CASE STUDY

Capro-X Participates in Energy & Greenhouse Gas Impact Evaluation

New York State Pollution Prevention Institute

Capro-X, Inc.

Capro-X has developed a fermentation bioprocess technology that converts acid whey into bio-oils. Capro-X's bioprocess, when scaled up, will process acid whey at the site of generation, as well as produce a bio-oil from a waste product, which may be used as a palm-oil substitute; combining two currently separate processes (whey processing and oil production).

Challenge

Acid whey is a byproduct of yogurt manufacturing, which has grown dramatically in recent years. With $4 billion of Greek yogurt consumed annually, over 100 million gallons of acid whey is produced as a byproduct. New York State in particular is home to several large yogurt manufacturers. To manage the manufacturing byproducts, acid whey is typically trucked long distances to be land-applied or added to existing anaerobic digesters, incurring substantial environmental and financial costs. Furthermore, typical palm oil production requires clearing large sections of land to grow and harvest oil palms, making it a resource intensive process. Capro-X claims that the energy use and greenhouse gas (GHG) impact of their process will be lower than that of the current (baseline) processes, reducing associated energy use and impacts as compared to anaerobic digestion of acid whey and palm oil production.

Solutions

Capro-X requested NYSP2I to evaluate the environmental impact of their process, converting acid whey into bio-oils. New York State Pollution Prevention Institute (NYSP2I) researched both off-site anaerobic digestion of acid whey and bio-oil production processes and evaluated the energy use and GHG impact of both to determine the baseline energy and GHG impacts. The same analysis was done for Capro-X's bioprocess and compared to the baseline results.

Challenge

- Capro-X requested NYSP2I's assistance to conduct an energy and GHG impact comparison between Capro-X bioprocess and traditional whey treatment and palm oil production.

Solution

- NYSP2I defined the baseline processes for comparison, conducted a literature review, collected pertinent data, and calculated energy use and GHG impacts for off-site anaerobic digestion of whey, palm oil production, and Capro-X bioprocess.
- NYSP2I compared calculated energy and GHG impacts to quantify energy and GHG impact reductions of the Capro-X bioprocess over the baseline processes.

Results

- The analysis showed the Capro-X bioprocess has the potential to provide more than 90% decrease in energy use and GHG impacts per gallon of whey as compared to the baseline processes.

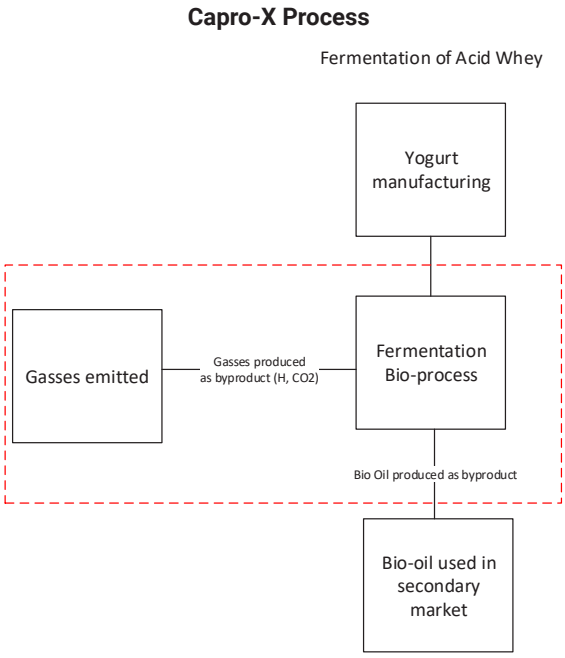

Figure 1: Process flow of Capro-X bioprocess, with analysis boundary shown in red

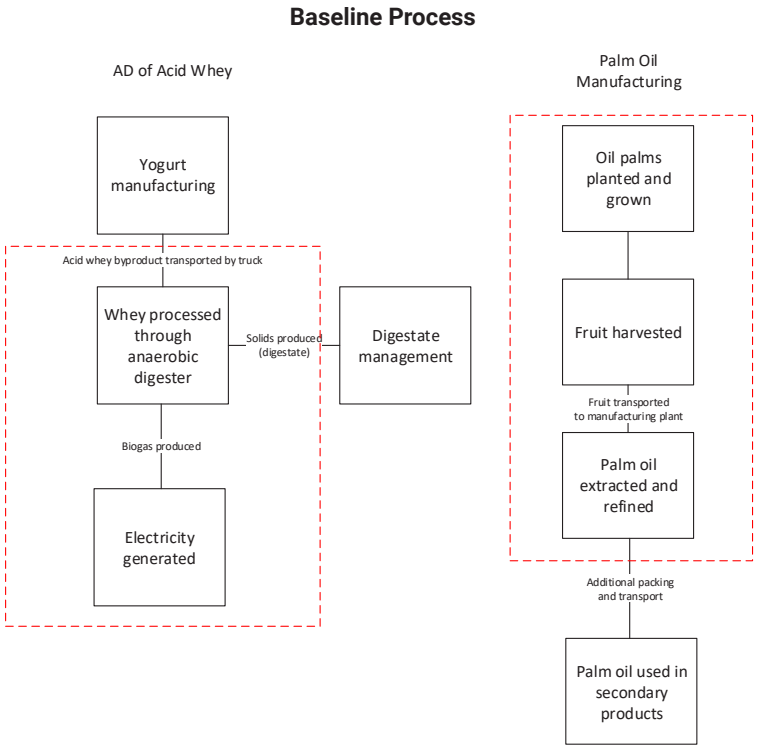

Figure 2: Process flows for two baseline processes: anaerobic digestion (AD) of acid whey (left), and manufacturing of palm oil (right); analysis boundary shown in red

Results

Operating at the size and efficiency provided by Capro-X for this analysis, NYSP2I estimates the energy use and GHG emissions impact per unit as follows, compared to off-site anaerobic digestion of whey and traditional production of palm oil.

- Capro-X's fermentation bioprocess has an energy impact per gallon of whey of 0.28 kWh/gal.
- Capro-X's bioprocess has the potential to displace energy use per gallon of whey by 3.66 kWh/gal; a 93% decrease in energy use over the baseline processes.
- Capro-X's bioprocesses has the potential to reduce GHG emissions per gallon of whey by 0.66 kg CO2e/gal; a 92% decrease in GHG impact as compared to current processes.

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Funding provided by the Environmental Protection Fund as administered by the NYS Department of Environmental Conservation.