



December 31, 2012

c2renew corporation
PO Box 253
Colfax, ND 58018

Industrial Commission
State Capitol 14th Floor
600 E. Boulevard Ave. Dept. 405
Bismarck, ND 58505-0840

Dear Industrial Commission Review Board,

In compliance with the fulfillment of the requirements on the North Dakota Industrial Commission “Renewable Energy Program”, c2renew corporation would like to present the proposal titled “Biocomposite Development for Industrial and Consumer Products”, in accordance with your instructions.

The outcome of the project is continued development and industrial trial of biocomposite materials produced by c2renew corporation into consumer products by Earth-Kind and industrial applications for Bobcat Co., John Deere Co., and Toshiba Corp.

c2renew corporation kindly asks the Industrial Commission Board to consider c2renew corporation for a Renewably Energy Program grant.

Regards,


Corey Kratcha
ceo

c2renew corporation



Renewable Energy Program

North Dakota Industrial Commission

Application

Project Title:

Biocomposites Development for Industrial and Consumer Products

Applicant:

c2renew corporation, Earth-Kind, & NDSU

Principal Investigator:

Dr. Chad A. Ulven

Date of Application:

01/01/2012

Amount of Request:

\$150,000.00

Total Amount of Proposed Project:

\$300,000.00

Duration of Project:

2 years

Point of Contact (POC):

Dr. Chad A. Ulven

POC Telephone:

701.212.2824

POC Email:

culven@c2renew.com

POC Address:

PO Box 253, Colfax, ND 58018-0253

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ABSTRACT

Objective: This proposal requests funds for continued development and industrial trial of biocomposite materials produced by c2renew corporation into 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 since 1995 when she began selling potpourris and organic produce on her farm. The technology developed and used by c2renew and Earth-Kind provides a means to diversify and promote additional use of ND agricultural biomass in materials and products to create a more sustainable biobased energy and materials economy.

Expected Results: The expected results include the establishment of a 100% biocomposite formulation to be used in a new home and industrial rodent repellent holder design for Earth-Kind; continued development and implementation of biocomposite materials for Bobcat, John Deere, and Toshiba prototype parts and applications; promotion of the demand and value of ND renewable materials; and prove the commercialization of the biocomposites developed in this project. The projected economic impact created by the success of the proposed product trials include a revenue increase of \$1.7mil/yr for c2renew, \$535,500/yr for Earth-Kind, and \$40,000/yr for ND biomass producers.

Duration: The duration of this project is estimated at 2 years.

Total Project Cost: The total project cost is budgeted at \$300,000.

Participants: This project is collaborative effort between c2renew corporation, Earth-Kind, and NDSU.

PROJECT DESCRIPTION

Objectives: This project will develop and trial biocomposite materials produced by c2renew corporation into consumer products by Earth-Kind and for industrial applications in Bobcat Co., John Deere Co., and Toshiba Corp. In addition, David Lehman, NDSU's Manufacturing Engineering Extension Specialist, will also be involved to provide guidance and to serve as a liaison to ND's manufacturing network. The experience NDSU manufacturing extension has with inventors, innovation, and bio-based projects will be beneficial to the project. Moving forward, manufacturing extension may also be able to identify additional applications in the state which may be a good fit for this new technology.

Worldwide annual production and use of plastics is 300,000,000 tons. Bioplastics and biocomposites such as the ones proposed in this project make up less than 1% of the entire market. Given this market size and potential, c2renew is mainly focusing first on the agriculture equipment industry. There are more than 6,840 different models of farm tractors manufactured by 183 different manufacturers and 1,070 lawn tractors manufactured by 41 different manufacturers. Some of our most notable material trial customers include John Deere Co., Bobcat Company, AGCO Corporation, and Shur-Co.

However, the investigators recognize a technology gap exists between laboratory scale development of biocomposite materials and commercial production of consumer goods. By funding the proposed project, we will be able to further prove different biocomposite formulations for interested companies on an industrial scale. The specific products we will focus on and the companies we will work within this project are as described as follows:

Rodent Repellent Holder – Earth-Kind: Earth-Kind manufacturing company is an innovator and green market leader in the retail, and structural pest control industry, with development and successful commercialization of the world's first bio-based rodent repellent to be certified by the Federal EPA; Fresh Cab®. The marketplace has come to know and expect Earth-Kind manufacturing to continue to innovate new products for existing distribution channels; products that are fully bio-based, highly

convenient, and offer a safe solution that is just as effective as the existing toxic solution. c2renew has been tasked to develop a design and 100% renewable biocomposite formulation for Earth-Kind's new delivery product. c2renew will help Earth-Kind to produce this product using 54,000 lb/yr of formulated biocomposite.

Headliner Trays - John Deere Co.: c2renew has been tasked to develop a biocomposite formulation for a paper tray insert for John Deere construction equipment headliners which are molded by Melet Plastics, Inc. located in Fargo, ND. Each part weights 0.7 lb and is currently produced with 100% petroleum based plastic. 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.

Inkjet Cartridge – Toshiba Corporation: c2renew was tasked to develop a biocomposite molding material for Toshiba's inkjet cartridges. Toshiba is working with c2renew to have a more stable supply of material that contains at least 25% recycled or renewable as required by Toshiba in their products. c2renew will develop a formulation that not only meets the 25% renewable threshold set by Toshiba but also eliminates the concern of sourcing potentially hazardous materials. If successful, Toshiba will purchase 1mil lb/yr of c2renew's specially formulated biocomposite to meet their production.

Engine Cooling Vent - Bobcat Company: c2renew has been tasked to develop a biocomposite formulation for an engine cooling ducting in Bobcat's new tier four engine compartment on their skid steers which is molded by Bemis Custom Plastics located in Sheboygan Falls, WI. They are a company who fully recognize the need to be strong stewards of the environment. Their goal is to use sustainable technology and experience not just to serve their customers, but also to ensure they do right by planet earth. c2renew will 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.

Methodology: Successful completion of this project has been determined to require the following tasks:

Acquisition of materials for Earth-Kind 100% biocomposite – Identify and purchase several types of biobased polymer and biomass to produce a 100% biocomposite.

Manufacturing of lab scale composite coupons of 100% biocomposite material – Compound multiple formulations of 100% biocomposite using a lab scale extruder and injection mold sample coupons for testing. Perform mechanical testing on sample coupons to determine ideal formulation for the Earth-Kind's application.

Design of injection moldable Rodent Repellent Holder for Earth-Kind – Design a plastic component capable of meeting the function of the Rodent Repellent Holder, is aesthetically pleasing, and is easily manufactured using an injection molding process.

Mold design and manufacture for Earth-Kind – Design a mold to produce the Rodent Repellent Holder by the injection molding process. Machine, assemble, and test the mold for production.

Identify OEM Components ideal for biocomposite material substitution – Coordinate efforts with interested Original Equipment Manufacturers (OEMs) to identify components of agricultural equipment and consumer goods which could ideally be replaced by a biofilled plastic.

Acquisition of materials for OEM trials – Identify and purchase thermoplastic polymers and biomass to meet OEM application specification requirements.

Develop formulations and test coupons to suit OEM needs – Determine the maximum amount of biomass filled in a polymer to satisfy the material requirements of the OEM through a process of formulation, test coupon manufacture, and mechanical testing.

Perform production trial and product testing with OEM – Compound trial batches of ideal formulations for each application. Oversee molding and product testing with trial material.

Receive approval for biocomposite material from OEM – Interact with engineering and purchasing to approve c2renew developed biocomposites for production in each application successfully trialed.

Anticipated Results: c2renew's focus will be to design materials as drop-in replacements for current petroleum based polymers or mineral filled petroleum based polymers for different OEMs. If all four trial products described above are successful, nearly 530,000 lbs of ND biomass (combination of sunflower hulls, flax shive, oat hulls, and sugar beet pulp) will be utilized on an annual basis for these products. As c2renew continues to grow and build stronger relationships with the OEMs we serve, we position ourselves to aid new product development within these companies, acting similarly to an engineering consulting firm in addition to designing the right material for the application and supplying it. This grant will help us secure relationships with Earth-Kind and the other OEMs we are working with while diversifying the use of agricultural biomass in ND.

Facilities: c2renew corporation, Colfax, ND (www.c2renew.com) is equipped with sufficient instruments and facilities by working with the Mechanical Engineering (ME) Department at NDSU for extrusion and materials characterization. Mechanical Engineering has a full suite of composite testing equipment in house. c2renew will purchase and bring on a large compounding extruder that is planned to be installed at ND manufacturing facility, ComDel Innovation, Wahpeton, ND (www.comdelinnovation.com), within 6 months using a ND Development Fund low interest loan. In addition, c2renew will purchase computer aided drafting software, finite element analysis software, and injection mold flow analysis software to support all of the projects identified in this project.

Earth-Kind manufacturing facility is located in Faribault, MN (www.earth-kind.com) at the axis of distribution and supply points. This 7500 Sq. foot facility will continue to serve as the distribution arm for new product. The facility is leased by Earth-Kind for past 5 years. Plant manager has 27 years of experience developing and managing all systems and processes for innovative food packaging business that went from 2 million in sales to over 500 million in sales to retail and industrial customers. Earth-

Kinds corporate offices are located in Bismarck ND, where all finance, marketing, HR, and customer service take place.

Resources: The biocomposite formulation expertise within c2renew combined with the composite characterization expertise at NDSU will ensure the smooth progression of the project. In addition, many bright talented students and engineering interns with fresh perspectives and ideas will contribute greatly to the vision set forth by the principle investigators and will act as the conduit for technology transfer between the collaborators. Also, the principal investigators will work closely with the OEM engineers to establish the criteria necessary for a drop-in replacement biocomposite, allowing for a tailored formulation to ensure successful implementation.

Techniques to Be Used, Their Availability, and Capability: c2renew's formulation development is based on principles of organic chemistry combined with composite micromechanics theory. Seven years of research conducted by Dr. Ulven and his research team at NDSU allowed the development of robust techniques for combining a multitude of agricultural byproducts (flax fiber, flax shive, sunflower hull, dried distillers grains with solubles, soybean hull, corn cob, sugar beet pulp, etc.) into a wide variety of commercial plastics such that no single formulation is dependent on one particular agricultural biomass. In this way, c2renew can purchase agricultural byproducts at the lowest price, regardless of their source, while repeatedly producing consistent biocomposite materials.

Environmental and Economic Impacts while Project is Underway: No negative environmental impacts are foreseeable during the project. The use of benign polymers and agricultural biomass significantly reduce the environmental and safety concern. Green chemistry principles such as bio-based raw materials, non-toxic surface treatments and compatibilizers will be implemented wherever possible in

the production of the prototype biocomposites. Any chemical waste produced in the testing will be disposed of according to established protocols

Ultimate Technological and Economic Impacts: The biocomposites developed by c2renew will have significant bio-renewable content, good performance and a lower cost for the companies we work with. In addition, the fabrication and use of such products will conform to the latest government environment regulations, thus they are expected to receive wide market acceptance. Ultimately these ND produced biocomposites will significantly contribute to a sustainable regional economy by job creation at both c2renew and Earth-Kind, as well as provide an additional market for agricultural materials. In addition, the stimulation of game-changing innovation like this in ND cannot be minimized as it creates the ideal eco-system for a clustering of like-minded innovators, and symbiotic spin-offs.

Why the Project is Needed: The proposed biocomposite trials are expected to bring both economic and environmental benefits to ND farmers, local businesses, and society. Biocomposites derived from abundant ND agricultural products will be used as building blocks, creating value and demand for ND agricultural products. Both c2renew and Earth-Kind expect to hire additional personnel and significantly increase their annual revenue as a result of being successful in this project. Specifics of this projected job growth and potential revenue are outlined in the Standards of Success. In addition, the projected annual revenue based on the usage of ND biomass (combination of sunflower hulls, flax shive, oat hulls, and sugar beet pulp) is outlined. Finally, these research and development projects will also promote the continued propagation of research in bio-based ND technology.

STANDARDS OF SUCCESS

The expected deliverables by the end of this project include:

1. The design and prototype of a 100% biocomposite formulation to be used in a new home and industrial rodent repellent holder design for Earth-Kind. The global market potential for this new delivery system is \$2 billion. The 5 year rate of growth for Earth-Kind has been 40% annually; the rate of growth of the retail pest control category is 4% annually. On the industrial side, the market is much larger and includes Government. **The success of this new product would allow a continued job creation at the rate of 25% per year at Earth-Kind and \$535,500/yr of increased revenue.**
c2renew will formulate and produce \$81,000/yr of biocomposite for this new device.
2. Prove the commercialization of the biocomposites developed in this project. With success of these products, c2renew will formulate and produce \$630,000/yr of biocomposite for Bobcat, \$950,000/yr of biocomposite for Toshiba, and \$48,750/yr of biocomposite for John Deere in addition to that for Earth-Kind. Purchase orders for these biocomposite will be secured by the 2nd year of the project. **c2renew will bring on one additional engineer and one compounding operator by the 2nd year of the project with an additional projected revenue of \$1.7mil/yr with the success of these products.**
3. Promotion of the demand and value of ND renewable materials. **If all four trial projects described are successful, nearly 530,000 lb of ND biomass will be utilized on an annual basis for these commercial products. This correlates to a projected \$40,000/yr of revenue.** The promotion and demand of bio-based composites is 100% aligned with Earth-Kinds global marketing initiatives and will be used within Bobcat's, John Deere's, and Toshiba's companywide sustainability initiatives.
4. Continued development and implementation of biocomposite materials for Earth-Kind, Bobcat, John Deere, and Toshiba prototype parts and applications. c2renew will identify two new applications of their biocomposites for each of these collaborative companies by the end of the project in addition to the ones identified and proven during the project.

BACKGROUND/QUALIFICATIONS

Dr. Chad A. Ulven, CTO/co-founder of c2renew corporation, Associate Professor of Mechanical

Engineering at NDSU: Biocomposite materials reinforced with natural fibers have been developed, processed, tested, and evaluated by Dr. Chad Ulven and his research group in the Mechanical Engineering (ME) Department at NDSU over the past seven years. These discoveries lead to the development of a small spin-off company, c2renew corporation, in which he acts as the chief technology officer. Dr. Ulven received his B.S. degree in Mechanical Engineering from NDSU (2001) and M.S. and Ph.D. degrees in Materials Engineering from the University of Alabama at Birmingham (2003 & 2005).

Michael Ehresmann, Operations Manager/Lead Engineer of c2renew corporation: Michael

Ehresmann has a B.S. and M.S. in Mechanical Engineering from NDSU and was hired to oversee the day-to-day operations and engineering of c2renew corporation. He is currently located in the NDSU Technology Incubator, Fargo, ND, with plans to relocate to office space in Colfax, ND within 6 months.

Kari (Warberg) Block, CEO/founder of Earth-Kind: Earth-Kind's roots date back to 1995 when Kari (Warberg) Block began selling potpourris and organic produce on her farm. The company has evolved since then, but remains centered on "community" investment by employment of developmentally disabled citizens, "agricultural" investment by the utilization of natural, renewable resources in all our products and packaging and "environmental" investment through a small carbon footprint that all work together to prevent economic, environmental, agricultural, and community destruction.

David Lehman, NDSU Engineering Extension - Manufacturing Specialist: David Lehman, a NDSU Engineering Extension Specialist based out of the IDEA Center (business incubator in Bismarck), graduated from NDSU with an Agricultural and Biosystems Engineering degree. He worked in the manufacturing industry for 11 years as an engineer improving manufacturing processes and managing new product start-ups.

**** CVs of all investigators can be found in the appendix***

MANAGEMENT

The project will be managed by Dr. Ulven and Michael Ehresmann in two parts. The first is the design of the 100% biocomposite holder in collaboration with Earth-Kind, and the second is working with OEMs to develop drop-in biocomposite materials to be used with existing parts.

For the portion of the project collaborating with Earth-Kind, monthly meetings will be held to discuss the progress of the design, and evaluate the budget. Attendees of this meeting will include Dr. Ulven, Michael Ehresmann, Kari Block, and David Lehman.

For the portion of the project working with OEMs (Bobcat, John Deere, and Toshiba), a separate monthly meeting will be held to discuss OEM interaction, progress compared to the schedule, and evaluation of the budget. Attendees of this meeting will include Dr. Ulven, Michael Ehresmann, and David Lehman.

TIMETABLE

Utilizing the tasks identified above, an associated timeline was generated in order to keep the workflow on track and set realistic deadlines with realistic deliverables. The following table provides the major tasks needed to be completed in the timeframe identified for the success of each product and in order to meet the objectives stated above for a two year project.

Task/Milestone	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Acquisition of materials for Earth-Kind 100% biocomposite								
Manufacturing of lab scale composite coupons of 100% biocomposite material								
Design of injection moldable Rodent Repellent Holder for Earth-Kind								
Mold design and manufacture for Earth-Kind								
Identify OEM components ideal for biocomposite material substitution								
Acquisition of materials for OEM trials								
Develop formulations and test coupons to suit OEM needs								
Perform production trial and product testing with OEM								
Receive approval for biocomposite material from OEM								
Interim Report	X	X	X	X	X	X	X	
Final Report								X

BUDGET

Project Associated Expense	NDIC's Share	Applicant's Share (Cash)	Applicant's Share (In-Kind)
Earth-Kind Product Trial Project			
c2renew's Material & Engineering Services	\$40,000		
Materials Testing Services	\$10,000		
Earth-Kind Product Marketing & Design Input			\$20,000 (Earth-Kind)
Materials & Supplies	\$10,000		
Tooling & Trial Production		\$30,000 (Earth-Kind)	
Bobcat, John Deere, and Toshiba Trial Projects			
c2renew's Material & Engineering Services	\$50,000		\$50,000 (c2renew)
Materials Testing Services	\$10,000		
Design & Analysis Software		\$40,000 (c2renew)	
NDSU Student Internship	\$10,000		
Materials & Supplies	\$20,000		
Travel		\$10,000 (c2renew)	
Totals	\$150,000	\$80,000	\$70,000

Budget Justification

Earth-Kind Product Trial Project:

c2renew's Material & Engineering Services – Mike Ehresmann will spend approximately 12 hours per week for the first year of the project working on the Earth-Kind Product Trial. c2renew's engineering services are billed at a rate of \$55/hr and a total of \$50,000 is expected to be spent.

Materials Testing Services – c2renew will need to contract materials trial and testing services from the NDSU Mechanical Engineering Department to verify the properties of the biocomposites produced. These trials and tests include: drying, grinding, compounding, melt-flow, tensile, flexure, impact, density, and heat distortion. Rates on most testing equipment with personnel oversight in the ME Department at NDSU are billed at a rate of \$75/hr and a total of \$10,000 is estimated to be spent.

Earth-Kind Product Marketing & Design Input – Kari Block and some of her employees will meet with c2renew on a monthly basis as well as dedicate their time to supplying functional design information, reviewing design concepts generated by c2renew, and helping to finalize design concepts for tool and die manufacturing. Their time will be tracked by employee rate and time dedicated to the identified tasks and is estimated to be \$20,000 over the first year of the project.

Materials & Supplies – Thermoplastic polylactic acid (PLA) and polyhydroxyalkanoate (PHA) copolymers will be sourced along with a variety of biomasses to formulate, blend, and analyze for the

development of a 100% renewable based biocomposite for Earth-Kind in this application. An estimated \$10,000 will be needed to purchase these materials and supplies.

Tooling & Trial Production – A production tool will need to be manufactured and trialed at an injection molding facility. The cost for a single or dual cavity tool of the size needed will cost approximately \$30,000 and will be paid for and owned by Earth-Kind.

Bobcat, John Deere, and Toshiba Trial Projects:

c2renew's Material & Engineering Services – Mike Ehresmann and an additional engineer will spend approximately 17.5 cumulative hours per week over the two year project working on the materials and product development for the other three OEM products we've identified in this project. c2renew's engineering services are billed at \$55/hr and a total of \$100,000 is expected to be spent.

Materials Testing Services – c2renew will need to contract materials trial and testing services from the NDSU Mechanical Engineering Department to verify the properties of the biocomposites produced. These trials and tests include: drying, grinding, compounding, melt-flow, tensile, flexure, impact, density, and heat distortion. Rates on most testing equipment with personnel oversight in the ME Department at NDSU are billed at a rate of \$75/hr and a total of \$10,000 is estimated to be spent.

Design & Analysis Software – Computer aided drawing (CAD) software, finite element analysis (FEA) software, and injection mold flow analysis software all need to be purchased and installed by c2renew in order to properly carryout the design and analysis objectives for all the parts identified in the project scope. Several quotes from different suppliers of such software have been gathered and the most cost efficient packages were chosen. The total cost for purchase and license of the chosen software for the two years of the project is approximately \$40,000.

NDSU Student Internship - c2renew would like to hire an undergraduate student from NDSU to help with the materials development, design, and analysis portions of this project to educate a student during their studies at NDSU on this technology and potentially secure an additional fulltime employee when their degree is complete. A student intern would be paid \$15/hr and expected to work part-time during the regular semesters and fulltime during the summers for a total of \$10,000.

Materials & Supplies – Thermoplastic polyolefins and acrylonitrile butadiene styrene (ABS) copolymers will be sourced along with a variety of biomasses to formulate, blend, and analyze for the development of different biocomposites for each of the OEM applications we will be working on. An estimated \$10,000 will be needed to purchase these materials and supplies.

Travel – c2renew will need to travel to meet with engineers, purchasing, and management within all the OEMs and injection molding companies they will be working with in this project several times over the 2 year project. An estimated \$10,000 will be needed.

CONFIDENTIAL INFORMATION

This proposal does not contain any confidential information.

PATENTS/RIGHTS TO TECHNICAL DATA

c2renew and Earth-Kind reserve the right to all intellectual property developed in this project.



AFFIDAVIT
 NORTH DAKOTA STATE INSURANCE DEPARTMENT
 SFN 4795 (1-2006)

State of North Dakota)
 County of Richland) SS

Authorized Official <u>Corey Kratcha</u>	Title <u>CEO</u>
Name of Company <u>Corenew Corporation</u>	City <u>Collax</u>
Name of Company That This Affidavit Is Made On Behalf Of <u>Corenew Corporation</u>	
State <u>ND</u>	

The above named individual, being duly sworn, deposes and says that the said company is not financially owned, in whole or part, or financially controlled by any foreign government outside of the United States or the Territories of the United States: That this Affidavit is made on behalf of the above-named company for the purpose of satisfying the Commissioner of Insurance of North Dakota that said company is not disqualified under the provisions of Section 26.1-02-04 of the Insurance Laws of North Dakota.

Date <u>12/31/2012</u>	Authorized Official Signature
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Subscribed and sworn to before me this _____ day of _____, 20____.

 Notary Public
 My Commission expires:

CHAD ANDREW ULVEN

Associate Professor, Department of Mechanical Engineering
North Dakota State University, Fargo, ND 58102
Phone: 701-231-5641, Fax: 701-231-8913, e-mail: chad.ulven@ndsu.edu

EDUCATION:

North Dakota State University	Mechanical Engineering	B.S., 2001
University of Alabama at Birmingham	Materials Engineering	M.S., 2003
University of Alabama at Birmingham	Materials Engineering	Ph.D., 2005

PROFESSIONAL PREPARATION:

2011 Aug.-present Associate Professor, Mechanical Engineering, North Dakota State University, Fargo, ND

2011 July-present Chief Technology Officer, c2renew corporation, Colfax, ND

2005 Aug.- 2011 Aug. Assistant Professor, Mechanical Engineering, North Dakota State University, Fargo, ND

2002 Jan.-2005 July Graduate Research Assistant / Fellow, Materials Engineering, University of Alabama at Birmingham, Birmingham, AL

2002 May-Aug. Graduate Research Assistant / Fellow, United States Army Research Laboratory, Aberdeen, MD

2000-2001 Dec. Undergraduate Research Assistant, Mechanical Engineering Department and Agricultural Engineering Department, North Dakota State University, Fargo, ND

PUBLICATIONS RELATED TO PROJECT (36 Journal, 4 Book, 75 Conference in Total):

1. Chevali, V.S., Nerenz, B.A., **Ulven, C.A.** (2012) Acrylonitrile Butadiene Styrene (ABS) / Lignocellulosic Fiber Biocomposite: Effect of Artificial Weathering on Impact Properties, *Journal of Biobased Materials and Bioenergy*, Vol. 6, No. 1, pp. 42-50.
2. Fuqua, M.A., Huo, S., Chevali, V., **Ulven, C.A.** (2010) Development of Flax Fiber/Soy-Based Polyurethane Composites for Mass Transit Flooring Application, *SAE International Journal of Materials and Manufacturing*, Vol. 3, No. 1, pp. 230-236.
3. Foulk, J.A., Fuqua, M.A., **Ulven, C.A.**, Alcock, M.M. (2010) Flax Fibre Quality and Influence on Interfacial Properties of Composites, *International Journal of Sustainable Engineering*, Vol. 3, No. 1, pp. 17-24.
4. Mekic, S., **Ulven, C.A.**, Akhatov, I.S., Jerke, E., Kerr-Anderson, E. (2009) Evaluation of In-Plane and Transverse Permeability of Flax Fiber Preforms for Biocomposite Materials, *Journal of Biobased Materials and Bioenergy*, Vol. 3, No. 2, pp. 156-164.
5. Sui, G., Fuqua, M.A., **Ulven, C.A.**, Zhong, W.H. (2009) A Plant Fiber Reinforced Polymer Composite Prepared by a Twin-Screw Extruder, *Bioresource Technology*, Vol. 100, No. 3, pp. 1246-1251.

OTHER PUBLICATIONS:

1. Chevali, V.S., Fuqua, M., **Ulven, C.A.** (2011) Vegetable Oil Based Rigid Foam Composites. In: Pilla, S. ed. *Handbook of Bioplastics and Biocomposites Engineering Applications*, Scrivener Publishing LLC, Salem, MA, pp. 269-284 (ISBN 978-0-470-62607-8).
2. Foulk, J.A., Akin, D., Dodd, R., **Ulven, C.** (2011) "Production of Flax Fibers for Biocomposites" In: *Cellulose Fibers: Bio- and Nano-Polymer Composites – Green Chemistry and Technology*. Kalia, S., Kaith, B.S., Kaur, I., eds., Springer-Verlag, Heidelberg, Germany, pp. 61-75 (ISBN 978-3-642-17369-1).

SYNERGISTIC ACTIVITIES:

1. Active member in the Nurturing American Tribal Undergraduate Research and Education (NATURE) program in North Dakota, hosting summer workshops and coordinating Sunday Academies during the regular school year, June 2007 – present.
2. Mentored North Dakota Space Grant Fellowship Program Students – Undergraduate Ben Aakre, Sept. 2006 – May 2007; Undergraduate Luke Gibbon, Aug. 2008 – Dec. 2008; and Undergraduate Kate Moser, May 2009 – Dec. 2009.
3. Mentored in the North Dakota (ND) Experimental Program to Stimulate Competitive Research (EPSCoR) Advanced Undergraduate Research Awards (AURA) Program Students – Nathan Sailer, May 2006 – Dec. 2006 and Luke Gibbon, May 2007 – Dec. 2007.
4. Mentored a McNair Scholars Program Research Student – Undergraduate Lori Winkenwader, Jan. 2006 – Dec. 2008.
5. Taught an Expanding Your Horizons Composite Workshop for middle school girls from local and regional middle schools, April 2007.

HONORS AND AWARDS:

- 2011 ASABE Honorable Mention Paper Award – Transactions of the ASABE
- NDSU College of Engineering & Architecture 2007-2008 Faculty Researcher of the Year Award
- NDSU Pi Tau Sigma Mechanical Honor Society - Carnot Award for Teaching Excellence: 2006, 2008

PATENTS:

1. US Patent 8,075,452, Composite Diving Board, William B. Isaacson, Stanley, N.D., **Chad A. Ulven**, Walcott, N.D, Assigned to Duraflex International Corp., Sparks, N.V. Issued December 13, 2011.

RESEARCH INTERESTS (\$3.6mil Raised in Total):

Biobased Composites Development, Environmentally Friendly Composites Manufacturing, Affordable Manufacturing of Thermoplastic and Thermoset Fiber Reinforced Composites, Composite Process Design and Modeling, Fire Exposure of Polymer Matrix Composites, Nondestructive Evaluation, Low Velocity, High Strain Rate, & Ballistic Characterization of Advanced Materials, Smart Composite Materials Development, Nano-Composites Development

GRADUATE ADVISOR:

M.S. & Ph.D. – Dr. Uday K. Vaidya, University of Alabama at Birmingham (UAB)

ADVISOR:

M.S. Thesis Advisees (22 total): Morteza Tatleri (MS-ME 2008), Jason Kopacz (MS-ME 2008), Nathan Schneck (MS-ME 2008), Michael Fuqua (MS-ME 2008), Jay Mosbrucker (MS-ME 2009), Amol Thapa (MS-ME 2009), Martin Hanson (MS-ME 2009), Shanshan Huo (MS-ME 2009), Kimberly Kramer (MS-ME 2010), Aron Fisk (MS-ME 2010), Loren Soma (MS-ME 2011), Michael Ehresmann (MS-ME 2012), Drew Pavlacky (MS-MNT 2012), Sethu Munusamy (MS-ME 2012), Luke Gibbon (current-ME), Derek Huotari (current-ME), Nicholas Goenner (current-ME), Jessica Lattimer (current-ME), Brent Nerenz (current-ME), Christopher Taylor (current-ME), Jeffery Flynn (current-ME), & Ryan Whitacre (current-ME).

PhD Dissertation Advisees (4 total): Sait Mekic (PhD-ME 2008), Michael A. Fuqua (PhD-ME 2011), Shanshan Huo (PhD-ME 2012), Nassibeh Hosseini (current-ME).

Michael John Ehresmann

Operations Manager/Lead Engineer, c2renew corporation, Colfax, ND 58018

Phone: 701-499-5269, email: mehresmann@c2renew.com

Education

M.S. Mechanical Engineering, North Dakota State University, 2012

B.S. Mechanical Engineering, North Dakota State University, 2003

Employment History

2012 Dec – Present Operations Manager/Lead Engineer , c2renew corporation, Colfax, ND

2006 Jan – 2012 Dec Systems Engineer, Delta-Energy, LLC, Fargo, ND

2010 Aug – 2012 May Graduate Research Assistant, Mechanical Engineering, North Dakota State University, Fargo, ND

2005 Feb – 2006 Jan Manufacturing Engineer, Tecton Products, LLC, Fargo, ND

Work Experience

Michael Ehresmann oversees the day-to-day operations and engineering of c2renew corporation. He is currently located in the NDSU Technology Incubator in Fargo, ND, with plans to relocate to office space to Colfax, ND within six months. Following graduation with a B.S. in Mechanical Engineering from NDSU in 2003, Michael went on to work as a Manufacturing Engineer for Tecton Products working with pultruded composites and extruded thermoplastics. He then went to work as a Systems Engineer for Delta-Energy, LLC., a startup working on the commercialization of tire pyrolysis technology. This process is capable of processing shredded rubber into oil , carbon black, and natural gas. Here he served as the company's only engineer supporting a pilot plant by both troubleshooting operations as well as designing and implementing process improvements. He also was a key part of a design team tasked with laying out plans for the construction of a new plant. Michael then completed an M.S. in Mechanical Engineering from NDSU in May of 2012 with a research focus of biocomposite materials. While working on his Master's Degree, he worked as a Graduate Research Assistant with research projects in the areas of permeability of natural fiber mats, natural fiber reinforced soy-based polyurethane bio composites, fiberglass polyurethane pseudo sandwich composites, and ballistic rated polyurethane based composites.

Publications

1. Ehresmann, M. (2012) A Study on the Processing Characteristics and Reinforcing Potential of Natural Fiber Mats, Master's Thesis, North Dakota State University, Fargo, ND.
2. Ehresmann, M., Mekic, S., Ulven, C.A., Meatherall, S., Foulk, J. (2011) In-Plane Unsaturated Permeability of Natural Fiber Mats, International Conference on Composite Materials, ICCM 18, Jeju, South Korea.
3. Ehresmann, M., Huo, S., Ulven, C.A. (2012) Bast Natural Fiber Reinforced Soy-Based Polyurethane Biocomposites, European Conference on Composite Materials, ECCM 15, Venice, Italy.



Personal Background

Name:	Kari Warberg Block
Education	BS Mgmt University of Mary Magna Cum Laude 1994; Williston High School
Company Name:	Earth-Kind, Inc.
What does your company do?	Earth-Kind manufactures bio-based rodent repellent & air fresheners for 30,000 retail stores [John Deere ,Ace, Menards, TSC] and private label for PMP's like Orkin
Service or Product Offered:	FRESH CAB™ botanical rodent repellent, the first and only EPA-certified natural rodent repellent for indoor use.

Business Background

Number of years in business:	16 years in current business
Number of employees/staff:	Full time: 10; Part Time:2 We also contract with a MN State agency to employ 12 FT people with developmental disabilities, plus up to 20 seasonal temp workers
Industry:	Bio-based Pest Control Manufacturing [3999 SIC/NAICS] (The retail rodent control industry is currently \$100 million; the structural rodent pest management industry is about \$2 billion)
Certifications:	SBA Woman Owned Enterprise USDA Bio Preferred status for Fresh Cab rodent repellent; EPA FIFRA certified Gold Status, Green America, Wash, DC
Professional organizations that I consult with/belong to:	<ul style="list-style-type: none"> • Vistage International #3133 • Ernst & Young • I've served as chair, co-chair, or member of a number of boards that are nationally recognized for innovation & entrepreneurship <ul style="list-style-type: none"> ○ Chair, ND Women's Business Centers ○ Co-chair, Dakota Manufacturing Extension Partnership ○ Advisory Board member, Minot State University Entrepreneurial Center of Excellence ○ Advisory Board member, Minot State University & Bottineau Horticultural Center of Excellence ○ Kauffman Foundation ND Start Up America Champion

Business Contact Information

Address: 2910 East Broadway, Bismarck ND 58501			
City:	Bismarck	State and Postal Code:	ND 58501
Work Phone:	701-751-4456	e-mail:	kari@earth-kind.com
Other Phone (e.g. mobile):	701-721-4839	Twitter:	@kariwblock
Web Address: www.earth-kind.com			

Business Vision and Leadership

Why did I start my business?

The *practical* reason that I started my business was that I was a farmer with young children and pets. I wanted a safe way to control rodents in my home and vehicle cabs. At the time, the only alternatives were poisons, traps, or mothballs—all of which posed potentially serious health and environmental dangers, were hard to use, and often didn't even work. I created FRESH CAB™ botanical rodent repellent to be safe, effective, affordable, and easy to use. View company history: <http://www.youtube.com/watch?v=wHu9Sb7phiw&list=UUrHgyNgatnPsYmuRGh8RBYw&index=3>

The *spiritual* reason that I started my business lies in my personality. Gandhi said, "Be the change you want to see in the world." This resonates deeply with me, but I'm not wired to be a political activist, so I became an entrepreneur. It's perfect for me. It lets me "be the change" and also help improve areas I'm passionate about: the environment, women and entrepreneurship, and our free-market economy.

Honors & Awards

- Regional winner and National finalist in Working Woman's Entrepreneurial Award of Excellence for most innovative new product or service.
- Country Woman Magazine cover girl September/October 2006.
- Named State and Regional Small Business Champions by SBA 2010.
- Vistage International named 3 most 'Innovative' CEO's worldwide, 2010
- Minnesota Handicapped Business Partner of the Year , by Epic Enterprises, 2010.
- Asked to present to the White House Business Council on Small Business job creation 2011.
- Named outstanding Alumni at University of Mary, Americas Leadership Univeristy, 2011.
- Named to 'top 10' of USA Green business by People Choice, Green America Wash. DC
- Named to Ernst & Young Winning Woman Class of 2012

DAVID L. LEHMAN

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SUMMARY

Management level Manufacturing Engineer Sr. with lean six-sigma black belt certification and international operations management background. Broad range of manufacturing experience resulting from an aggressive, progressive, cross-training program has developed the following competencies:

- Team development
- Strategic planning
- 5 Yr planning
- Capital implementation
- Project management
- Robotic work cells
- Ecoat, powder & liquid paint systems
- Regulatory compliance
- New product development (NPD) stage gate process
- Managed labor union issues

HISTORY & ACCOMPLISHMENTS

North Dakota State University

2009-Present

Founded in 1890 as a land grant university, NDSU is the largest university in North Dakota. A major component of the Red River Research Corridor, NDSU is the highest ranking research institution in the region. In an effort to tap synergies between NDSU and private industry, NDSU has constructed a 55 acre Technology Park on campus and started the Industrial and Manufacturing Engineering Extension program located in Dickinson, ND.

NDSU Industrial and Manufacturing Engineering Extension Specialist: Dickinson, ND

2009-Present

- Assist economic developers and inventors in idea commercialization
- Network with manufacturing resources across the state (SBDC, Business Incubators, Universities, Economic Development groups, etc)
- Liaison between private industry and NDSU engineering and business colleges
- Mentor 4H and Bison BEST robotics programs
- Participate in and assist manufacturers with continuous improvement activities
- Participate in economic development activity in the region
- Assist companies with outsourcing activities

BOBCAT CO.

1997-2008

Bobcat is a 61 year old US manufacturer of rugged, dependable, construction equipment used around the globe. Business competencies include steel fabrication, weld, paint & assembly. With seven manufacturing facilities employing over 2500 employees worldwide, Bobcat has aspired to become the global leader in the manufacture of compact construction equipment.

Production Manager: Paint and Wastewater Systems (Bismarck, ND)

2006-2008

- Utilized LSS black belt tools to reduce E-coat defects by 86%.
- Reduced departmental hours by 30% while improving quality and efficiency.
- Developed and implemented two paint systems.
- Participated in global paint team.
- Implemented 5S and safety programs.
- Supervised 20 direct and indirect reports.
- Developed and monitored operating metrics.
- Managed departmental strategic & capital planning.
- Managed multi-million dollar departmental budget.
- Ensured regulatory compliance (city, state, federal).

- Conducted career path planning and mentoring, to develop and retain key talent.
- Conducted Sarbanes Oxley audits.
- Implemented Quality Control Improvement (QCI) savings.
- Managed waste water system which processes all of the factory's process waste.

Staff Engineer: Fabrication & Paint (Bismarck, ND) 2005-2006

- Developed web based program to calculate rolling 12 month resource capacity resulting in a 99% reduction in calculation time.
- Mentored subordinates (ME's and interns).
- Managed multi-million dollar capital plan (including implementation).
- Enhanced paint line resulting in 115% capacity improvement.
- Recruited cooperative education students for the Bismarck facility.
- Conducted Sarbanes Oxley audits.

Chef de Méthodes Central (ME Mgr) (Pont Château, France) 2003-2005

- Lead manufacturing activity on international NPD team.
- Coached manufacturing engineers to achieve increased productivity.
- Conceptualized and implemented a moving assembly line in conjunction with a production system which improved throughput by 78% and was awarded the CVT President's Award for Operational Excellence.
- Implemented IR's US capital structure in Pont château.
- Managed all capital planning and justification for the facility.
- Transferred US manufacturing best practices.
- Developed Sarbanes Oxley documentation.
- Implemented Total Quality Control (TQC) process.

Manufacturing Engineer: Assembly / Paint Line (Bismarck, ND) 2002-2003

- Provided general shop support.
- Manufacturing lead for new product stage gate process during mini-excavator development.

Manufacturing Engineer: Weld (Bismarck, ND) 2000 – 2002

- Implemented various weld cells and provided general shop support.
- Doubled attachment capacity by installing Bismarck's first robotically loaded press brake cell.

Manufacturing Engineer: Weld Intern (Bismarck, ND) 1999

- Developed AutoCAD shop layouts to optimize processes and space utilization.
- Managed robotic weld cell moves.
- Trained welders how to assemble new expandable undercarriage.

Electrical Test Engineer: Intern (Gwinner, ND) 1997

- Designed and built electrical test fixtures.
- Tested Bobcat's skid steer loader electronics.

Missouri Valley Perforating (Kenmare, ND) 1997

Wireline Logging Hand

- Safely handled explosives and set up wireline logging, perforating, and fishing tools for oil field sites in the Bakken formation region.

Lehman Farm and Ranch (Kenmare, ND) to 2000
Farm/Ranch Hand

- Performed general farm and ranch duties on family farm.

EDUCATION

LEAN Enterprise Certification Bronze Program, SME (Society of Manufacturing Engineers)	2010
Masters of Business Administration UND-Grand Forks, ND National Scholars' Honor Society	2009
Lean Six-Sigma Black Belt Certification	2008
Dale Carnegie 12 Week Training	2007
Agricultural and Biosystems Engineering, BS NDSU-Fargo, ND	2000

AWARDS

Ingersol-Rand Global CVT President's Award for Operational Excellence
2012 Prairie Business Magazine's Top 40Under40 business professionals

ASSOCIATIONS

Mandan Economic Opportunity and Prosperity Committee: Member	2013-Present
Bismarck-Mandan Young Professional Network: Service Chair	2011
Society of Manufacturing Engineers: Senior Member	2010-Present
Bismarck-Mandan Young Professional Network: Member	2010-Present
I.D.E.A Center Executive Board: Member	2011-Present
I.D.E.A Center Advisory Board: Manufacturing Engineering Mentor	2010-Present
ND 4H Science, Engineering, and Technology Leadership Team: Member	2010-2011
Rotary club of Dickinson: Member	2009-2010
NDSU Industrial and Manufacturing Advisory Board: Member	2009-2011
NDSU Community Economic Development and Leadership Team: Member	2009-Present
Dickinson Young Professionals Network: Professional Development Chair	2009-2010
SW ND Manufacturers Roundtable: Member	2009-Present
SW ND Economic Development Professionals: Member	2009-2010
Dickinson Community Relations Committee: Committee Member	2009-2010
National Scholars Honor Society: Member	2008-Present