

Contract No. R-025-035

**“Pilot Scale Facility for Biocomposites Development for Industrial and Consumer Products
- Phase II”**

Submitted by c2renew corporation
Principal Investigator: Chad Ulven

PARTICIPANTS

Sponsor	Cost Share
c2renew	<u>\$750,000</u>
Subtotal Cash Cost Share	\$ 750,000
North Dakota Industrial Commission	<u>\$500,000</u>
Total Project Cost	\$1,250,000

Project Schedule – 18 months	Project Deliverables:
Contract Date – 5/25/2016	Status Report: June 30, 2016 ✓
Start Date – 5/1/2016	Status Report: December 31, 2016 ✓
Completion Date – June 30, 2017	Status Report: June 30, 2017 ✓
	Status Report: June 30, 2018* ✓
	Status Report: February 28, 2019*^ ✓
	Final Report: July 31, 2019^

*Denotes changes to the original contract.

^Denotes second set of changes to the original contract.

OBJECTIVE/STATEMENT OF WORK:

The objective of this project is to develop a pilot facility to enable the applicant to assess the following:

- Scalability of additional extruder lines.
- Unit economics of expanded production projects such as Toshiba, Intelligent Agricultural Solutions and Fargo 3D Printing.
- Personnel growth.
- ERP system integration, such as production scheduling and inventory management.

Expected results of the project include expanded production from 520,000 pounds of material to 6 million pounds of material per year, increased throughput rate, lower production costs, expanded compounding capabilities, and new customers and market growth. Ultimately the applicant plans to establish a production facility in Colfax.

^The Industrial Commission approved a change to the scope of work on 4/30/19 from building a facility in Colefax to leasing a facility in Fargo.

STATUS:

The contract has been signed.

The first Status Report has been received. It states:

The objective of the project is for 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. With the previous support of the North Dakota Industrial Commission, c2renew corporation is positioned for growth and implementing a pilot scale operation will provide us the ability to measure production efficiencies, customer growth, job growth, rural development and innovation development in North Dakota.

To advance down the path of getting equipment in place to begin to scale the facility it is important to identify specifics of the equipment that would need to be tweaked and adjusted from the budgetary quotes that were received in the beginning of the project. In addition to assessing needed modifications, it is equally necessary to sketch out what the facility layout would be (i.e. material flow, storage, equipment placement) as well as what are the needed infrastructure upgrades (i.e. electricity, waste water, ventilation).

What was yielded from the preliminary work was first addressing the building layout. In the layout we plan for our ventilation and blow out panel on the south wall, extruder in the center of the space and ancillary equipment (i.e. dryer, classifier) in-line with the system to automate the process. We have a small staging area at the east end of the facility to prepare for shipping out the loading dock.

In addition to laying out the facility for material flow, we also had to address the limitations in power currently coming into the building, and worked with the building owners to identify the size and location of a new transformer to handle the load. In addition to the power requirement we also needed to work to identify the best location of where to locate the transformer to ensure that we shorten the distance between the extruder and the power supply to limit the cost of pulling power the extruder. The expected location will be in the north-west corner of the adjacent building so the owner can also draw power for their needed expansion.

As indicated in the earlier paragraph we also had to review some questions regarding the blow out installation for our dryer and review building codes to ensure we met specific setbacks. We also looked at those comparable restrictions as it related to where we could position our dust collection system.

The preliminary work will make the transition into the space much smoother and should mitigate or eliminate unnecessary downtime due to power needs, transformer location, materials need to run power, ventilation location, etc.

The second status report was received on February 21, 2017. It states:

The objective of the project is for 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. With the previous support of the North Dakota Industrial Commission, c2renew corporation is positioned for growth and implementing a pilot scale operation will provide us the ability to measure production efficiencies, customer growth, job growth, rural development and innovation development in North Dakota.

To continue the pace of expansion we've identified in Phase II, we have focused our efforts on growing our existing customer base to prepare for the new equipment. A prime example of this growth has been

our work with Earthkind and 3DomFuel (formerly Fargo 3D Printing). During the first phase of our NDIC project we had started working with Earthkind on the first generation of holder for their Stay Away line. Through that work we moved to the second generation and was scaled up for launch in a big box retailer. From the end of the first phase we saw that business double and it is projected to double again in 2017.

As for 3Dom we had initially launched a single filament line, Wound Up (coffee filament) at the tail end of the first phase and to date have 4 filament lines available in the market (Wound Up, Buzzed, Entwined and LandFilament). We have an additional two line scheduled to launch in quarter 2 and are reengineering one of their existing lines for relaunch. In starting with 3Dom we grew our filament business from 0 to approximately 8,500 spools per month; with three of the lines (Entwined, Buzzed and Wound Up) among 3Dom's top selling products.

In addition to the two examples we've outlined above we also worked to help one of our early partners assess an acquisition offer and expand their product line; made our second line of coffee cups from hemp, started supplying a toy company with material, expanded into the UAV space by manufacturing advance composite wing structures and continued to provide engineering services for a broad base of customers.

To continue to move the ball forward on the projects we rely heavily on the great people we that work at c2renew to continue to help us to grow and scale the business. As part of our NDIC Phase II we identified employee salary as a portion of scaling our growth to ensure we filled the pipeline for the new piece of equipment listed in the proposal. It is important to us to fill the demand of the new equipment as to not have an idle piece of equipment.

Each of the projects outlined above as well as others we are working on are critically important for executing on our Phase II. By taking a pragmatic approach to growing our business in smart long term approach, we feel it is important to have at least 80% of the demand for the new extruder filled prior to executing on the purchase. To ensure we do that we need to have our personnel working hard to execute on the current customers and be efficient with the line we have. In addition, it continues to advance our mission of building the bio-economy by utilizing various streams of materials ranging from; flax, coffee, barley, hemp, corn, municipal solid waste, cotton, etc. In total we have utilized approximately 25-40 tons of materials and will continue to grow that as we expand through Phase II.

In addition to scaling the growth and in preparation for the new equipment we have scheduled our extruder trial with Century Extrusion for early April. The trial will be to validate the size of the extruder and that it is scaled appropriately for annual estimated output, determine what the necessary ancillary equipment will be and lastly see how our material processes in the equipment. To facilitate the trial Mike Ehresmann will be traveling to Century's facility for roughly a week to participate in the trial and review the results.

April 2017, the contract was amended c2renew indicated that they will be submitting a modification request which will include revisions to the original request and a time extension. Revisions to the original request included a no cost budget adjustment in expense categories. This request was approved by the Commission.

May 2018

Status report was received. The report states in part:

With the scale up the focus is always on adding new production outlets, whether through our existing customer base or new customers. We have continued to expand our work with 3DFuel and grow that side of the business at 25% month over month. This has resulted in 3DFuel expanding their production capacity with plans to add two additional lines. They are also expanding into a larger space which we are co-locating with them to continue to broaden our product offerings.

The exposure we have received from developing the 3D printer filament has led to some interesting collaborations and development projects. We have developed custom material for a large beer brand that is printing custom beer coasters in bars this summer to highlight their sustainability efforts. This has led to us utilizing their waste stream which is a new market opportunity for them. We are also working with a large coffee brand on a similar project where we would be developing eyewear for them that would be used in a digital advertising campaign that will be highlighting their social and sustainable side of their business. We are also working with a large car company that is using our filament for custom developed components in the interior of the car that will be highlighted at a showcase in summer 2018. These are just a few examples of what the benefit of our collaborative development relationship with 3DFuel. It highlights how ND companies can utilize local resources (i.e. biomass) and develop new products that can get national use and recognition.

In addition to the work we have been doing on the filament side of the business our material development for injection molding and sheet extrusion has also been just as busy. Some of our very early partners have started to expand their production capacities which is a testament to the foundation that was built in our early projects. Bogobrush is a prime example of this. They are currently expanding their production capacity from a single cavity tool that could 10s of thousands of brushes to now moving to 100s of thousands of brushes. We are currently formulating materials for 3 new product SKUs that will be launching in summer of 2018.

In addition to Bogobrush we are also expanding our work into packaging and have started working with a company that has developed a hemp package brand. We are currently supplying Sana Packaging with more than 20,000 lbs of material each quarter. This is an example of an opportunity to build our ND's infrastructure to include growing and processing hemp. For the work we are doing with Sana and other companies we will acquire more than 50,000 lbs of hemp feedstock. However, given we do not have hemp being grown and processed in ND we have to source it from Kentucky.

We also continue to provide engineering services to a broad number of partners that are in ND as well across the US. We have had a hand in helping to launch over 7 products that we have helped design, test or develop material for. We are continuing to work with these brand partners and have 4 more products in are engineering services que throughout the Q2-Q3 that we will be working on...ranging from journals made from recycled wood waste, retail displays from cotton, speakers, modular furniture and aerospace components.

To help to sustain the growth and work we are doing we needed to add an additional oven that dries down the biomass so we are able to keep up with the demand while we wait to get our larger dryer installed in our new facility this summer. In addition to that we have continue to rely on our great team to do double duty as both production and technical engineers that can wear multiple hats.

As we've outlined in the report we continue to work toward the expansion goal and as part of that we continue to grow both in production, customer base, equipment and space. As part of this report and previous we continued to expand each of these areas by making targeted trips to customer's locations and trade show to grow our potential customers. We have also purchased some scaled equipment that

will help to mitigate some production bottle necks when drying biomass. Lastly, we have continued to expand our production and office space to facilitate the grow...at the inception of the project we were in a shared double office and then expanded to a space that could house 10-15 people. We also added production space that put our square footage to just around 9,000 sq ft.

To accommodate the next phase of growth we are moving everything into one space that approximately 15,000 sq. ft. This will prepare us to bring in the remainder of the equipment we had specified to reach the production output we anticipated.

August 2018

Status report received. It states in part:

- We are purchasing a larger capacity polymer dryer and a single screw extruder line. Our larger scale biomass dryer has been installed in our new facility in Fargo, ND and we are getting a new control system installed. While that is being installed we have had to contract dry with the manufacturer of our dryer to keep up with our production demands. We have a new air compressor line that has been brought in as well. We have quotes from 4 extruder manufacturers for a larger throughput machine.
- We have currently oversold the current capacity on our existing extruder line and are assessing whether to add a second shift of production once our large scale biomass dryer is at full operational capacity. This would allow us to evaluate the economics of how multiple shifts impact the throughput of our equipment.
- We have looked closely at the unit economics and what a larger machine would do for us specifically as it relates to toll manufacturing.
- We continue to grow our customer base and work on new industries. We are currently developing material utilizing hemp waste and field 5-6 new leads each week of folks inquiring about our materials. We are expanding our production work into large format printing and have developed an exclusive material for a manufacturer based in Wisconsin.
- We have added 2 new interns this past summer and through our collaborative work 3DFuel has added two new employees.
- We have decided to locate our newest production facility in Fargo, ND. Although it is Fargo, we are located in what is defined by the state of North Dakota as an Opportunity Zone, which is an area that is economically distressed area that needs investment.
- We recently tested a new technology in collaboration with ComDel Innovations to test the feasibility of utilizing rapid tooling that would lower the time and cost of bring a product to market. Our initial test was successful but will need further refinement. For this project we shared in the cost of development with ComDel and manufactured the tooling and the material for the trial.

FEEDSTOCK	POUNDS PROCESSED PER YEAR
Hemp	30,000
Flax	15,000
Barley	3,000

November 2018

Status report received. It states in part:

- We are currently installing equipment into our new space at 2222 7th Ave N in Fargo, ND. As part of the equipment install we had some electrical upgrades made to the space. A larger

electrical panel was installed to provide 480 V service to our equipment. In addition to the panel a larger electrical transformer was installed by the utility provider, Xcel Energy.

- In addition to the panel, conduit lines were run for new plugs as well as lines for equipment that needed to be hardwired. Modifications are currently being made to the building to accommodate the air handling and ventilation of equipment.
- We continue to try different scheduling systems; Slack, Airtable, Asana, old-fashioned Excel spreadsheets and we are finding a combination of an online portal and Excel is a good combination. We have met with a local software firm that is developing an ERP system for service businesses.
- We continue to analyze the unit economics have started to get better margins as we continue to purchase larger amounts of biomass as well as working out larger biomass supplier agreements.

May 2018

Status report received. It states in part:

- We are currently installing ventilation equipment in our new space. We waited until the weather warmed up as we will need to punch a hole in our walls to vent outside. We brought on Patrick Simpson to equipment install, maintenance and oversight. Patrick also modified our pelletizer as well as our polymer dryer that we brought in.
- We are testing a new system for our biomass drying with the dryer manufacturer. So we have been sending them material for preparing the equipment and providing us details on equipment set up.

An extension through July 31, 2019 has been granted along with a budget modification and changes to the scope of work.

5/17/2019