco also facilitated discussions with CARB staff to address questions on the H2B2 application and the methodology used for CA-GREET3.0 modeling. This proactive approach allowed H2B2 the insight and guidance needed for a successful CA-LCFS pathway application.

A source of anxiety for project developers on their regulatory journey is a lack of knowledge about the various programs and their often-complex requirements. Project developers also often struggle with a lack of resources internally to carry the load of preparing and submitting a CA-LCFS application themselves. The H2B2 team accessed educational content through Eco's EcoUniversity training platform. Expert instructors provided the H2B2 team with insights into the factors that influence the market price of the environmental attributes of hydrogen, the concept of CI, and other program requirements, along with relevant considerations specific to developing clean hydrogen projects. This laid the necessary foundation of knowledge that made the CA-LCFS pathway application process go smoother and more efficiently due to a shared baseline level of insight into carbon markets as a whole.

Eco also developed a project-specific CA-LCFS monitoring plan to ensure H2B2 was well-positioned to meet the ongoing compliance requirements of a first-of-kind project. The development of the monitoring plan involved creating templates, which H2B2 staff could easily complete after the CA-LCFS pathway approval, and a project-specific compliance map that could be followed to ensure compliance.

[5] *CARB LCFS Life-Cycle Analysis Models and Documentation*

Our goal was to help H2B2 build an ecosystem of partners, to help guide the company through complex regulatory frameworks, and to ensure the SoHyCal team was empowered to confidently manage their LCA and compliance. The submission of the CA-LCFS pathway application sets H2B2 on a path to be able to deploy renewable hydrogen at scale.

- Tanya Peacock, Managing Director, California and Hydrogen, EcoEngineers

Outlook

According to the International Energy Agency (IEA),[6] the annual production of clean hydrogen could reach 38 million MT in 2030. However, demand for low-emission hydrogen far exceeds production capacity. With the successful launch of its project in California, H2B2 is well-positioned as a leader in scaling low-emission hydrogen in North America.

Within North America, opportunities exist for H2B2 to commercially deploy its low-carbon hydrogen business model. For example, Canada's Hydrogen Strategy[7] provides a roadmap for 30% of the country's end-use of energy coming from clean hydrogen by 2025. Beyond North America's borders, the European Union's (EU) REPower EU Plan[8] targets 10 million MT of domestically produced renewable hydrogen with the remaining 10 million MT to be imported to the continent. Several EU countries have also declared targets promoting the development of low-carbon hydrogen.

Currently, H2B2 and the Eco team are submitting the CA-LCFS pathway registration of SoHyCal's second phase, which involves solar panel-mediated hydrogen production. H2B2 plans to increase the production capacity by including 15 MW of PV and additional MW of electrolysis. H2B2 is also evaluating the development of similar projects as SoHyCal across the U.S., with plans to increase electrolytic capacity to 9 MW over the next several years. Several of these projects are expected to reach final investment decisions (FID) as early as the first half of 2025. With Eco serving as its guide, H2B2 is preparing to submit applications for these new phases with confidence.

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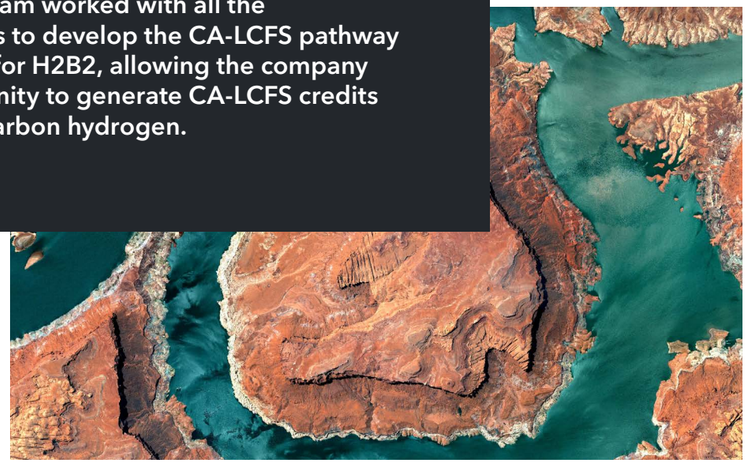

[6] *IEA Hydrogen*

[7] *Government of Canada, The Hydrogen Strategy*

[8] *Hydrogen Europe, "The case for global H2 trade: a factual response to T&E", February 2024*

About Us

H2B2 is a global, vertically integrated provider of renewable hydrogen energy systems, services, and equipment, with its proprietary water electrolysis technology. H2B2's suite of products and services spans the production and transport of hydrogen, from design through operation. Hydrogen is commercialized across a variety of sectors such as industrial, energy storage, mobility, and residential. For more on H2B2, visit www.h2b2.es.

EcoEngineers is a consulting, auditing, and advisory firm with an exclusive focus on the energy transition and decarbonization. From innovation to impact, Eco helps its clients navigate the disruption caused by carbon emissions and climate change. Its team of engineers, scientists, auditors, consultants, and researchers live and work at the intersection of low-carbon fuel policy, innovative technologies, and the carbon marketplace. For more information, visit www.ecoengineers.us.

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