

# North Dakota Renewable Energy Program Final Report

**Recipient:** c2renew

**Contract Number:** R-025-035

**Report for time period of:** March 31, 2024

## DESCRIPTION OF PROJECT

*Please provide a brief description of the project:*

The objective of the project was to develop a pilot scale operation to measure and validate expansion of c2renew corporations' production and development with existing collaborators; Bobcat Co., John Deere Co., Earth-Kind Inc. and Toshiba Corp., as well as new customers, Fargo 3D Printing, Intelligent Agricultural Solutions, Bogobrush, etc. The pilot facility will include a 75 mm twin screw extruder and ancillary processing equipment.

## PROJECT TASKS

*Please describe the progress on all project tasks achieved during the reporting period:*

### **Purchase of: Twin Screw Extruder, Polymer Dryer, Air Compressor, Dust Collector, and Chiller**

- We purchased additional equipment for the installation of the dust collector and polymer dryer, but unfortunately were not in a position to purchase the twin screw extruder and chiller until recently, long after the project period ended.

### **Throughput Rate – measure percent change from current production to production in pilot facility and how additional extruder lines impact the rate.**

- During the project duration, we doubled our throughput rate by adding an additional dryer which allowed us to dry more on the front end and back end of our production. We also performed maintenance on our spin dryer which allowed us to mitigate some post drying took up additional dryer space.
- After the project period ended and we purchased a 43mm twin screw extruder, we streamlined all of our production and increased production capacity.

### **Unit Economics – analyze the difference in the cost of goods, personnel cost and shipping with an expansion of production (i.e. IAS and Toshiba)**

- We have been able to drill down more closely on our unit economics by working with our suppliers and logistics company. We focus heavily on just in time manufacturing and have worked hand in glove with our suppliers to provide our monthly and quarterly projections to accommodate for this method. On certain formulations we have been able to tweak our formulation to increase our margins by 5-10%.

### **Cost of Production – measure the change in scrap rate, equipment up-time and extruder profile change over.**

- With addition of ancillary production equipment during the project period we were able to increase our run times which naturally allowed us to reduce our scrap rate. Currently we are generating an estimated average of 3-6% scrap. The amount can change based on size of the material order. For instance, we typically have a higher scrap rate when running for filament on up-time, purging, and change overs of smaller batches of material.

**Production Scheduling – refine production schedule and define a manufacturing ERP system for scaled growth.**

- Following the end of project period when we were finally able to purchase our 43mm twin screw extruder, the production schedule also became much more streamlined. To-date it has not reached the point of needing a dedicated ERP system, but is managed by Excel files instead.

**DELIVERABLES**

*Please describe the progress on project deliverables, as stated in your contract, achieved during the reporting period:*

**Production Growth: Expand production to 6 million pounds per year**

<b>FEEDSTOCK</b>	<b>POUNDS PROCESSED PER YEAR</b>
Flax shive	1,000s
Hemp hurd	10,000s
Kernza stalk	1,000s
Cotton fiber	1,000s
Wood flour	10,000s
Polylactic Acid (PLA)	1,000s
Polypropylene (PP)	10,000s
Polyethylene (PE)	10,000s
Cellulose acetate phthalate (CAP)	1,000s
Other plastics	10,000s

- During the project period and up until today we have continued to expand in the types of feedstocks we work with as well as total annual biocomposite production, but are still shy of producing 1 million pounds of final product annually.
- Much of the growth we were predicting during the project period was scaled back due to the slow down resulting from the pandemic and years following.

**Production Efficiency: Lower costs of production to \$0.20 to \$0.25 range**

- The additional pieces of equipment we brought on did allow us to reduce our input costs as we were able to process more efficiently and reduce scrap, but unfortunately due to the increase in utilities and employee compensation since then our production costs are in the \$0.30 range.

**Customer Acquisition: Intent is to grow the customer base**

- As a company we were able to grow our customer base both during the project period and following it. Currently we sell biocomposite pellets to multiple molders and 3D printers throughout the US as well as are a contract manufacturer for a biocomposite products company from Finland.

**Job Growth - increasing the number of team members between 4 to 6**

- During the project period we were able to bring on 2 additional employees, but once the pandemic hit and we streamlined our processes, we scaled back down to 2 total employees as we found most of our production could continue to be served that way.

**New Technology Development**

- During the project period and up until today, we have continued to be a part of some development projects as well as proof-of-concept products. Many of these opportunities have allowed us to expand our material offerings and challenged us to develop some advanced biocomposite materials along the way.

**EXPENDITURES**

*Please provide a breakdown of expenditures. Include all sources of match. Provide supporting documentation as a separate attachment.*

<b>EXPENDITURES FOR THIS REPORTING PERIOD ONLY</b>				
<b>Project Expense</b>	<b>NDIC</b>	<b>REP Recipient</b>	<b>Other Sponsor</b>	<b>Total</b>
<b>Total</b>				

<b>CUMULATIVE EXPENDITURES</b>				
<b>Project Expense</b>	<b>NDIC</b>	<b>REP Recipient</b>	<b>Other Sponsor</b>	<b>Total</b>
<b>Total</b>				

**EXPENDITURE JUSTIFICATION**

*Use this space to explain how costs relate to the project as necessary.*