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Canada

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Canada

# Investments in Forest Industry Transformation (IFIT) Performance Report



2015–2016

Canada 





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# **Investments in Forest Industry Transformation (IFIT) Performance Report 2015–2016**

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*Aussi disponible en français sous le titre : Rapport sur le rendement du programme Investissements dans la transformation de l'industrie forestière (ITIF)*

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# Minister's MESSAGE



Canada's forest industry has experienced unprecedented change over the past decade. From changing approaches in the ways we read and watch our news, to shifting global demands for wood and wood-based products, to the pressures of climate change, our forest industry continues to evolve to meet the new and emerging challenges of the 21st century.

As a measure of our government's response to these challenges, *Investments in Forest Industry Transformation (IFIT) Performance Report* provides a detailed review of the projects and companies that have received funding through IFIT, including their successes and lessons learned. The new report also describes the many practical benefits of these projects to the forest sector as whole, to its workers and to the more than 170 rural municipalities that have a significant portion of their local economies generated by the sector.

Our government supports innovation and transformation in the forest sector, and we are using the IFIT program to help industry demonstrate and commercialize new technologies and higher-value products that will improve environmental outcomes for Canadians and contribute to clean economic growth and jobs. Additionally, IFIT helps the forest industry generate new business opportunities that can help diversify its product portfolio and position Canada as a global leader in new technology areas.

It is for these reasons that our government announced on June 1, 2017, an additional \$55-million investment in IFIT over three years as part of over \$860 million in measures to strengthen the softwood lumber industry, support its workers and diversify the uses and markets for Canadian wood and wood products.

The Government of Canada remains committed to Canada's forest sector, and I firmly believe that IFIT and other programs like it will continue providing new opportunities for Canada's forest industry in areas such as the emerging bioeconomy, sustainable forest management and renewable wood-based products.

I invite you to examine the details given in the pages that follow to fully appreciate the variety and scope of the many successes that the IFIT program has won for Canada and for Canadians.

**The Honourable Jim Carr, P.C., M.P.**  
Minister of Natural Resources

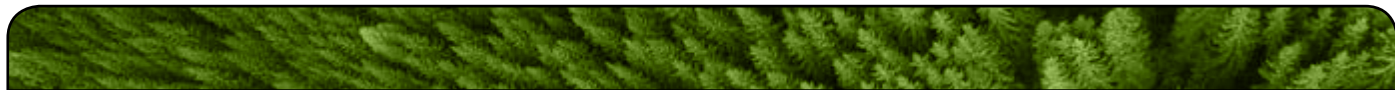




**THE OBJECTIVE OF THE IFIT PROGRAM IS TO:**

Support forest industry transformation by investing in innovative technologies that lead to a more diversified, higher-value product mix including bioenergy, biomaterials, biochemical and next generation building products to ensure a more commercially and environmentally sustainable forest industry.

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# Executive SUMMARY



This report provides an interim update of the Investments in Forest Industry Transformation (IFIT) program since its renewal in 2014 with an additional budget of \$90.4 million. This report will outline the program's activities between 2015 and 2016, highlight early success stories from the third Call for Proposals and summarize the IFIT program's outcomes to date. This report will look at the achievements of the new projects and which projects have a strong potential for replicability in the forest sector.

All IFIT reports, project profiles and additional program information will be published on our departmental website in order for interested stakeholders to follow the progress of these projects and their outcomes across Canada.

## Expected Outcomes

- ▶ An economically competitive and environmentally sustainable forest sector
- ▶ Collaboration between forest sector companies and non-traditional sectors on bio-product initiatives
- ▶ The deployment and acceptance of innovative, first-in-kind technologies across the country
- ▶ Increased replicability and availability of new, value-added forest products, technologies and processes

## IFIT Recipients

IFIT recipients are companies that produce forest products and have existing forest products manufacturing facilities in Canada. Selected recipient projects are funded up to 50% of total projects; demonstrate innovative technologies from the pilot to commercial scale; and implement new technologies that produce or lead to new, wood fibre-based bio-products.





## Anticipated Benefits

The first two years after IFIT's renewal (2015–2016) demonstrated a wide range of innovation in the forest sector. The third Call for Proposals received 79 applications, valued at more than \$1.9 billion. Of the applications received, 15 projects have since been funded across five provinces.



**79** applications



**15** projects



**5** provinces

Since the program's inception in 2010, IFIT has numerous success stories of funding innovative projects in the Canadian forest sector. IFIT's three Calls for Proposals generated 186 applications valued at over \$3.9 billion in projects of which 28 projects were funded across seven provinces.



**186** applications



**28** projects



**7** provinces

**IFIT's 28 funded projects are expected to benefit Canadians in four key ways:**

► **Environment**

Reduce greenhouse gases (GHG) by 210 kilotonnes per year and increase Canada's green electricity by 40 gigawatt-hours per year.

► **Social**

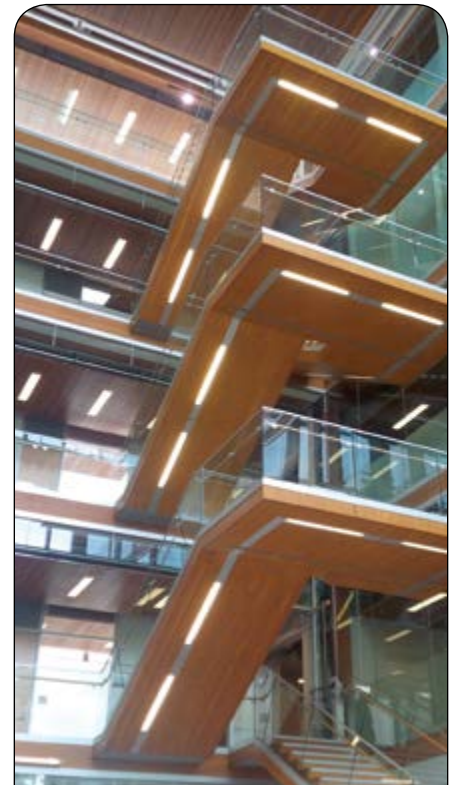
Create 280 new direct innovation-related jobs, secure another 4,900 in the forest sector and require over 1,000,000 person-hours of construction work to implement.

► **Financial**

Generate more than \$365 million per year in new revenues for companies.

► **Technology Leadership**

Commercialize 13 world-first technologies and develop new or diversified products in over 75% of the projects.



# Communicating IFIT'S SUCCESS



From its inception, the Investments in Forestry Industry Transformation (IFIT) program has remained focused on helping companies mitigate financial risks associated with innovation in the forest sector. This focus builds on Natural Resources Canada's effort to make the sector more competitive and environmentally sustainable. In the past two years, IFIT has developed a multi-faceted communications strategy in order to spur replication in the forest sector. IFIT developed an open innovation platform, designed project information sheets and published replicability fact sheets on the technologies supported by the program. Such communications expand knowledge sharing in the forest industry that is often otherwise limited to conferences and events, as well as bridge barriers that exist between forest subsectors.

In 2015, IFIT partnered with an open innovation service provider to run a two-year pilot that would see a platform created in which IFIT companies could broadcast their corporate needs and capabilities to potential service providers and/or clients. This platform used a collaborative community of connected innovators across the world, allowed IFIT supported companies to showcase their innovative capabilities and strengthen new products and markets through creative solutions and ventures. Open innovation provided an external innovation option while strengthening technology progress within the forest sector.

In 2016, the IFIT program commissioned a design firm to produce a series of one-page fact sheets with the intention of providing a snapshot of project information in a clear, easy-to-understand manner. The summaries were designed to depict potential project opportunities and expected results. Each summary is made up of infographics, images and short facts about the project. They are featured on the IFIT web page, showcased at conferences and distributed to industry in order to demonstrate the types of projects the program is supporting.



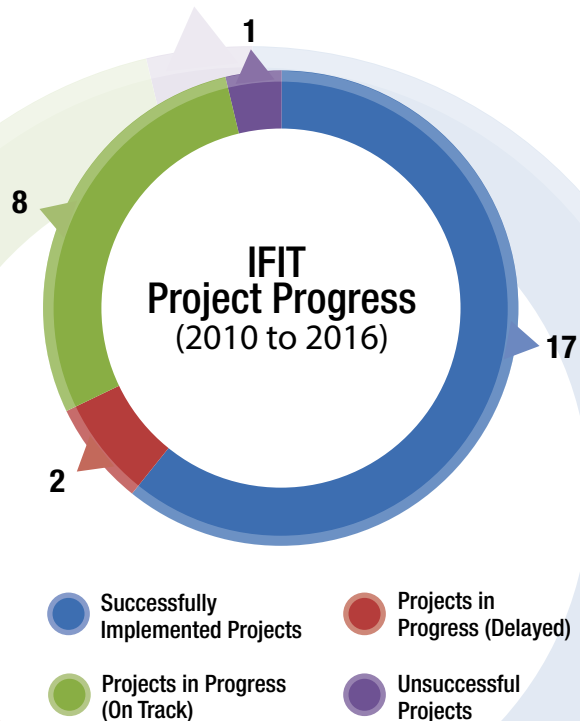
Finally, IFIT engaged an engineering and consulting firm to evaluate and define the replicability opportunities of current IFIT-funded project technologies in Canada. By identifying the potential to replicate technologies from implemented IFIT projects, companies can be better informed about the technical, financial and socio-economic potential associated with the uptake of these new technologies. With numerous IFIT-funded facilities in Canada to learn from, the initial risk of implementing new technology is continuously being minimized. To highlight and raise awareness of these new technologies within industry, IFIT has developed a series of replicability fact sheets to help the forest sector decide whether a technology is worth adopting. One of the main objectives of the IFIT program is to see the technologies it has funded be replicated by others to help transform the Canadian forest sector into a more innovative and robust global competitor.

# Anticipated Program Performance AND BENEFITS



The IFIT program supports the implementation of commercial, capital intensive, first-in-kind technologies in the Canadian forest sector. Investing in these innovative technologies helps to optimize value for the Canadian forest sector and benefits forest companies across Canada and the communities they support. This section will highlight the 28 projects funded to date by IFIT and the anticipated economic, social and environmental benefits that will accrue as more of these projects come to completion.

IFIT-funded projects range across seven provinces with strong project concentration in British Columbia, Alberta, Ontario and Quebec. The innovative projects supported by IFIT demonstrate a strong track record of progress and successful completion. As of December 31, 2016, over 60% of IFIT's projects have been completed from all three Calls for Proposals, with the majority of the remaining projects still on track for completion. Considering the high levels of financial, technical and market complexities surrounding such innovative technologies, the success rate of projects is a strong indicator of IFIT's thorough due diligence process. The strong project success rate can also be attributed to IFIT's dedication to helping projects navigate the entire funding process, from initial application through to final reporting. Moreover, IFIT's support and timely funding have helped solidify and catalyze many successful projects.



## Locations of the 28 IFIT-funded projects



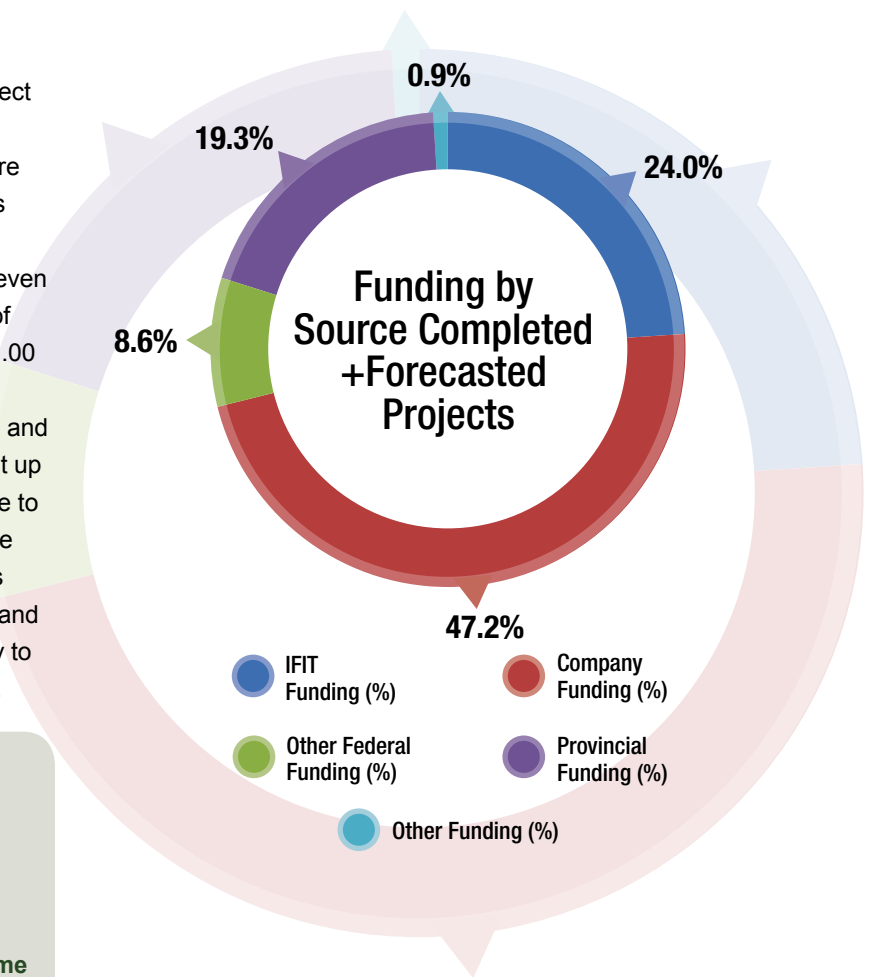


Funding from IFIT plays a critical role in first-in-world project implementation and success. First-in-kind technologies often face market risk, which can be an obstacle to acquire traditional funding. Early investment from IFIT establishes the validity of the projects and often assists companies in gaining the additional funding the project may require or even more favourable terms. On average, IFIT provided 24% of project costs, leveraging IFIT investment at a \$3.17-to-\$1.00 ratio. Early funding from IFIT has contributed to the large portion of additional funding from other federal, provincial and private sources. While projects can receive an investment up to 50% of the project's cost from IFIT, companies continue to contribute by far the largest proportion of funding for these projects. A high level of internal investment by companies demonstrates a commitment to the technology, products and processes, and that the support required from IFIT is only to ease the financial hurdles or to secure additional funding.

**Through the use of a novel conditional funding clause, IFIT was able to provide companies with a signed agreement and confirmation of funding to use as leverage to secure additional project funding from other organizations and traditional funding mechanisms. However, if the remaining project funding had not been secured within a reasonable time frame, then the agreement could have been terminated with no funds having been transferred to the company, thereby protecting IFIT's funding for future projects.**

### Economic Benefits

Projects supported by IFIT focus on growing an economically competitive and sustainable forest industry through diversifying portfolios, generating new revenue streams and reducing internal costs for companies. IFIT anticipates that funded projects will increase revenues for forestry companies by over \$365 million annually once at full capacity. Revenues will come from the sale of new products, power generation



and increased capacity through more efficient processes and fibre usage. Internal cost reductions will stem from energy savings, fossil fuel reductions, decreased chemicals and enzymes usage and reduced water treatment requirements. IFIT projects also demonstrate solid returns on investment (ROI), which are anticipated to be on average 22.7% for funded projects.

In particular, projects focused on new and innovative solid wood products have demonstrated very strong financial performance and a sound project investment. Biomaterial projects are likewise an attractive investment with relatively low project costs and high return on investment. And while bioenergy projects have a higher initial project cost, the payback periods are reasonable and the projects provide companies with a stable source of energy or an additional revenue stream. Overall, IFIT projects demonstrate strong economic growth and positive financial returns while at the same time de-risking new technology and encouraging broader adoption and market acceptance across Canada.

PROJECT SUB-SECTOR OUTLINE	AVG. PROJECT COST (MILLIONS)	AVG. PAYBACK PERIOD (YEARS)	AVG. PROJECT ROI (PERCENTAGE)	AVG. NEW REVENUES (MILLIONS/YEAR)
BIOCHEMICALS	\$16.7	8.4	11.9%	\$4.1
BIOENERGY	\$42.6	6.7	12.7%	\$7.9
BIOMATERIALS	\$9.9	3.9	32.5%	\$8.8
SOLID WOOD	\$13.5	3.6	27.4%	\$25.9
<b>ESTIMATED AVERAGE FOR ALL PROJECTS</b>	<b>\$19.0</b>	<b>5.4</b>	<b>22.7%</b>	<b>\$14.2</b>

EMPLOYMENT IMPACTS BY SUB-SECTOR	AVG. NEW JOBS CREATED PER PERSON	AVG. JOBS SECURED PER PROJECT	AVG. EMPLOYMENT DURING CONSTRUCTION (HOURS)
BIOCHEMICALS	2	272	87,651
BIOENERGY	13	86	55,000
BIOMATERIALS	6	146	27,567
SOLID WOOD	19	172	15,528
<b>ESTIMATED TOTAL FOR ALL PROJECTS</b>	<b>284</b>	<b>4,926</b>	<b>1,066,585</b>

## Socio-Economic Benefits

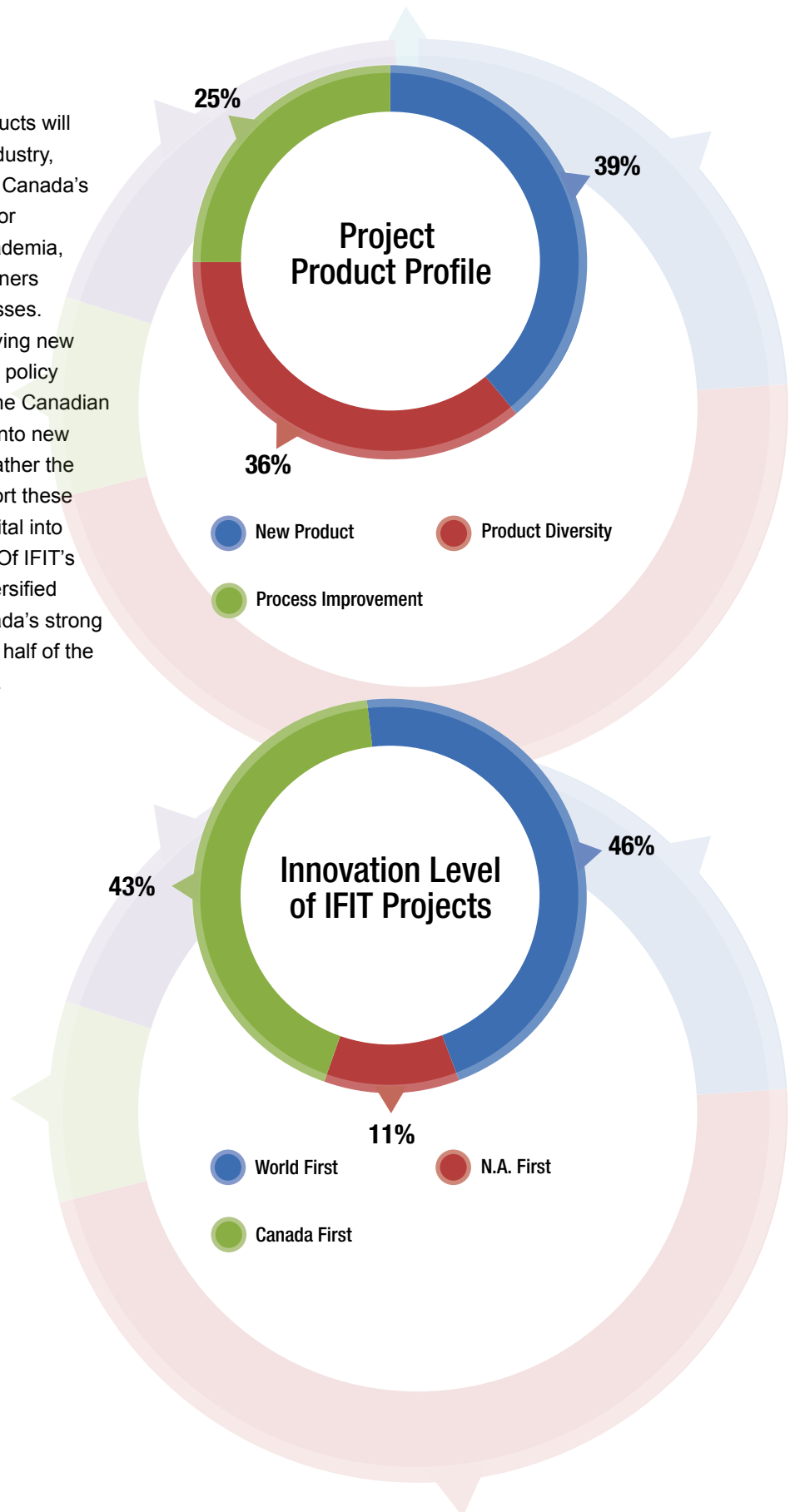
The forest products industry has been one of the most significant contributors to employment and development opportunities throughout Canadian history. IFIT investments in the industry have benefited Canadian communities that are forest-resource dependent by directly fostering new jobs and securing existing ones, as well as by injecting money back into the local community. IFIT anticipates signed projects will create over 280 new permanent jobs and secure over 4,900 existing jobs across the Canadian forest industry. IFIT also anticipates that projects, once implemented, will require well over 1,000,000 hours of temporary employment during construction, further benefiting the communities in which the projects take place. At funded facilities, IFIT likewise anticipates that employees will receive hundreds of hours of training and skill enhancement to operate new equipment, learn new processes and develop new expertise.

## Environmental Benefits

As Canada is home to 9% of the world's forests and more than 166 million hectares of certified forests, Canada's forest sector is continually working to advance its environmental leadership and reduce its ecological footprint. To do so, the forest sector focuses on reducing GHG, increasing green electricity and renewable fuels production, producing energy-efficient building materials and limiting water and air pollutants. IFIT seeks to invest in projects with strong environmental benefits in order to further the sector's efforts. IFIT anticipates that, once fully commercialized, projects will add 41 gigawatt hours (GWh) of renewable green electricity capacity each year and reduce GHG emissions by over 210,000 tonnes. These environmental efforts will also result in significant water savings, waste reduction and improved effluent treatment efficiency.

## New Products, New Markets

While traditional lumber and pulp and paper products will continue to play a core role in Canada's forest industry, new uses of wood fibre are key to demonstrating Canada's commitment to the optimization of our forest sector resources. The forest sector often works with academia, institutions such as FPInnovations and other partners to adopt innovative, new technologies and processes. Industry and government have realized that weaving new technologies, expertise, products, processes and policy into a coherent sector strategy is imperative for the Canadian forest industry's future. Innovation and breaking into new markets does not simply happen overnight, but rather the process takes risks. As such, IFIT seeks to support these investments in new technologies by injecting capital into key stages of development and demonstrations. Of IFIT's 28 funded projects, 75% represented new or diversified products. IFIT-funded projects demonstrate Canada's strong environmental and technological leadership, with half of the projects representing world-first implementations.







**OVERALL, IFIT PROJECTS DEMONSTRATE STRONG ECONOMIC GROWTH AND POSITIVE FINANCIAL RETURNS WHILE AT THE SAME TIME DE-RISKING NEW TECHNOLOGY AND ENCOURAGING BROADER ADOPTION AND MARKET ACCEPTANCE ACROSS CANADA.**

# COMPANY PROFILES

## Biomaterials Kruger Biomaterials Inc.

**Strength from wood:** Founded in 1904, Kruger Inc. is active in traditional forest industry sectors (such as pulp and paper) and continues to target its commitment to sustainable development. Kruger Inc.'s spinoff Kruger Biomaterials was created in 2013 to be the first to commercialize cellulose filament production. Its demonstration plant is located in Trois-Rivières, Quebec.



With \$15 million in funding from IFIT and additional support from the Governments of Quebec and British Columbia, Kruger has installed new technology and modified existing equipment to undertake a cellulose filament demonstration, application development and a commercialization plant. As a commercialization plant, the Trois-Rivières mill will produce enough cellulose filaments to permit large-scale mill trials for new grades of pulp and paper, towel, tissue, board and various non-traditional applications, including foams, mats and laminates.

### Innovation

Kruger obtains cellulose filaments by peeling the filament from wood fibres using a mechanical process without the use of chemicals or enzymes and without producing any effluent. Cellulose filaments are a cutting-edge biomaterial that can be applied to several applications due to its unique process and properties. The filament's high surface area and high

length-to-width ratio allow for a flexible, lightweight material with unique bonding capacities, making it an exceptional reinforcement additive in various pulp and paper and composite products. As well, existing products can be made stronger and greener with the inclusion of cellulose filaments, such as novel films, mats and composite materials.



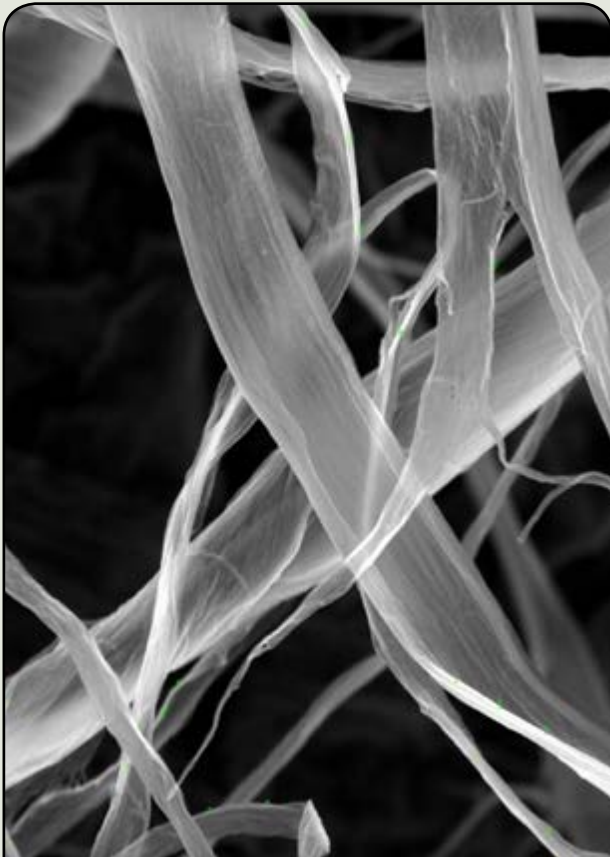


## Results

- ▶ 5 tonnes per day of FiloCell® Cellulose Filaments
- ▶ Cellulose filaments are 80–300 nanometres wide and up to 2 millimetres long
- ▶ Estimated North American market potential of 120,000 tonnes per year
- ▶ 323 secured jobs

## Benefits

- ▶ **Economic:** increased profitability of mill through enhanced productivity, product diversification and sales
- ▶ **Environment:** no chemicals or enzymes used in production
- ▶ **Market:** further commercialization will enable the Canadian pulp and paper industry to lead the world in developing new cellulose filament-based products



**Cellulose Filament:** Long, thin, ribbon-like structures found in the cell wall of trees and plants



**FiloCell® cellulose filaments** — An innovative bio-based material that brings strength, lightness and other benefits to plastics, concrete, paper and many other products.

“The unique potential of cellulose filaments, combined with our R&D efforts, will help the Canadian forest industry progress and have a bright future.”

— Daniel Archambault  
Executive Vice President  
Kruger Biomaterials Inc.



# Biomaterials West Fraser Mills Ltd.

**Evolutionary lignin recovery process:** Founded in 1955, West Fraser has several divisions across North America. West Fraser's core beliefs and leadership in environmental performance have resulted in the development of a world-first commercial-scale lignin recovery plant using the new LignoForce™ process developed by FPInnovations that was further engineered by NORAM at its mill in Hinton, Alberta.



IFIT's contribution of \$10 million in funding toward the \$22-million project allowed West Fraser to implement the Kraft lignin recovery process at a commercial scale. The new process allows for West Fraser to become a major supplier of lignin as well as use the lignin at the company's other facilities as a renewable adhesive in its engineered wood products, displacing resins traditionally used.

## Innovation

The installation of a process in Canada, such as LignoForce™, allows for the production of lignin by removing a portion of black liquor from the recovery boiler and processing it in the lignin recovery plant, where it undergoes a number of digesting and washing stages to deliver the final product.

The LignoForce™ process specifically allows for the creation of lignin products based on clients' needs that range from dry

powder to a moister product. The final products produced at Hinton Pulp are transported to nearby plywood, medium-density fibreboard (MDF) and laminated veneer lumber (LVL) plants to replace glue components. The production of lignin from Hinton Pulp will also be used to develop new markets for Canadian bioproducts and a variety of other innovative high-value applications (e.g., as an additive to thermoplastics, pulp moulded products and adhesives).

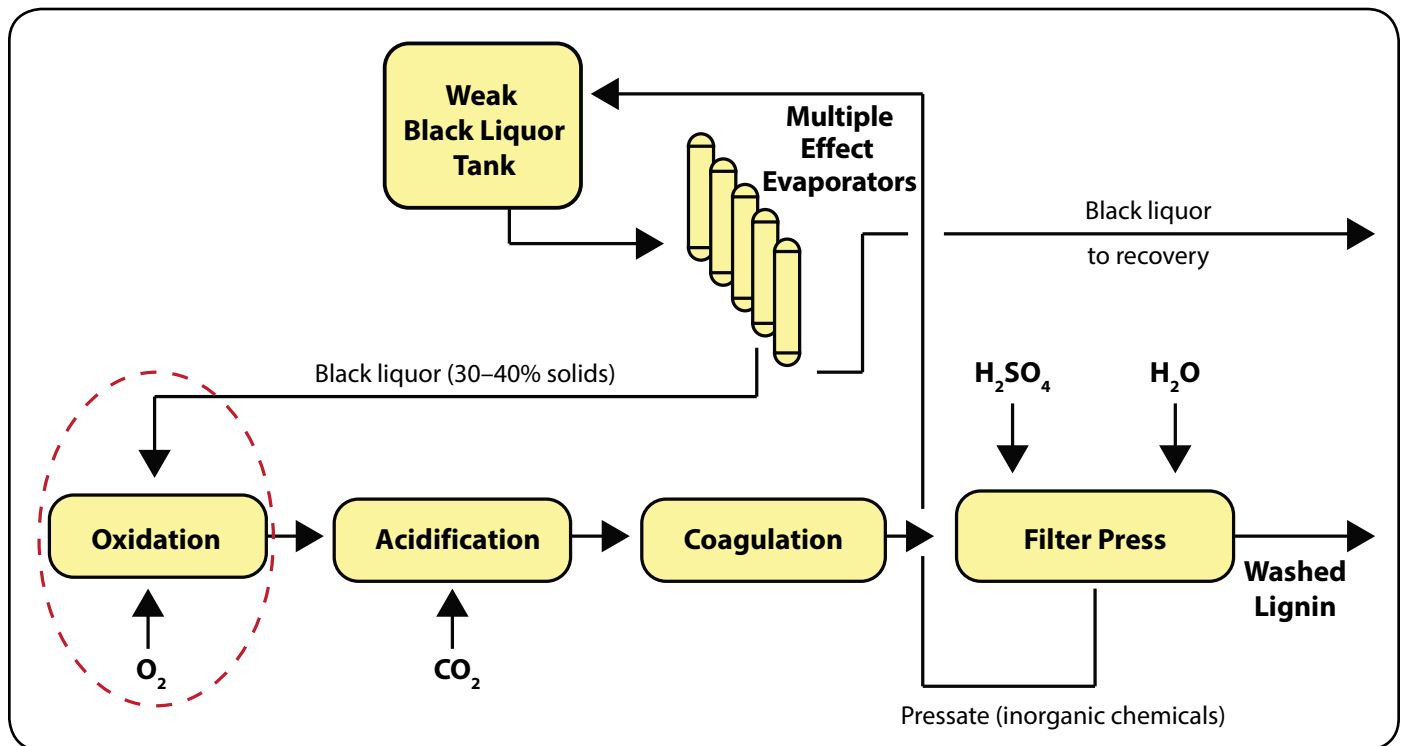


## Results

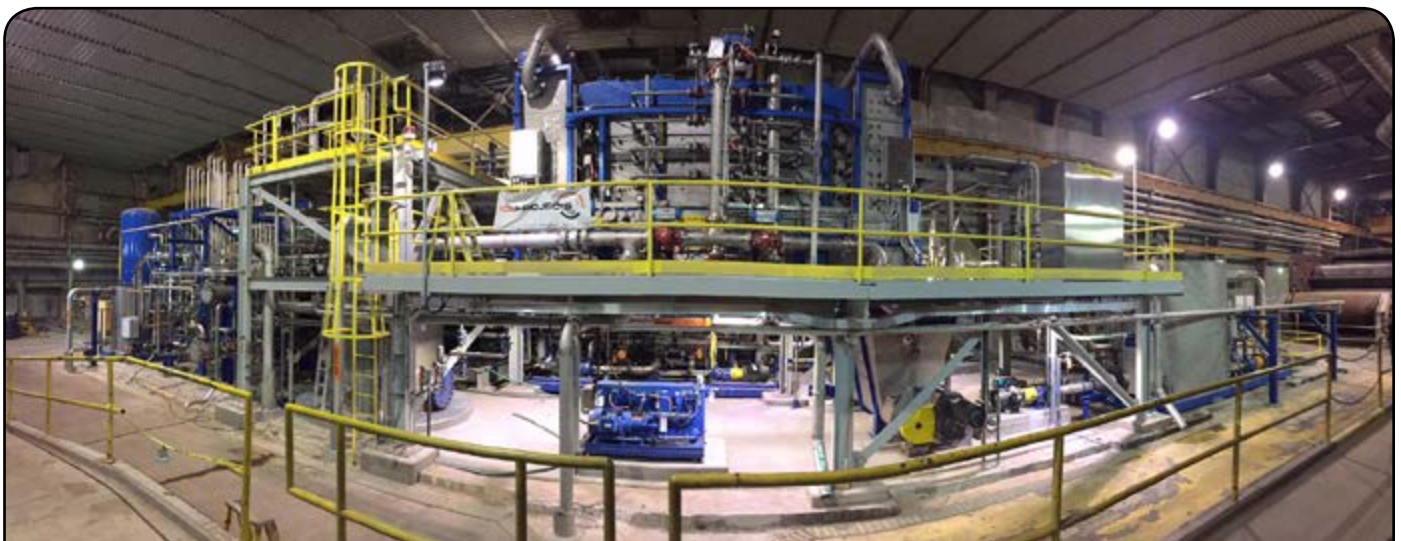
- ▶ 10,000 tonnes per year of lignin produced
- ▶ Extraction of lignin early in the pulping process generates additional value from forest fibre without increasing the number of trees harvested
- ▶ 7 new jobs
- ▶ 318 secured positions
- ▶ 60,000 hours of employment during construction
- ▶ Up to 30% of the phenol-based resin used in OSB glue mix can be substituted with lignin

## Benefits

- ▶ **Environment:** a low-cost green chemical alternative to phenol-based products
- ▶ **Environment:** reduced GHG emissions by 10,300 tonnes/year
- ▶ **Economic:** diversification of product line revenue stream
- ▶ **Economic:** preservation of the long-term sustainability of the mill
- ▶ **Market:** possible new applications as an additive to thermoplastics, pulp moulded products and adhesives



Source: KSH Consulting





# Biomaterials Corruven Inc.

**High performance corrugated panels:** Founded in 2010, Corruven is a leading-edge, business-to-business technology provider for product manufacturers in several industries, such as building materials, transportation and furniture. Corruven developed the patented Corruven corrugated core at its industrial facility in Edmundston, New Brunswick, which has made a breakthrough in the use of wood fibre for panels.



IFIT's investment of \$2.5 million, with additional funding from the Atlantic Canada Opportunities Agency (ACOA), supported Corruven's move to a commercial-scale product, making the technology more competitive in the market. The commercialization of Corruven® Core technology involved expanding the facility's production line and incorporating the capacity to make a multitude of core heights and grades. The mill will increase market potential and open new doors to various industries, such as packaging, architectural panels, bed platforms, core materials and flooring systems.

## Innovation

Corruven® Core is a patented technology for wood-based composite core material. The concept of Corruven® Core technology was to utilize the "natural" carbon of wood with as little transformation and energy as possible. The technology combines rejected wood fibres from regional suppliers, green chemistry and a corrugated shape. The creation of the

Corruven® Core involves the lamination of two pieces of thin wood or other material using formaldehyde-free glue to make a finished hollow core panel with improved strength stability. The result of the innovative technology is a formaldehyde-free core that allows Corruven to make panels up to 75% lighter and six times stronger and capture up to two times more carbon dioxide.





## Results

- ▶ Requires 60% less wood, 40% less energy and 40% less resin than standard composite panels
- ▶ 24 new jobs created
- ▶ Production line has the capacity to produce up to 15,000 ft./hour of four- and 5-ft. wide sheets of Corruven® Core

## Benefits

- ▶ **Market:** Over \$50 million in exports per year to high value markets, thereby increasing the competitiveness of the Canadian wood panel industry
- ▶ **Environment:** GHG savings through lower fibre and resin requirements
- ▶ **Environment:** Lower transportation and fuel requirements with lighter shipped goods



*“ Our vision is to unite a family of leaders that inspires game changing innovation to build a better world. ”*

— Alain Bélanger,  
President  
Corruven Inc.

# Biomaterials Enerlab 2000 Inc.

**Lignin-based polyurethane products:** Founded in 1982, Enerlab is a manufacturer of thermal insulation products used in construction. Enerlab developed a new technology at its Saint-Mathieu-de-Beloeil facility in Quebec to produce Iso-Lignin a new product that uses lignin to replace twenty percent of petroleum-derived raw material when manufacturing polyurethane products. Iso-Lignin technology allows for the direct use of large quantities of lignin, without any chemical transformation, which can be easily integrated into Enerlab's existing manufacturing process.



With \$1.25 million from IFIT and additional support from the Government of Quebec, Enerlab is now able to commercialize a new line of lignin-based polyurethane products.

## Innovation

Iso-Lignin will be produced from black liquor-derived lignin, a by-product of the pulping process and an abundant and underutilized Canadian resource. The produced Iso-Lignin will be blended with polyurethanes to produce insulating foams. Polyurethanes with Iso-Lignin can be used to produce a variety of products, including flexible, high-resilience foam setting, rigid foam insulation panels, high-performance adhesives, surface coatings, packaging, surface sealants and synthetic fibres.

## Results

- ▶ New production line capable of manufacturing up to 20 million board feet of different structural panel types

## Benefits

- ▶ **Economic:** raw material costs reduced by up to 20%
- ▶ **Environment:** reduced environmental footprint by replacing petroleum-based raw materials
- ▶ **Market:** competitive new polyurethane-based products attractive to environmentally friendly customers

*“The preparation of higher valued green chemicals and bio-based products favours the future use of lignin biomass components with substantial environmental and economical benefits. Lignin is the second most naturally abundant substance after cellulose.”*

— Armand Langlois,  
President  
Enerlab 2000 Inc.



*Iso-Lignin foam being sprayed to create a high-performance insulation board with customizable properties such as fire resistance and specific densities*



# Solid Wood Louisiana-Pacific Canada Ltd.

**Mill conversion introduces new innovative siding products:** Founded in 1973, Louisiana-Pacific Corporation is a leading manufacturer of quality engineered wood building materials with manufacturing facilities in the United States, Canada, Chile and Brazil. Louisiana-Pacific is a supplier of high-quality commodity and speciality products that are sold to builders and homeowners worldwide.



With a \$5-million investment from IFIT, Louisiana-Pacific converted one of its older oriented strand board (OSB) mills in Minitonas, Manitoba, to implement their Smartside® technology, a sustainably produced wood panel product for building exteriors. To convert the OSB mill, significant modifications and additions to equipment and infrastructure were required.

## Innovation

Louisiana-Pacific's Smartside® is a wood-based exterior siding product made from renewable, fast-growing and underutilized hardwoods. The process uses several innovative technological advancements, such as preservative solutions that increase insect and fungi resistance; advanced resin technology to enhance product performance; and new overlay technology to increase aesthetic appearance and finish. Louisiana-Pacific's process allows for products of various lengths, widths and thickness based on client's needs. Customer specifications are also met by upgraded controls and increased production speeds to generate greater throughput and flexibility.

## Results

- ▶ Use of fast-growing, underutilized hardwood, specifically Trembling Aspen, in the Swan Valley region
- ▶ 350 million sq. ft. produced annually
- ▶ 60 new jobs

## Benefits

- ▶ **Economic:** efficiency and life expectancy of the existing mill increased
- ▶ **Environment:** completely sustainable product with a low CO<sub>2</sub> emission profile, due to state-of-the-art processing technology and low-emitting, formaldehyde-free resins
- ▶ **Community:** revitalized local economies





# Solid Wood StructureCraft Builders Inc.

**A future for wood construction:** A future for wood construction: StructureCraft is an established designer, fabricator and installer of complex timber structures across North America and Asia. StructureCraft has 30 years of experience in structural consulting and working with architects to build new complex structures with timber. StructureCraft's new Dowel Laminated Timber (DLT) facility will be constructed in the Fraser valley, British Columbia.



With \$1.93 million in investments from IFIT, StructureCraft will procure and implement a DLT production system. The new machinery and associated storing and handling systems will be housed in the new facility in Fraser Valley. As well, the facility will have the capacity to support existing business operations alongside the DLT production line and build on the company's work with pre-fabricated panels and modular structures.

## Innovation

StructureCraft's facility in the Fraser valley is the first mill in North America to develop and automate the production of DLT for green construction purposes. DLT is made by mechanically fixing laminations of dimensional lumber to each other by a series of hardwood dowels, primarily using undervalued Western Canadian species and pine

beetle-affected wood. This system creates a high-quality wood product without any nails or glue, thus eliminating tool damage during onsite modifications, and is more aesthetically pleasing. The installed production system will produce a higher-quality product than is achievable with the existing manual process.



## Results

- ▶ 1 million sq. ft. of product per annual shift
- ▶ 10 new jobs



**1 million** sq. ft.



**10** new jobs

## Benefits

- ▶ **Economic:** more cost-effective by using 10–15% less material
- ▶ **Market:** potential for reuse in complex timber structures
- ▶ **Environment:** replacement of cement and steel with DLT with high carbon sequestration potential
- ▶ **Environment:** higher value products from low-quality wood such as pine beetle-affected timber



**“ This kind of innovative manufacturing using large quantities of Canadian forest products will help fuel the rapidly growing demand for advanced green building products that is revolutionizing the construction industry in North America. ”**

— Gerald A. Epp,  
President and Chief Engineer  
StructureCraft Builders Inc.



# Solid Wood Irving Pulp and Paper

**Healthier trees grown faster:** Founded in 1882, Irving operates in Canada and the United States as a manufacturer of softwood, maple and mixed Kraft pulp for use in tissue and paper products. Irving's new Advanced Seedling Production Technologies Centre located in Sussex East, New Brunswick, is the only facility in Canada able to produce somatic seedlings at a large commercial scale.



With \$982,000 in funding from IFIT and additional support from ACOA and the Government of New Brunswick, Irving developed a state-of-the-art facility mechanized to commercialize Somatic Embryogenesis Seedlings for the first time in Canada and Endophyte-Enhanced Seedlings for the first time globally. These two advancements possess valuable traits, including improved growth rate, disease resistance, fibre quality, increased climate adaptation and improved tolerance to various insects and fungal pests. The Somatic Embryogenesis process also has the possibility to branch out to new areas, for example, the growth of potato plantlets for the seed potato industry.

## Innovation

Irving's new 5,320-sq. ft. facility takes advantage of unique automation equipment and advanced climate-controlled growth rooms to allow for the mass production of up to 2.5 million somatic seedlings per year. The facility also

contains sophisticated fermentation and bioreactor equipment to produce sufficient quantities of endophyte inoculum to treat up to 40 million seedlings per year with beneficial conifer fungi that improves a tree's natural tolerance to insects and pests.





## Results

- ▶ Capacity to produce 2.5 million somatic seedlings annually
  - ▶ Treat up to 40 million of seedlings per year with endophyte inoculum
  - ▶ 20,000 hours of work for over 200 skilled trades people during construction
  - ▶ 10 additional full-time jobs
- ▶ **Economic:** increased revenues of \$1.5 million from seedling activities
  - ▶ **Environment:** less need for pesticides due to increased pest resistance of new seedlings
  - ▶ **Community:** continued employment and financial stability in a rural resource-dependent community

## Benefits

- ▶ **Economic:** increased quality and quantity of wood from the same forest plot

## Market

- ▶ The somatic embryogenesis process is applicable to a number of forest and agricultural species.



*Splicing seedlings to create more copies*

**Somatic Embryogenesis:** A vegetative plant propagation technique that causes plant tissue culture to produce many individual seedlings with the same genetic characteristics.

**Endophyte-Enhanced Seedlings:** A process whereby seedlings are inoculated with cultures of carefully selected fungal species to reduce the impact of any insect and disease that might be present in forest plantations.

# Bioenergy Millar Western Forest Products Ltd.

**Energy from waste water:** Founded in 1906, Millar Western owns and operates two sawmills and a pulp mill in Alberta. The company's Bioenergy Effluent Project is located on its integrated site adjacent to its Bleached-Chemi-Thermo-Mechanical Pulp (BCTMP) mill in Whitecourt, Alberta.

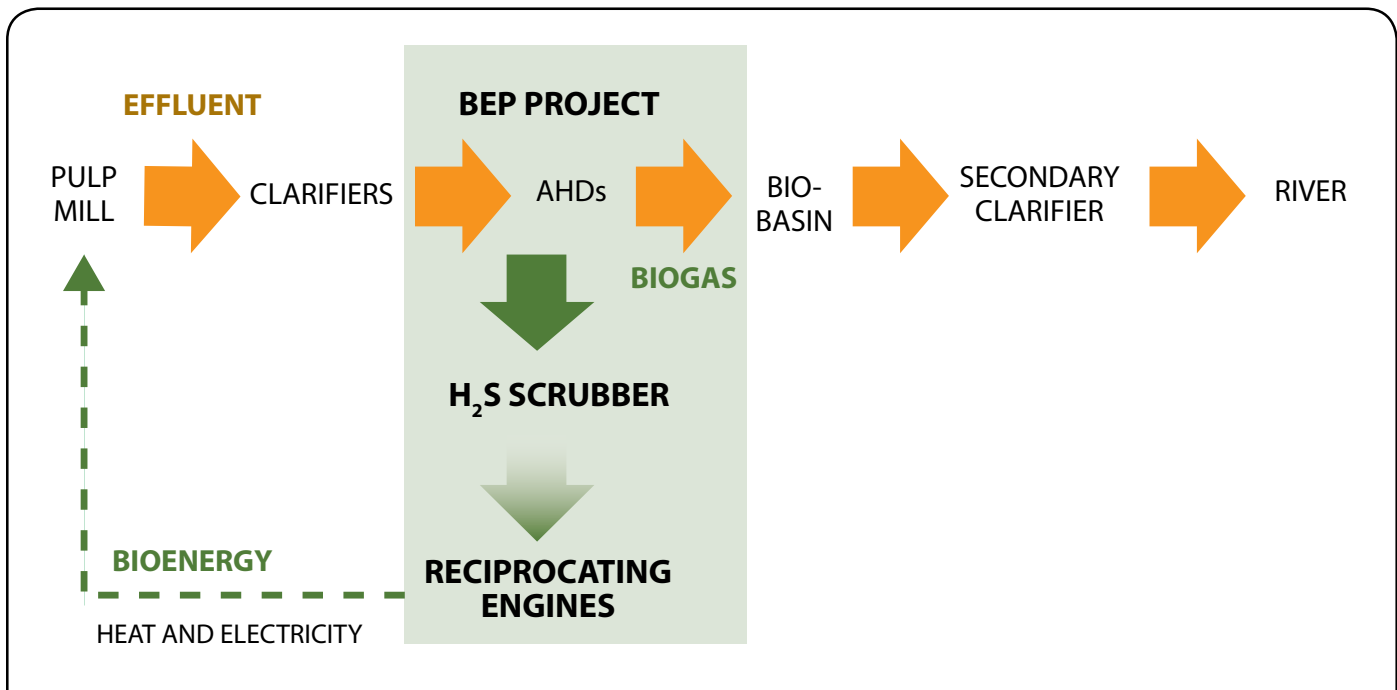


With \$6.75 million in funding from IFIT and support from the province of Alberta, Millar Western was able to install North America's first anaerobic hybrid digester (AHD) pre-treatment technology. The installation will generate power and heat for the mill, enhance the quality of effluent discharge, reduce water intake, cut GHG emissions and improve the mill's long-term economic viability.

## Innovation

AHD is a reliable technology ready for commercial application in Canada's pulp and paper industry. AHD provides the Whitecourt mill with the capacity to strengthen its environmental performance by removing organic pollutants and bio-solids and to improve economic competitiveness by generating bioenergy, reducing input

costs and increasing pulp and paper production. The installation of the technology allows Millar Western to remove organic matter from its effluent and convert it to methane-rich biogas, which can be used for fuel at co-generation stations. As well, the converted biogas can then be further conditioned for green electricity and sold to natural gas distributors.



Source: KSH Consulting

## Results

- ▶ \$9.6 million in new annual revenues and savings
- ▶ 5.2 megawatts of bioenergy
- ▶ 10 direct jobs



**\$9.6** million



**10** direct jobs



**5.2** megawatts

## Benefits

- ▶ **Environment:** Cut direct (on site) emissions by 10,300 tonnes per year of CO<sub>2</sub>; cut indirect (off site) greenhouse gas emissions by 35,000 tonnes per year
- ▶ **Environment:** Reduced mill consumption of inputs
  - Cut electricity purchase by 11%
  - Reduce consumption of natural gas by 10%
  - Reduce consumption of nutrients by 70%
  - Reduce consumption of polymers by 80%
- ▶ **Environment:** 70% decrease in nitrogen and phosphorus usage
- ▶ **Environment:** 10% reduction in fresh water consumption
- ▶ **Environment:** 50% reduction in annual fuel consumption for hauling and disposal of the mill's solid biomass waste
- ▶ **Community:** Significant employment benefits to community during implementation phase, with 200,000 construction hours and 130 secured mill jobs



**Anaerobic hybrid digester:** Anaerobic (no oxygen) treatment uses microorganisms to convert organic matter into biogas from industrial wastewater containing a high concentration of biodegradable organic matter.





# Bioenergy Woodland Biofuels Inc.

**Ethanol from wood biomass:** Founded in 2000, Woodland Biofuels is a global leader in the move to sustainable, renewable and clean fuel production. The company installed its Catalyst Pressure Reduction (CPR™) technology, a world first, at its demonstration facility in Sarnia, Ontario.



**With \$1.9 million in funding from IFIT, Woodland Biofuels will optimize its plant configuration and operating conditions with the addition of CPR™ technology, thereby validating the technology's ability to thrive as a full commercial scale operation.**

## Innovation

During commercialization, Woodland Biofuels Inc. will combine robust, proven unit operations to convert wood and wood waste into a novel cellulosic ethanol solution. The CPR™ technology creates a high-yield, low-cost

process that produces sustainable fuels from virtually any renewable biomass, including wood and agricultural waste. As well, the technology generates no toxic emissions and eliminates the need to use food crops, such as corn, to produce ethanol.



## Results

- ▶ Potential for direct and indirect new jobs with each installation
- ▶ Process approximately 191,000 bone-dry metric tonnes of wood waste per year into 79.5 million litres of ethanol.
- ▶ 20 secured jobs



**20** secured jobs



**72%** less GHGs

*“ This demonstration project will open the doors to the commercial deployment of full-scale CPR™ plants that promise attractive economic returns and significant environmental benefits compared to fossil fuel and corn ethanol. ”*

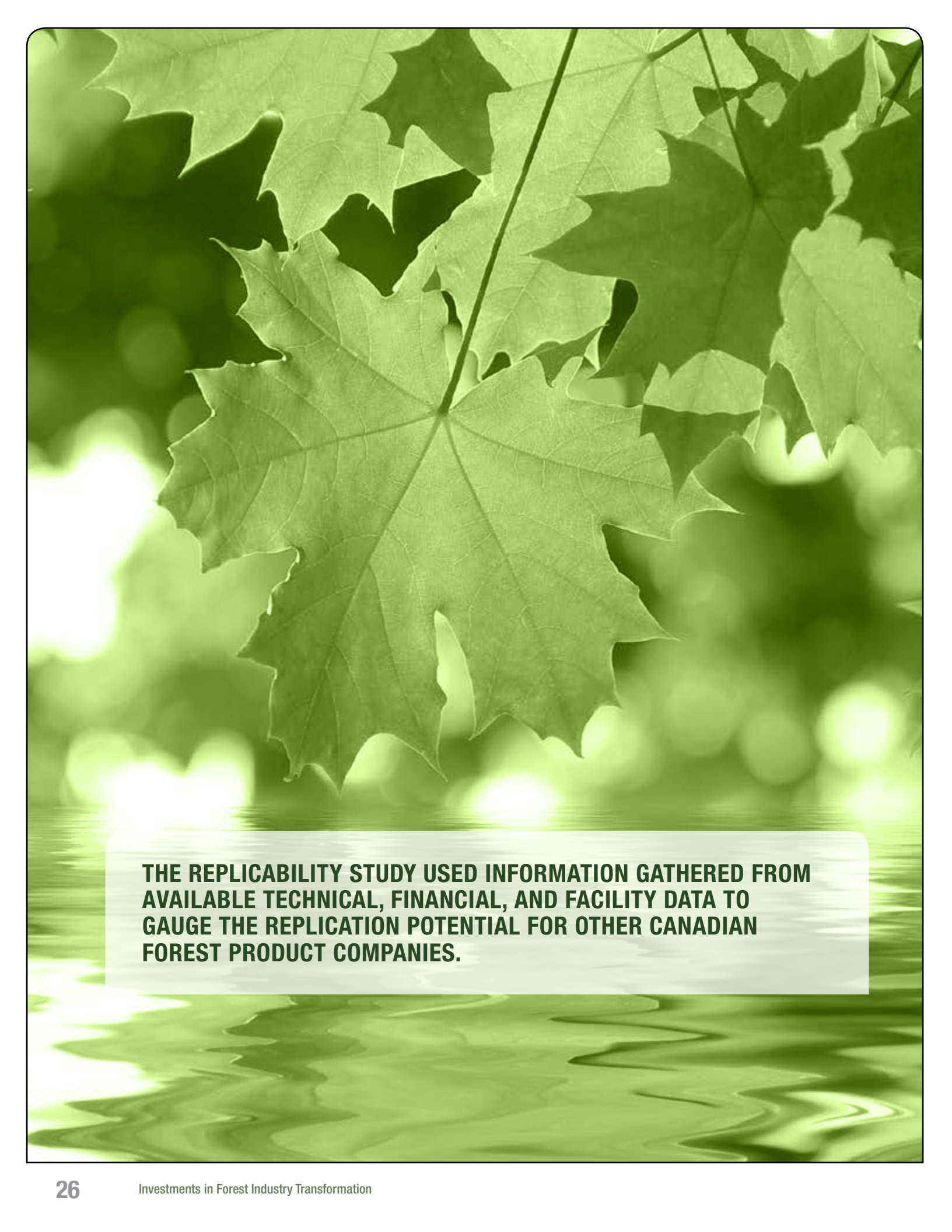
— Greg Nuttall,  
President and CEO  
Woodland Biofuels Inc.

## Benefits

- ▶ **Environment:** 72% less GHG emissions and no volatile organic compounds released
- ▶ **Environment:** reduced impact on land and soil
- ▶ **Environment:** reduced water usage compared with production of corn ethanol
- ▶ **Market:** At full deployment, Woodland's technology would be capable of producing approximately \$25 billion of ethanol in Canada
- ▶ **Economic:** Commercialization of biofuel technologies such as CPR™ will enable the Canadian bioenergy industry to access a diversified, innovative biofuel process portfolio.



**95% ethanol created using Woodland's biomass to ethanol process**



**THE REPLICABILITY STUDY USED INFORMATION GATHERED FROM AVAILABLE TECHNICAL, FINANCIAL, AND FACILITY DATA TO GAUGE THE REPLICATION POTENTIAL FOR OTHER CANADIAN FOREST PRODUCT COMPANIES.**



# REPLICABILITY

In 2015, the Investments in IFIT program engaged an engineering firm to complete a series of analyses on funded projects from each IFIT Call for Proposals. The goal was to identify where existing Canadian forest product companies may be able to replicate the first-in-world and first-in-Canada technologies that were supported by IFIT. This effort reflects NRCan's desire to encourage the replication of technologies across Canadian forest facilities and to further strengthen Canada's economic capacity and environmental sustainability. The replicability study used information gathered from available technical, financial and facility data to gauge the replication potential for other Canadian forest product companies. These findings examined each technology from a number of facets, from technology maturity and ease of implementation to market opportunities and social benefits, to determine the overall impact of each technology. Project results are illustrated in radar plots, with indexes ranging from one to five, which demonstrate the relative ease of replication for each new technology. Full two-page replicability profiles of over a dozen IFIT supported technologies can be found on the program's website at [www.nrcan.gc.ca/forests/federal-programs/13139](http://www.nrcan.gc.ca/forests/federal-programs/13139).

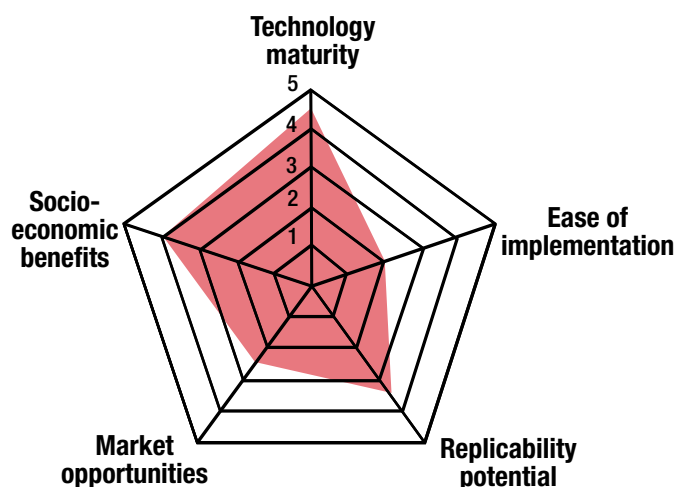


**The BioComposites Group (BCG)** has implemented an Engineered Fibre Mat (EFM) process based on a high-capacity, air-laden, non-woven production line that uses wood biomass as the main feedstock. Engineered fibre mats are a stand-alone technology best suited to large-scale facilities with access to large quantities of wood and agricultural fibres. Engineered fibre mats can be marketed and applied as automotive composites, natural fibre insulation or even erosion control mats, all of which have strong growth and demand in North America. Replication of an EFM production line can be completed through commercially available equipment; however, configuration

and engineered fibre mat design would need to be developed internally or through licensing from BCG or another fibre mat design firm.

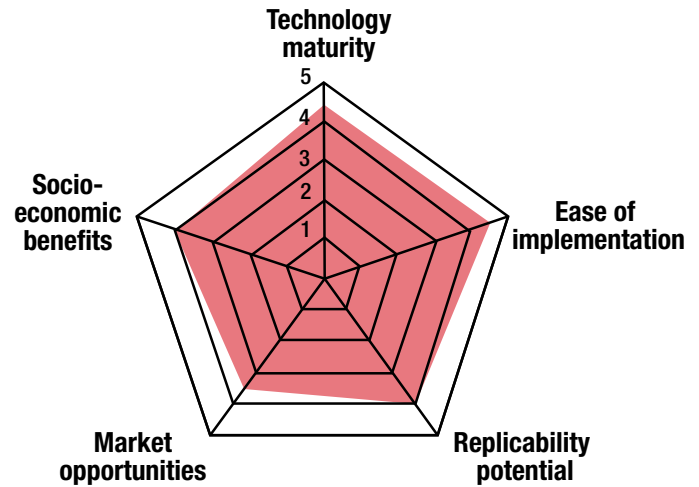
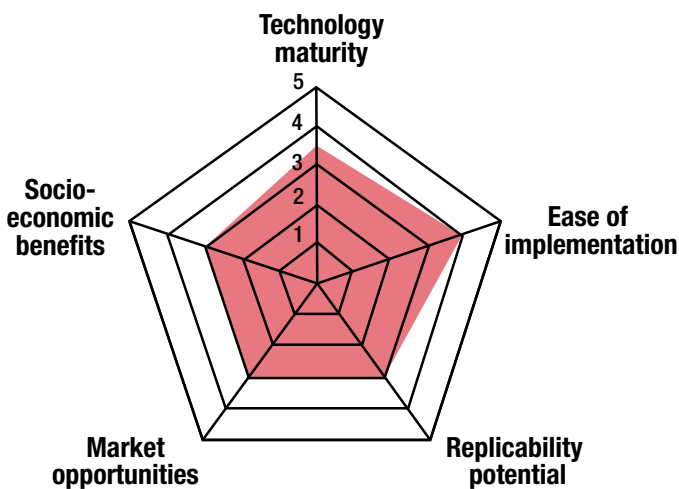


*The BioComposites Group (BCG)*



**Kruger Biomaterials** has implemented a process, designed by FPInnovations, to produce 15 BDt/d of cellulose filament (CF), a speciality cellulose from wood fibre, without the use of any chemicals or enzymes. This novel cellulosic material, with unique strengthening properties, can be used in a wide range of existing and new product applications. This process can be replicated at any mill across Canada that produces Thermo-Chemical Pulp (TCP), Thermo-Chemical Mechanical Pulp (TCMP) or Bleached Chemical Thermo-Mechanical Pulp (BCTMP) processes with high-consistency refiners. Kruger Biomaterial's cellulose fibres have a high commercialization value with many potential market applications as a strength-reinforcing additive for thermoplastics, adhesives and specialty coatings. As the process was developed to take advantage of idled pulp and paper equipment, replication only requires access to such idled machinery and the cellulose filament extraction technology developed by FPInnovations.

a company's portfolio of products as well as improving the performance of its processes. LignoForce™ can be replicated at any Kraft mill across Canada regardless of the end product and, specifically, at facilities also looking to debottleneck a recovery boiler. Currently, replication of the LignoForce™ process would require a licensing arrangement with FPInnovations.



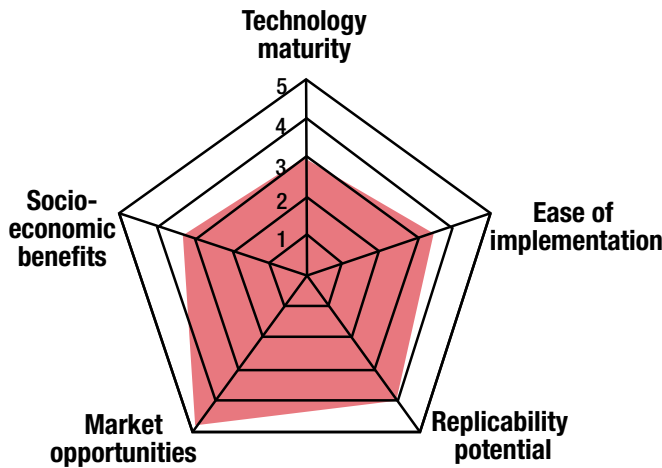
**Nature's Affinity's** innovative new product, BioBinder, is a proprietary, 100% bio-based binding agent used in moulded pulp product made from recycled fibres, displacing traditional petroleum-based binders. BioBinder can be used in many of the same applications as traditional binders but with better

**West Fraser's** commercial-scale implementation of the LignoForce process demonstrates the ability for a mill to produce up to 30 tonnes per day of high-quality lignin from black liquor. Lignin precipitation has been proven an effective and viable means of both diversifying



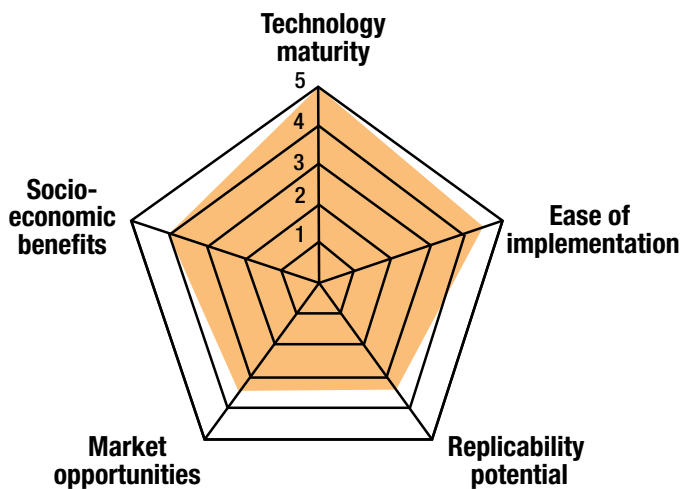
**Nature's Affinity Inc.**

water resistance, strength properties and a lower carbon footprint. BioBinder use is not limited by product standards and has been certified by the USDA and accepted by Health Canada. Replication at new sites can be easily coupled with any existing packaging or pulp-moulded process. As this first-in-kind technology was developed by Natures Affinity, a commercial arrangement would need to be made in order to access the technology.



## Solid Wood

**BC Passive House's** prefabricated panelized system allows for the construction of ultra-low energy use buildings that meet Passive House Standards. This innovative new system creates energy-efficient, safer and more comfortable homes for Canadians. The pre-fabrication system is easily integrated into existing building products facilities and only requires sufficient floor space for manual panel assembly and access to Computer Numeric Control (CNC) technology.

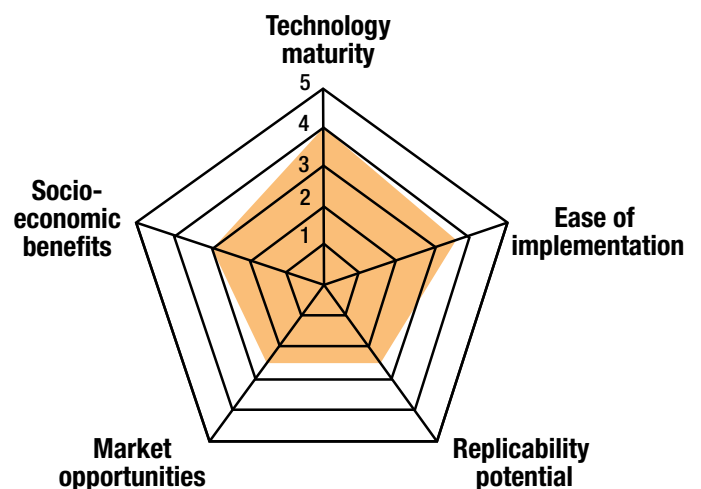


Significant interest has already been sparked around BC Passive House's building systems approach, and the Passive House market is expanding rapidly in North America.



*BC Passive House*

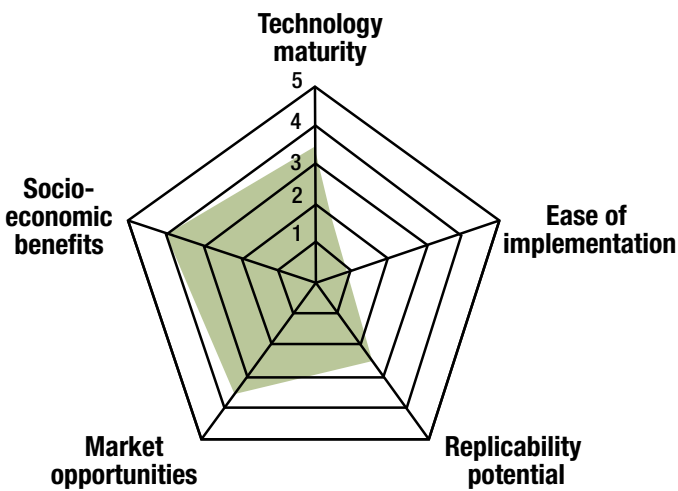
**Corruven's** world-first corrugated composite boards are up to six times stronger than traditional wood product boards and up to 75% lighter due to their unique design and manufacture. The Corruven® Core technology also requires less fibre and resins than standard panel processing facilities, making them cost-advantageous for companies manufacturing building materials, furniture or packaging materials. Replication would require access to reject veneer or paper fibreglass and equipment similar to traditional corrugated or panel manufacturing technologies. The customized knowledge required to produce the unique core technology would need to come via an arrangement with Corruven.





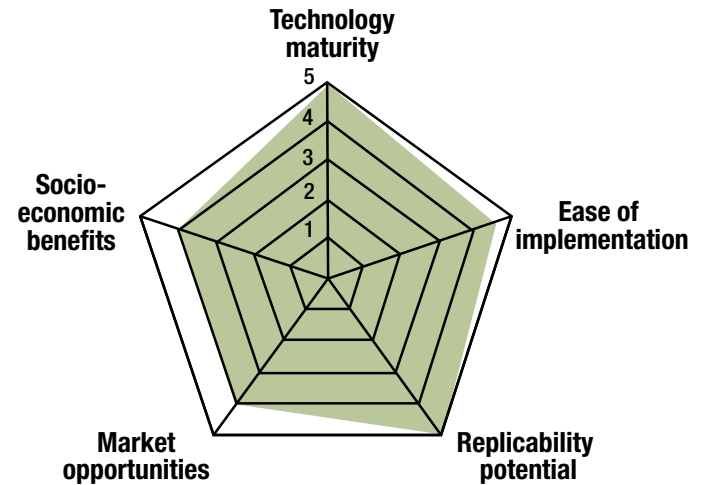
# Bioenergy

**Millar Western** installed a unique hybrid AHD to remove suspended solids and dissolved organic material found in the mill's effluent streams and convert them to a methane-rich biogas, which would then be used to fuel a co-generation unit. AHD can be replicated at any large facility with an effluent treatment system or ideally a Bleached Chemical Thermo-Mechanical Pulp (BCTMP) mill that produces a similar effluent to Millar Western. Replication of the AHD system would reduce costs and environmental impact, as well as provide a facility with a source of green electricity and heat.



**Nechako Green Energy's** implementation of an Organic Rankine Cycle (ORC) allowed the company to take waste heat from its mill operations and convert it into electric power. The ORC technology has reached full maturity in biomass applications, only requiring a sufficient source of heat for the production of energy. Nechako Green Energy's

project can be easily replicated by any forest product facility, or any other industrial sectors, where heat of low quality is generated, provided a heat waste source of sufficient quality is accessible. Successful replication of the ORC has already been demonstrated at forest facilities multiple times across Canada and has the potential for hundreds of additional installations.



**Nechako**

# CONCLUSION



Natural Resources Canada's IFIT program continues to encourage transformation in the forest industry by investing and supporting first-in-kind technologies at Canadian forest industry facilities. Innovation leads to greater diversification in the sector, thereby adding higher-value products to the mix nationally and internationally and promoting a more commercially and environmentally sustainable Canadian forest industry.

The 28 projects funded by IFIT between 2010 and December 31, 2016, have supported innovation across the entire forestry sector, including bioenergy, biomaterials, biochemical and advanced building projects. With each successful project, IFIT continues to help de-risk new technologies and encourage broader adoption across the forest industry, while at the same time providing significant benefits to the environment, economy and all Canadians.

## Acknowledgements

The Investments in Forest Industry Transformation program would like to thank the following organizations and individuals for their contributions to this report and their ongoing efforts to support innovation and wider transformation of the forest sector.

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**Forest Products Association of Canada**

**FPInnovations**

**Gerald A. Epp**, StructureCraft Builders Inc.

**Greg Adams**, Irving Pulp and Paper

**Greg Nuttall**, Woodland Biofuels Inc.

**Guy Martin**, KSH Consulting

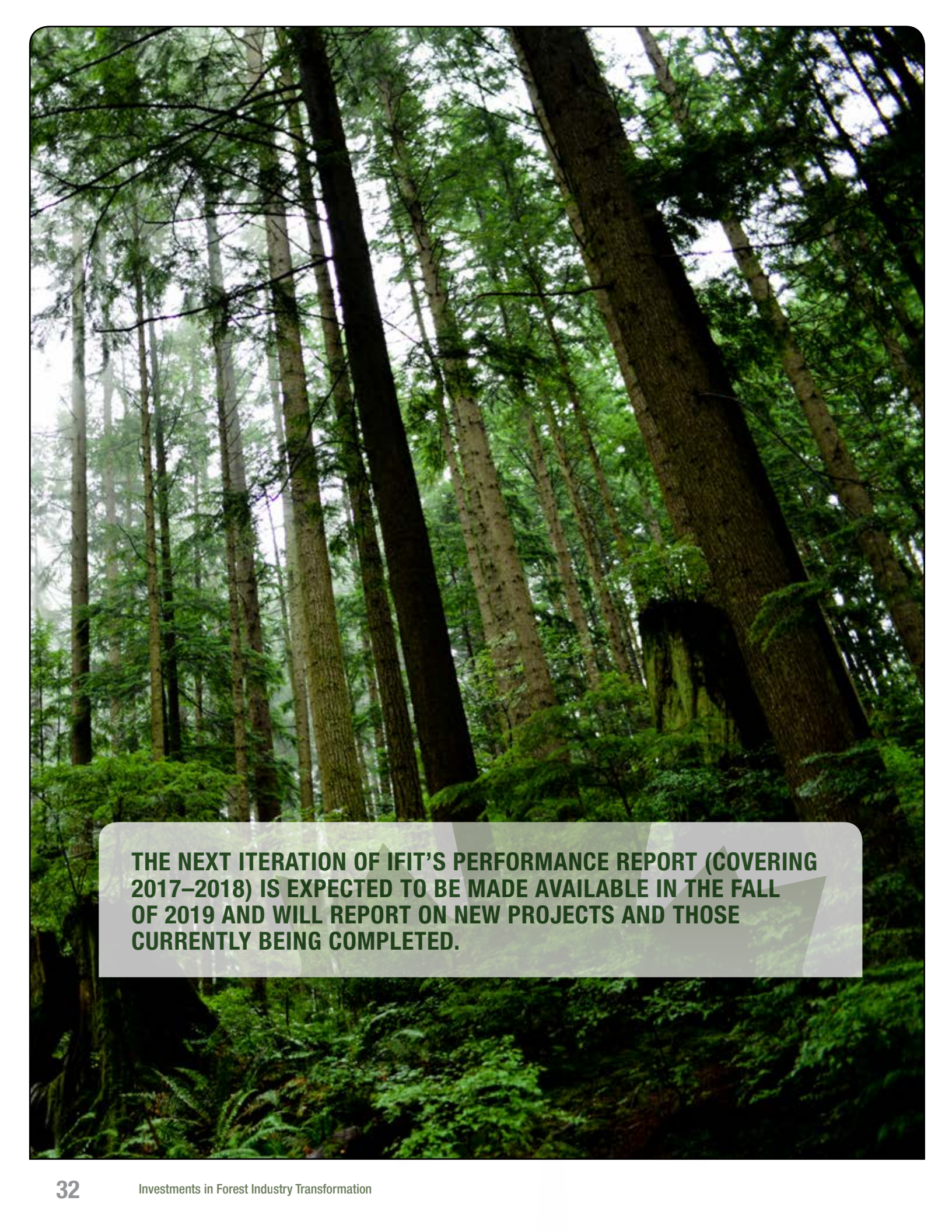
**Kevin Warkentin**, Louisiana-Pacific Corporation

**NineSigma, Inc.**

**Ron Reis**, Millar Western Forest Products

**Samantha Jarvis**, University of Ottawa





**THE NEXT ITERATION OF IFIT'S PERFORMANCE REPORT (COVERING 2017–2018) IS EXPECTED TO BE MADE AVAILABLE IN THE FALL OF 2019 AND WILL REPORT ON NEW PROJECTS AND THOSE CURRENTLY BEING COMPLETED.**







**Investments in Forest  
Industry Transformation (IFIT)  
Performance Report**

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