



RENEWABLE
THERMAL
COLLABORATIVE

Decarbonizing Process Heat at California Dairies, Inc. with Skyven Technologies

CASE STUDY

April 2024

CDI's Visalia, California facility

Project Overview

California Dairies, Inc. (CDI), the largest member-owned milk marketing and processing cooperative in California, partnered with Skyven Technologies, an Energy-as-a-Service (EaaS) company with a mission to decarbonize industrial process heat, to complete a total of six decarbonization projects across CDI's two largest facilities in 2023.

The projects deployed three renewable thermal technologies: solar thermal systems, smart steam traps, and boiler heat recovery systems. Skyven and CDI expect the projects to avoid approximately 7,000 metric tons of CO₂ emissions and over 110,000 MMBtu of natural gas consumption each year.

The multi-technology, integrated energy efficiency and renewable thermal approach achieved more emissions reductions and fuel savings than any one of the measures alone. These projects support CDI's goals to achieve a 30% reduction in direct and supply chain greenhouse gases by 2030 and carbon neutrality by 2050.

CDI implemented the decarbonization technologies with no capital expenditure (CapEx) using a public-private financing structure built on Skyven's EaaS model. The projects combined four funding sources: direct investment from Skyven, third-party financing from renewable thermal investor Kyotherm, Inc., grants from the California Energy Commission's

LOCATION

Visalia, California; Turlock, California

INDUSTRY TYPE

Food and beverage

FACILITY TYPE

Butter, milk powder, fluid milk, and dairy processing

TEMPERATURE RANGE

Up to 180°F

TECHNOLOGIES DEPLOYED

Solar thermal, steam traps, heat recovery

EMISSIONS IMPACT

Expected to avoid approximately 7,000 metric tons of CO₂ emissions annually

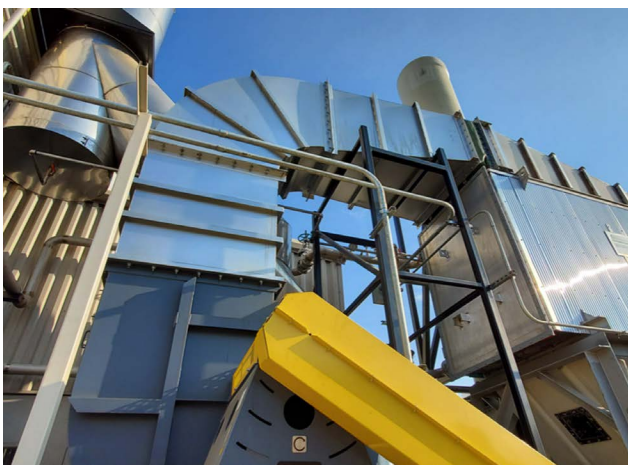
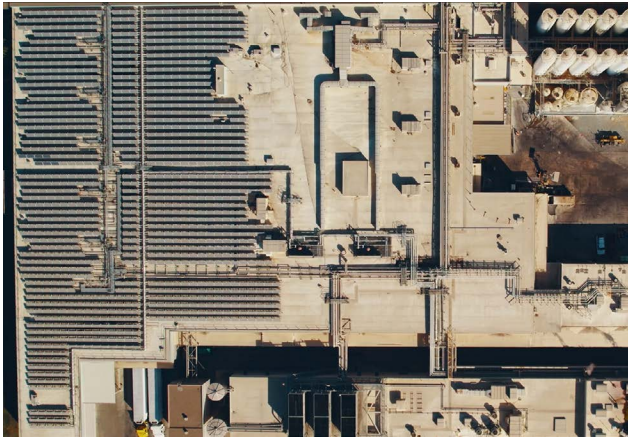
Food Production Investment Program, and incentives from Pacific Gas & Electric and Southern California Gas Company.

Project Description

Beginning in 2019, Skyven and CDI worked together to identify, analyze, and ultimately select a set of six projects across CDI's two largest facilities. With an approved project portfolio, Skyven and CDI executed a ten-year Thermal Energy Services Agreement (TESA), the basis for Skyven's EaaS model. Similar to a renewable electricity power purchase agreement (PPA), the TESA deploys third-party capital to fund the thermal decarbonization projects and reduces execution risk for the buyer while providing immediate financial benefits.

Under the TESA, Skyven provides end-to-end project execution and performance monitoring, including detailed engineering design, procurement, installation, and commissioning for the six projects at the two facilities. After project commissioning, Skyven provides ongoing operations monitoring and maintenance over the ten-year contract term.

Financially, CDI is reducing its natural gas expenditures. Under the TESA, CDI is purchasing decarbonized heat from Skyven at a fixed discount from CDI's actual, real-time natural gas prices that results in guaranteed net savings. The projects' total savings over the ten years of the TESA will recoup Skyven's and Kyotherm's investments and provide ongoing savings for CDI.



TOP Aerial view of solar thermal panels on the roof of CDI's Visalia facility.
BOTTOM Boiler heat recovery system.

As part of its service, Skyven identified, prepared, and submitted applications for public funding and utility incentive programs on behalf of CDI. By combining direct investment from Skyven, third-party financing from Kyotherm, approximately \$9 million in grant funding from the [California Energy Commission's Food Production Investment Program](#), and utility incentive funding from Pacific Gas & Electric and Southern California Gas Company through the [California Solar Initiative Thermal Program](#), these projects leveraged a unique public-private financing structure.

Although the EaaS model for industrial decarbonization was new to CDI, the company quickly realized that the EaaS model delivered several important benefits. CDI was able to complete multiple decarbonization projects through a single portfolio and transaction, accelerating progress toward its sustainability goals. Freed of being the decarbonization project manager or having to identify financing resources, CDI has been able to make progress on its sustainability goals and maintain its focus on the 300+ family-owned dairies in the co-op. Utilizing third-party financing for decarbonization allows CDI to allocate capital to other key operational areas throughout the co-op.

Project Implementation

Project implementation started at CDI's dairy processing facility in Visalia, CA in 2021. Skyven hired and managed local contractors to install and integrate three thermal decarbonization technologies at the Visalia facility: (1) a rooftop-mounted solar thermal system to preheat the facility's boiler feedwater, (2) smart steam traps with internet-connected sensors to reduce steam loss at the facility, and (3) a boiler heat recovery system to boost the facility's boiler efficiency by nearly 10%.

Skyven installed flat plate solar thermal panels on the roof of the Visalia facility. By using solar heat to preheat the facility's boiler feedwater up to 180°F, the solar thermal system reduces CDI's use of natural gas to generate steam. The smart steam traps enable rapid detection of steam trap failure at the facility through continuous monitoring. Early detection and maintenance of steam trap failure

reduces boiler wear and tear and improves energy efficiency. The boiler heat recovery system uses a condensing economizer to transfer heat from the boiler flue gas to preheat boiler feedwater. Skyven installed the condensing economizer outside of the flue gas stack to prevent any interruptions to existing processes.

During construction, on-site roof and piping conditions required slight modifications to the original installation plans. Skyven covered all changes at its own expense. The installation and integration of these three technologies did not interrupt the Visalia facility's 24/7 operations. There have been no changes to production quality at the facility and no shutdown time or special outages for equipment operations and maintenance. Skyven and CDI installed a similar set of integrated technologies at CDI's Turlock South facility.

Key Outcomes

In total, the projects will avoid approximately 7,000 metric tons of CO₂ emissions and over 110,000 MMBtu of natural gas consumption each year. This is equivalent to removing 1,665 gasoline-powered passenger vehicles from the road annually. Skyven's meters and internet-connected monitoring system directly measure and verify the emissions-free heat delivered to CDI.

The projects are performing as expected and have delivered \$419,659 in net savings to CDI to date. The benefits of these projects extend beyond CDI's two facilities. As a leading manufacturer of butter, milk powder, and fluid milk products, CDI supplies food ingredients to customers in the food and beverage industry. By reducing emissions from CDI's direct operations, these projects in turn lower the supply chain emissions of CDI's customers.

Reducing natural gas combustion at CDI's facilities also improves local air quality and community health. The Visalia and Turlock South facilities are located in or adjacent to disadvantaged communities ranked in the 99th percentile for pollution burden in the state of California. By reducing onsite natural gas combustion by more than 110,000 MMBtu each year, the projects reduce CO₂ emissions and other criteria pollutants generated from the combustion of natural gas,

“Our customers are seeking to reduce their supply chain emissions. As a major food ingredients supplier, CDI's progress on our decarbonization journey also helps our customers on their journeys.”

– Darrin Monteiro

*Vice President of Sustainability and
Member Relations at CDI*

including particulate matter, NO_x, SO_x, VOCs, and CO. These projects have also preferentially employed California-based workers for engineering, construction, and maintenance, thereby bolstering the state economy and boosting local benefits.

Lessons Learned

- **Energy-as-a-Service eliminates CapEx and risk for buyers.** The EaaS model enabled CDI to pursue decarbonization projects with no CapEx, minimal risk, and immediate operational savings. The EaaS model further reduces transaction costs for energy buyers by concentrating expertise and project management within a single service provider.
- **Technology integrations maximize savings.** By integrating solar thermal systems with thermal efficiency measures, including steam traps and heat recovery systems, the projects at CDI's two facilities achieved more emissions reductions and fuel savings than any one of the measures alone. Energy buyers can maximize emissions reductions by combining renewable thermal technologies and thermal efficiency measures.
- **Public-private funding unlocks decarbonization opportunities.** Combining Skyven's direct investment with third-party financing, grant funding, and utility incentives created an effective financial structure for the projects. This model demonstrated the potential for collaboration between industry, government, and finance to accelerate industrial decarbonization solutions.

Next Steps for Interested Buyers

Buyers interested in learning more about renewable thermal should:

- Check out the U.S. Department of Energy's [case study](#) and [Skyven's press release](#) on the projects.
- Read more [case studies](#) from the RTC to learn how energy users and solutions providers are deploying renewable thermal technologies.
- Find solutions providers through the RTC's [Partner Locator](#).
- Join the RTC to participate in Working Group meetings, learn from other renewable thermal energy users, and connect with solutions providers. Contact the RTC's Membership Director, Perry Hodgkins Jones (perry@dgardiner.com) to learn more.
- See more information on the applications and market potential of renewable thermal solutions in the [Renewable Thermal Vision Report](#).



The Renewable Thermal Collaborative (RTC) is the global coalition for companies, institutions, and governments committed to scaling up renewable heating and cooling at their facilities. Learn more about our work at www.renewablethermal.org.

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APRIL 2024