Community BioRefineries
The Epitome of American Innovation

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SAF Focus

Transforming Dairy Waste into Renewable Energy: The Community BioRefinery and Burnett Dairy Cooperative Partnership

Bridging Tradition and Innovation

Cheesemaking, one of humanity's oldest food preservation methods, dates back over 7,000 years. However, this ancient craft comes with a modern challenge: managing the byproduct of cheese/whey waste. In an era of climate action and renewable energy, partnerships like the one between the Community BioRefinery (CBR) and Burnett Dairy Cooperative are reshaping how whey waste is managed. By converting whey into biobutanol, a next-generation biofuel and feedstock for Sustainable Aviation Fuel (SAF), this collaboration achieves sustainability goals while unlocking new economic potential.

This blog explores the partnership's innovative approach to turning whey waste into renewable energy, providing a replicable model for industries seeking sustainable growth.

The Problem of Dairy Waste

Environmental Impact of Whey Waste

For every pound of cheese produced, approximately 9 pounds of whey waste are generated. Globally, the cheese industry produces billions of gallons of whey annually, creating two significant challenges:

1. **High Biological Oxygen Demand (BOD):** Whey contains organic material like lactose and proteins, which deplete oxygen in waterways, leading to aquatic ecosystem harm (Hooda et al. 217).
2. **Greenhouse Gas Emissions:** Decomposing whey generates methane, a potent greenhouse gas with a warming potential 28 times greater than carbon dioxide (Smith et al. 15).

Economic Challenges of Whey Waste Disposal

Treating whey to meet environmental regulations is expensive, average cost between $0.50 to $1.50 per gallon (Smith et al. 12). For Burnett Dairy Cooperative, which generates approximately 800,000 gallons of whey waste annually, disposal costs total $1.2M-1.4M annually. This underscores the need for innovative waste-to-value solutions.

The CBR-Burnett Partnership

Waste Valorization Through Biobutanol Production

CBR's partnership with Burnett Dairy addresses the economic and environmental burden of whey waste by transforming it into biobutanol. This biofuel serves as a renewable alternative to traditional fossil fuels and a key feedstock for SAF production. Benefits include:

- **Eliminating Disposal Costs:** Saves Burnett Dairy up to $1.4M annually.
- **Revenue Generation:** Converts whey waste into an added marketable resource.

Continuous-Flow Fermentation: A Technological Overview

CBR's advanced continuous-flow fermentation technology offers the following advantages:

- **Efficiency:** Maximizes microbial stability and reduces downtime.

- **Environmental Compliance:** Reduces BOD levels, ensuring waterway protection (Hendriks and Zeeman 169).
- **Scalability:** Modular systems allow expansion as demand grows.

Financial Analysis and Market Potential

SAF Production Capacity and Financial Viability

From 800,000 gallons of whey waste annually, CBR produces approximately:

- **80,000 gallons of biobutanol** (after 90% water removal).
- 40,000 gallons after STJ conversion process
- 200,000 **gallons of SAF** (with a 20% blend ratio).

Revenue Projections

The current SAF market price ranges from $8 to $12 per gallon. Based on these figures, annual revenue projections***** are:

SAF Price ($/gallon)	SAF Produced (gallons)	Total Revenue ($)
8.00	200,000	1,600,000
10.00	200,000	2,000,000
12.00	200,000	2,400,000

* SAF price per gallon is the finished fuel ready for consumption. Bio-butanol will make up 20-50% of the SAF blend; therefore, 50-80% of the blend will be petroleum jet fuel.

Leveraging Incentives

1. **Federal Programs:**
   - **Renewable Identification Numbers (RINs):** Each gallon of SAF generates 1.5 RINs, valued at $1.20 per RIN, totaling $1,036,800 annually.
   - **SAF *Blenders* Credit:** Offers $1.25 to $1.75 per gallon (IRS 2022).
2. **Wisconsin Incentives:**
   - **Dairy Business Innovation Alliance (DBIA):** Grants for renewable energy projects.
   - **Clean Energy Incentives:** State programs supporting SAF and biobutanol infrastructure.
3. **Global Programs:** Compliance with CORSIA standards incentivizes SAF adoption (ICAO 2021).

Environmental and Economic Impact

Environmental Benefits

- **BOD Reduction:** Lowered organic load prevents water pollution.
- **Methane Mitigation:** Reduces emissions from decomposing whey.
- **Lifecycle Emissions Savings:** SAF reduces greenhouse gases by up to 85% compared to conventional jet fuel (ICAO 2021).

Economic Benefits

- **Cost Savings:** Eliminates $1.2-1.4M annually in waste management expenses.
- **Revenue Streams:** Biobutanol sales to conversion entity creates significant income.

SAF with a bio-butanol blend will incur significant production cost increase due to the 1) cost of a sub-refinery to convert to STJ; 2) the loss of 50% of the bio-butanol during the conversion; 3) loss of blending credits unless a blending station is also added.

Conclusion: A Model for Sustainability

The CBR-Burnett partnership exemplifies how sustainability and profitability can coexist. By converting whey waste into biobutanol and SAF, this collaboration addresses longstanding environmental challenges while generating only minimal economic value, at least in the near term. The model's replicability across industries underscores its significance as a template for future renewable energy innovations.

Together, CBR and Burnett Dairy are leading the way toward a cleaner, more sustainable future.

For more in-depth information please see our website. Community BioRefineries

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