

Bloom Energy Corporation

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CASE STUDY

Biogas

Location

Kerman, California

Industry

Dairy Farm

Key Values

- Lowest Carbon Intensity
- No Local Air Pollution
- Highest revenues vs. other uses of onsite biogas

Bloom installation

1 MW Microgrid fueled by dairy biogas

Objective

Maximize the utilization of onsite dairy waste with the most favorable impact on the environment



Bar20 | CalBio

Bar20 & CalBio Partner with Bloom Energy to Generate Renewable Power from Dairy Farm Waste

Bar20 Dairy Farms is a dairy based out of Kerman, California that produces milk and ice cream products. Most of the milk produced is sold under Costco's 'Kirkland' brand. Along with milk production, the dairy also produces a lot of biogas from cow manure.



Dairy biogas contains between 55 to 70 percent methane (CH₄) – a greenhouse gas with a short but highly potent lifespan when released into the atmosphere. Livestock and agricultural practices, represent the largest source of CH₄ emissions in the United States (EPA).

This project, which has been in operation since October 2022, has won many awards and was recently featured on the BBC StoryWorks Humanizing Energy series. It was awarded a Carbon Intensity (CI) score of **-790 gCO₂e/MJ** by the California Air Resources Board (CARB) - the lowest CI recorded under the Low Carbon Fuel Standard (LCFS) program as of December 2023.



Featured on
BBC energy
video series



American
Biogas Council
Award



2022 U.S. Dairy
Sustainability
Award

Plugging into Cow Power

The Bar20 dairy farm does not have access to a natural gas pipeline to dispose of their biogas emissions and the farm is plagued by high electricity costs and declining reliability from the electrical grid. To help the environment and to secure more reliable power, Bar20 partnered with CalBio to build a digester project to hold the farm's manure and capture methane and partnered with Bloom to deploy fuel cells to produce electricity onsite from the methane.

Historically, it has been difficult to efficiently convert biogas into electricity without negatively impacting the environment. Onsite power generation has traditionally been performed using combustion-based gas turbines or gas engines, both of which suffer from low conversion efficiency and emit harmful criteria pollutants such as SO_x, NO_x and other particulate emissions. That's where Bloom Energy comes in.

Bloom Energy's solid oxide fuel cells (SOFCs) provide an electrochemical pathway to convert biogas directly to electricity without combustion. Bloom's SOFCs exhibits the highest electrical efficiency among commercially available technologies and is therefore able to produce the most electricity per volume of biogas, roughly 30% to 50% more than combustion-based platforms.

The SOFCs are paired with a gas conditioning system, onsite, that cleans the biogas of moisture and contaminants, enabling its use for renewable electricity generation and dramatic methane reduction in the process.

To turn cow waste into renewable electricity, Bar20 combined CalBio's methane digester, a gas clean-up skid, and Bloom Energy's solid oxide fuel cells for an end-to-end, waste-to-electricity solution.



Biogas Treatment and Utilization

The Bar20 project includes 1 MW of onsite energy production from Bloom's SOFC Microgrid solution. The project allows Bar20 to offset high energy prices, generate Low Carbon Fuel Standard (LCFS) revenues and power critical loads such as the gas clean-up equipment in the event of a grid outage.

Bloom's SOFCs at Bar20 are paired with a 3rd party two-stage gas clean up system. The first stage equipment is used for bulk Hydrogen Sulfide (H_2S) removal, moisture removal using chillers, and blowers for increasing the gas pressure, all which help clean and pressurize the gas for use.

In the second stage, the gas is further polished and conditioned to reduce the sulfur compound levels. From here, the gas goes through another set of blowers to raise the pressure to approximately 15psi, turning it into a suitable feed fuel for use within Bloom's SOFC equipment, the Energy Server. The clean-up process to remove contaminants is simple, cost-effective, and efficient and the solution does not require the removal of CO_2 which adds complexity and cost to the traditional treatment of biogas needed for RNG pipeline injection applications.

Once the SOFCs are operating on biogas, as long as the grid is available, any excess electricity generated by the system is exported to the grid through a net metering and grid export agreement, which serves as an added source of revenue for the project

Economic Value Proposition

The Bar20 project generates value from two key sources. First, the project significantly reduces the use of expensive power from the local electric utility and allows compensation of excess electricity not consumed to be sent to the local electric utility. Second, the project generates LCFS credits per the California's LCFS program. This program is designed to decrease the overall CI of California's transportation fuel mix by incentivizing the production of low-carbon and renewable alternatives to reduce petroleum dependency and achieve air quality and GHG reduction benefits.

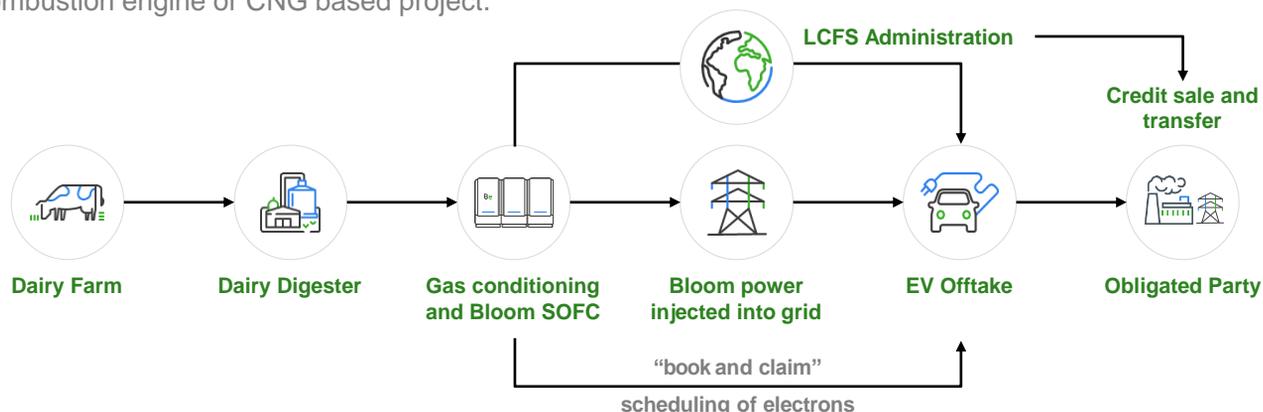
All fuel producers (also called Obligated Party or "OP") bringing transportation fuel into the state of California is subject to the LCFS market. Credit generation is driven by the delta between the annual CI benchmark for the displaced fossil fuel and the project's fuel CI. Fuels that have a CI score lower than the established benchmarks generate tradeable credits while those with higher CI scores generate deficits. No OP may close a year with a deficit, which means producers of high emission fuels must procure credits to maintain compliance.

Biogas to electricity is an eligible pathway under the LCFS program if the electricity is used to charge Electric Vehicles ("EVs") in California on a book and claim basis. Electricity projects using Bloom's fuel cells generate the highest number of LCFS credits due to its industry leading electrical efficiency of 50%+ when fueled with biogas.

The Bar20 project contracted with BMW for the offtake of the environmental attributes to be used to charge BMW's fleet of EVs in California. Once the electricity is retired in EVs, a LCFS credit is generated that is then sold to an OP.



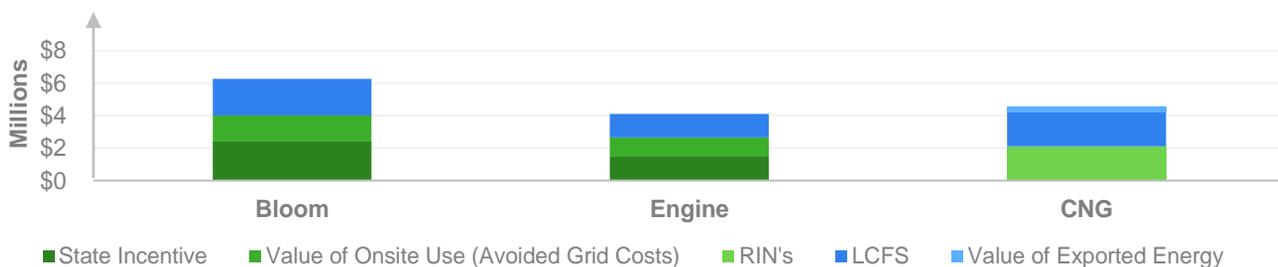
The Bar20 project was awarded the first CI for a fuel cell project in the LCFS program. At $-790 \text{ gCO}_2\text{e/MJ}$, the project has the lowest CI under the program at the time of certification and generates approximately ~50% more revenue via displaced onsite electricity and LFCS vs revenues generated via a similar combustion engine or CNG based project.



The table and chart below illustrates the differences in CI score and revenue streams of using Bloom at Bar20 vs using an engine to produce electricity or upgrading to CNG.

	Dairy eLCFS Bloom	Dairy eLCFS Engine	Dairy CNG
CI Score	(790)	(730)	(342)
Gas Produced (MMBtu)	~60,000	~60,000	~60,000
Electricity Produced (kWh)	~9,000,000	~6,000,000	N/A
MT CO ₂ e Reduced (Total/Incremental)	~34,000/~27,000	~22,000/~17,000	~25,000
Use Energy Onsite	Y	Y	N

Revenues Generated



Using Methane Responsibly

The LCFS incentive program has encouraged biogas producers like Bar20 to reduce lifecycle GHG emissions by linking revenue directly to its CI score. Dairy biogas is the highest value feedstock available as a fuel source, with the lowest carbon intensity relative to other waste forms. Given the “stranded” nature of the dairy from a RNG pipeline perspective, Bloom’s distributed onsite waste-to-electricity solution provides the best pathway for the farm to use its methane responsibly and in a way that adds more revenue-generating value to its day-to-day operations.



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Flexible. Future Proof.
 Accelerate your path to
 A zero-carbon future.