

Final Report

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The objective of the project is for continued development and industrial trial of biocomposite materials produced by c2renew corporation for consumer products by Earth-Kind and industrial applications for Bobcat Co., John Deere Co., and Toshiba Corp. c2renew corporation is a recent spin-off small business created in ND from technology developed at NDSU and Earth-Kind is a ND company founded and run by Kari (Warberg) Block (CEO/founder) since 1995 when she began selling potpourris and organic produce on her farm.

The culmination of the hard work put toward this project has been completed and we couldn't be more pleased with the results. It was a project that resulted in some great outcomes and larger opportunities going forward.

The bulk of our project was focused on our continued work with Earth-Kind to develop a bio-based air freshener holder. Through our work we developed a holder that met the criteria but needed some further refinements which lead to the work we did on the 2nd generation holder. The 2nd generation holder closely matches the form, fit and function that more closely matches the size of Earth-Kinds repellent pouches.

Our work with Earth-Kind on this project and others has led to a great collaborative effort that will continue to bear fruit for years to come with larger distribution of the holder as well as new product launches. The work has resulted in job growth at both Earth-Kind and c2renew as well as facility expansion to continue meeting the needs.

In addition to working with Earth-Kind, c2renew focused on expanding our work with Bobcat and John Deere. With Bobcat we focused our efforts across a couple of opportunities. The first was to introduce our material into a select few product lines. We had good success in moving this through the manufacturing, testing and validation phase however we were slowed a little due to personnel change in the sourcing and reassignment of engineering leads. The second opportunity that we are focusing more on is working more closely with Bobcat on their engineering service needs.

The proposal stated that c2renew would develop a biocomposite containing up to 30wt% agricultural waste filler into its biocomposite formulation for this application. If successful, Bemis will purchase 700,000 lb/yr of c2renew's specially formulated biocomposite to meet their production needs for Bobcat. We have presented to their engineering team and continue to have

an open discussion of where we can provide support to the engineering team leads. We were approved by Bobcat and listed on the engineered drawings for this part however we have been working with the molder to get this part into production as there has been turnover in Bobcat sourcing with 3 new people we've had to get up to speed on the material and process.

With John Deere we focused on parts in their turf division and working specifically with their Tier 1 molder in Minnesota to continue our work. During our work we were successful in getting to PDP (product delivery process) which gets our material into the production stream. We will continue to explore other opportunities with John Deere and their molder.

The proposal stated that c2renew will develop a biocomposite containing up to 40wt% agricultural waste filler into its biocomposite formulation for this application. If successful, Melet Plastics will purchase 15,000 lb/yr of formulated biocomposite to meet their production needs for John Deere. We did get another part with Melet for 10,000 lb/yr.

One of the tasks listed in the proposal was a project with Toshiba. c2renew hoped to develop a formulation that not only meets the 25% renewable threshold set by Toshiba but also eliminates the concern of sourcing potentially hazardous materials. It was hoped that Toshiba would purchase 1mil lb/yr of c2renew's specially formulated biocomposite to meet their production. We are continuing our work with Toshiba on this but have not scaled into the 1 million lbs/yr of production. We are currently working on 250,000.

Lastly, one of the other charges of the project was to advocate for building the ND bio-economy and sharing the importance of expanding into bio-based materials. With this work we were able to gain some great visibility and collaborate with a number of new companies; Bogobrush, Appareo, Falcon Plastics, etc. We will continue to advocate for the importance of utilizing bio-based products that provide mechanical, economical and sustainable advantages.

In closing we feel the outcome of the project was successful. Below are few highlights:

- Increase in employee headcount to 8 employees.
- Growth in revenue.
- Growth in customers both in material sales and engineering services. Over the course of the grant we grew our customer base by 15 customers in materials and engineering and indirect by more through our work with 3Dom.
- Continued work with project collaborators.
- Production expansion – larger extruder.
- New 10,000 sq ft. production space planned for 2016 in Colfax, ND.
- Number of pounds of ND biomass utilized – 25 tons.
 - The amount of agricultural residuals that we used was lower than originally anticipated however we did branch out into some interesting (i.e. coffee, beer, hemp).