EMISSIONS REDUCTION ALBERTA

Milestone Progress Report

Report Number: Milestone #2
Reporting Period: Jan, 2023 to May 31, 2024

Project Title: Brewery GHG reduction first-of-kind commercialization project
Agreement Number: B0161031

Project Leader: Kirk Zembal
Lead Institution: Blindman Brewing
Project Partners: Olds College, Amii

Project Budget: $ 204, 507
ERA Funding: $ 102, 254

Project Schedule			*Cost Status*		
(1)		Project on schedule	(1)	X	Cost on budget
(2)	X	Project delayed	(2)		Cost overrun
(3)		Project cancelled	(3)		Cost underrun
(4)		Project complete			

1 Overall Project Objectives

1.1 Describe the overall goals and objectives of the project.

This project will demonstrate the applicability of a new CO2 capture and reuse technology from Earthly Labs in the Albertan and Canadian markets. The project will reduce the amount of CO2 that Blindman Brewing vents to the atmosphere. The project will produce clear positive financial returns. The project will be demonstrated in a way that drives adoption by other Albertan and Canadian brewers.

1.2 Explain any changes that have occurred to the original goals and objectives of the project.

No significant changes to the original goals and objectives of the project.

1.3 Describe any changes to the overall approach for execution of the project.

Vendor Earthly Labs was acquired by Chart Industries, a larger industrial gas equipment supplier, so installation, equipment procurement is through Chart now.

2 Progress and Accomplishments

2.1 List the critical tasks and milestones to be achieved over the course of the project, as outlined in the contribution agreement, and describe the progress made toward each of these tasks and milestones during the reporting period.

- Equipment purchased: CiCi Carbon Capture System, Dewar Tanks, Manifold System, Foam Traps, Scales.
- Process Design commenced.
- Equipment testing and verification has been completed in Denver, CO to ensure equipment ability to capture ISBT beverage grade CO2.
- Equipment re-verified at Chart Industries.
- CRN certification process is finalized.
- ASBA certification process finalized.
- Equipment is Delivered and Installed.
- Fermentation tanks are plumbed in.
- Training on Equipment has begun.
- Process Design is completed.
- CO2 is being captured.
- CO2 is analyzed for quality and for suitability in utilization in brewing processes.
- CO2 is introduced in a staged approach in brewing operations.
- Process upset (oxygen ingress) is identified, mitigated and controlled for.
- System design upgrade (manifold) designed and produced for install.
- Operational maintenance and media replacement undertaken.
- Equipment upsets identified and mitigated with PM procedures created.
- Utilization of captured CO2 undertaken.

2.2 Explain any differences or variances between the planned progress and the progress-to-date in reference to project plan (tasks, milestones, and timelines), including reasons for the variances.

Major delays were incurred to date on project milestone progress. Primarily, these are related to 2 factors: regulatory delay, and supply chain delay. As this equipment was novel to Canadian regulators, a full regulatory review had to be completed before it was to be certified for use in Canada. In the process of review, Canadian regulators required numerous design changes as well as additional documentation. This required the vendor to source different components than originally planned. Then, those components had to be tested in the equipment for suitability. As well, components were harder to source than anticipated due to COVID related supply chain delays. These delays were compounded by a labour shortage in the United States that affected the main vendor in this progress.

Then, there was delays due to the acquisition of the main vendor by a larger supplier requiring logistical and testing changes and delays.

Finally, equipment was damaged in transport and had to be repaired onsite, leading to a delay in commissioning.

During certain periods of operation of the unit, oxygen ingress was detected which creates an off-spec captured CO2 stream. This CO2 would not be suitable for carbonation, therefore a staged approach of introducing captured CO2 into the brewing process was implemented. This staged approached will allow for full utilization of captured CO2 into carbonated beer in the mid-year of 2024. Work has been undergoing and a new stainless-steel manifold is being constructed in June of 2024.

Overall, Milestone #1 was delayed to May 31, 2023, Milestone #2 to May 31, 2024 and final project completion will be delayed until May 31, 2024.

2.3 Discuss key accomplishments and results obtained during the reporting period for each milestone and task. Include technical details where possible.

- Approximately 750 kgs of CO2 has been captured and utilized by November 2022.
- Approximately 2600 kgs of CO2 have been captured and utilized by December 2023.

3 Overall Assessment of Progress

3.1 Is the project progressing as planned?

Progressing, but delayed overall due to previous regulatory, operational and supply chain issues.

3.2 Do you foresee any delay in completion of the project?

Project was completed by May 31, 2024. There will be some residual work occurring post-project end date in order to maximize the amount and quality of CO2 captured in the future.

3.3 Describe any challenges that have been encountered in executing the project as planned.

Major regulatory and supply chain issues. Acquisition by vendor by competitor. Transport damage to equipment. Occasional Oxygen ingress into CO2 stream which degrades the quality of CO2 and eliminates possibility of utilization.

3.4 Is there anything ERA should be aware of? For example:

- *Have there been any changes to the business environment and/or project drivers?*
- *Have there been any key team member changes?*
- *Are there any external forces impacting the project?*
- *Have there been any environmental incidents?*

Acquisition of main project supplier Earthly Labs by Chart Industries. Change in Head Brewer from Lisa Barclay to Jasmine Weenink.

Milestone #1 costs are higher than anticipated due to longer length of Milestone #1 stage, but overall project budget is not expected to be impacted.

Milestone #2 costs are slightly higher than anticipated due to longer length of Milestone #2 stage. Overall ERA contribution is unchanged.

4 Greenhouse Gas Reductions and Benefits

4.1 Describe how the project will result in, enable, or lead to GHG emissions reductions in Alberta.

Blindman Brewing with purchase, install and commission a technology that will allow it to capture the CO2 it produces during fermentation and re-use it in the brewing process. Blindman Brewing produces CO2 via fermentation at an approximate rate of 4.1 kg/HL. This CO2 will be captured, scrubbed and compressed for re-use. Nearly all the CO2 produced via fermentation will be captured and re-used as the rate of CO2 usage is above the rate of CO2 production.

4.2 Discuss any changes or updates to the anticipated greenhouse gas reductions/benefits for the project (including immediate reductions from project implementation and expected future benefits through market adoption). Describe why these changes have occurred and the driving forces behind the change.

No significant changes expected from project plan. Occasional operational upsets (oxygen ingress) are identified and mitigated/controlled as needed. Market adoption is expected to be wide across Alberta and Canada due to the strong economics, and already equipment is being manufactured for other brewing customers across Canada.

5 Budget

5.1 Budget summary: update the following table so that the information is current as of the end of the reporting period.

Total Project Budget	ERA Maximum Contribution	Expenditures for the Reporting Period	ERA Invoice Amount for the Reporting Period	Total Project Expenditures to Date	ERA Total Contribution to Date (exclude current invoice)
$ 204, 507	$102,254	$ 45653.72	$ 12844.56	$ 224,470.61	$89,408.44

6 Expected Outcomes for the Next Reporting Period

6.1 Describe the expected activities and outcomes for the next reporting period, including any anticipated differences from the project plan as outlines in the contribution agreement.

- Financial Model can be verified: Operating costs will be captured, analyzed and modeled. Installation and commissioning costs will be tracked and scrutinized. Cost reductions due to offset of purchased CO2 will be captured and analyzed. Modelling will be completed based on fermentation data to develop a comprehensive financial returns model to drive wide adoption of technology.

- GHG emission reduction can be quantified, by taking mass readings to determine the amount of CO2 captured. These will be compared with the mass of CO2 purchased and can be compared with the baseline of 5.614 kg/HL of CO2 currently purchased to verify a reduction in CO2 being produced/used by the facility.