FOREST INNOVATION
EXPECT US IN THE UNEXPECTED

TEXTILES
BIO-ENERGY
FOOD ADDITIVES
BIO-FUELS
PULP & PAPER
BIO-CHEMICALS
BIO-PRODUCTS
BIO-PLASTICS
SOLID WOOD
THE WONDERS FROM WOOD

The Canadian forest products industry has overcome significant challenges and is now unleashing its enormous potential as a global leader in transformation and breakthrough innovation — a revolution that will result in significant economic opportunity and jobs. More and more surprising uses are being discovered for wood fibre — everything from clothing to car parts, from cosmetics to chemicals to advanced construction systems and more. Using these “green” bio-products in some traditional consumer goods would be good for the planet as it would decrease the product’s carbon footprint and reduce overall reliance on fossil fuels. Canada is uniquely positioned to take advantage of the economic promise of these value-added eco-friendly products because of our abundant renewable forest resource. The Canadian forest products sector is poised to lead the global revolution in developing game changing technology from wood fibre by leveraging our unique innovation system of strategic partnership alignment, pooled resources, and targeted research which involves governments, industry, research bodies, academia and others.
THE CONSTRUCTION INDUSTRY
Sophisticated building materials such as cross-laminated timber will allow wood buildings to safely go to new heights. Many advanced construction materials are being produced such as hybrid roof tiles. There will be an increasing number of wood-based building systems going forward, resulting in a greener built environment.

THE COSMETICS INDUSTRY
The iridescent properties of wood fibre at the nano-level have vast potential in products such as lipstick and nail polish. Wood cellulose can also make cosmetic creams smoother and more luxurious. Sugars derived from wood can be used in a host of cosmetic products.

3D PRINTING
Wood fibre has the potential to play a major role in the largest manufacturing revolution this century — providing substrate for 3D printers from lignin, an affordable and renewable by-product of pulp mills.

The sky is NOT the limit when it comes to the potential products made from wood fibre. However, there are many surprising possibilities — some that are now being produced, and some that are in the development stage.

EXPECT US IN THE UNEXPECTED
THE ENERGY INDUSTRY
Many forest companies have become energy self-sufficient, thus removing the need for fossil fuels, by using pulping by-products and residues such as bark, shavings and sawdust to produce greener electricity. Many mills are selling their excess energy to the grid. The Canadian sector now produces enough green energy to power all the houses in Calgary’s metropolitan area.

THE GREEN CHEMICALS INDUSTRY
Bio-methanol produced as a by-product at traditional pulp mills can be used in windshield wiper fluid, plastics, glues and fabrics or be blended with gasoline to fuel cars. This is just one example of the almost endless opportunities for bio-based chemicals from wood.

GREENING OTHER INDUSTRIES
Wood-based chemicals can be developed to help the oil and mining sectors remediate tailing ponds and landfills. For example, cellulose nanocrystals can be added to drilling fluids to minimize loss in geological pores. This could represent a large-scale commercial potential.

COOL COMPOSITES
Cellulose products can be used as a substitute for glass fibres in reinforced plastics, for example for eye glass frames. Research is continuing on making carbon fibre from lignin that could be used in high-end sporting equipment such as bicycles, golf clubs and tennis racquets. Sugar streams generated from wood can be used in a range of bio-plastics for example medical applications such as bone implants.

THE FOREST PRODUCTS ASSOCIATION OF CANADA (FPAC) AND ITS MEMBER COMPANIES HAVE LAUNCHED VISION2020 FOR THE INDUSTRY.
It has three ambitious goals to reach by the end of the decade:

- Generate an additional $20 billion in economic activity through new products and markets;
- Improve environmental credentials by an additional 35%; and
- Refresh the workforce with an additional 60,000 workers.
Canada is a world leader in forest innovation because of a unique culture of working together, a shared vision, a tradition of pooling resources, and a targeted research environment that aligns with industry needs to increase the likelihood of commercialization.

Industry’s efforts to adopt innovation are led by the Forest Products Association of Canada (FPAC).

The federal government has invested $1.8 billion since 2007 in strategic programs such as Investments in Forest Industry Transformation (IFIT), and in critical research funding through the Transformative Technologies Program (TTP). These investments have included the creation of Pilot Scale Demos and market development for further commercialization.

FPInnovations has emerged as the world’s largest public-private R&D partnership dedicated to the forest sector and is the catalyst for our innovation system.

The Natural Sciences and Engineering Research Council of Canada (NSERC) is tapping into the creativity of academic researchers by supporting the Forest Innovation by Research & Education (FIBRE) network, which involves 27 universities, 100 professors and 400 students.

Provincial governments have added their muscle, with strategies and roadmaps to complement and leverage efforts at the national level, as well as providing support for FPInnovations.

The Bio-Pathways Partnership Network brings together industry partners such as the chemical, plastic, auto and bio-tech sector while the Bio-Economy Network (BEN) is exploring ways to take advantage of the emerging markets for bio-based products.

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Forest product innovation is rapidly spanning the gap between research and development and the commercial production world. As the Canadian forest products industry travels along this road of innovation, it is positioning itself to take advantage of a sizeable economic potential. The Bio-Pathways Program led by FPAC estimated the market potential for bio-products at $200 billion by 2015 and the global construction market has been valued at about $8 trillion a year. Canada finds itself in the pole position to take advantage of this opportunity because of leadership by FPAC, FPInnovations and FIBRE in helping to produce game changing technologies that are now advancing from the research and development stage to commercial viability in the global marketplace.

CELLULOSE NANOCRYSTALS (CNC)

Nano-technology has become part of the industry’s future and Canada has been at the forefront of the race to exploit the wonders of CNC, the primary structural building block of trees. CNC is a cutting-edge emerging technology that is light, strong and bio-degradable, with a wide array of possible uses, from bone replacement and tooth repair, to airplane and car parts to chemicals, composites and coatings. One of the most intriguing aspects of CNC is its iridescence — the type of sheen you see on fish scales or hummingbird wings — making it possible to revolutionize many applications including sunscreens, cosmetics, pigments in paint, optical films for use in specialty packaging, or even to prevent counterfeiting.

The research and development behind CNC is a shining example of Canada’s innovation partnerships in action. FPInnovations led the research with support from the federal and Québec governments. FPInnovations also tapped into the creativity of the academic world with Professor Derek Grey of McGill University.
winning the prestigious Wallenberg Prize in Sweden for his pioneering work on CNC. The world’s first pilot plant for CNC was built at the FPInnovations laboratory in 2011 and the next year CelluForce Inc. became the world’s first commercial demonstration plant producing CNC at the Domtar pulp and paper mill in Windsor, Québec.

Work continues to identify unique and advanced uses for this high value nano-material that comes from a renewable, recyclable natural resource.

**CELLULOSE FILAMENTS (CF)**

Canada is currently first in the global competition to develop the next generation of cellulose-based materials because of its work with cellulose filaments. CF optimizes the strength, stability, flexibility and longevity of a variety of materials including composites, coatings and consumer products. It is a strength reinforcing agent for traditional pulp and paper products but also has numerous non-traditional uses such as flexible packaging, thermoplastics, coatings and construction panels.

Once again the development of CF in Canada was spurred on by collaboration, targeted investments and research. Support came from Natural Resources Canada (NRCan) and from the Québec and British Columbia governments. Canadian academics provided technical support for process and product development. FPInnovations again led the research effort and joined forces with Kruger to open the first demonstration plant in the world in Trois-Rivières. Two other companies, Resolute and Mercer, have joined forces in a joint venture called Performance BioFilaments to explore commercial applications for this exciting new bio-material. FPInnovations estimates the revenue potential for CF to be $500 million per year.

**CROSS LAMINATED TIMBER (CLT)**

CLT was first used in Europe but the Canadian government has supported research on the development and market acceptance of CLT in the North American market. This panel product is made of multiple layers of timber stacked and glued together resulting in a strength-enhanced product, with a smaller environmental footprint and faster construction (which results in lower costs).

FIBRE engineers helped develop sound scientific and engineering arguments for taller wood buildings. FPInnovations developed a multi-disciplinary design manual now playing a key role in the adoption of this engineered wood product, and is also involved in research on other engineered and hybrid wood products. The Canadian Wood Council estimates that the use of wood in non-residential construction such as shopping centres, hospitals and buildings up to six storeys in North America has a market potential of up to $10 billion.

A joint project of NRCan and the Canadian Wood Council, the Tall Wood Building Initiative is aimed at expanding the North American market for Canadian wood products by encouraging the use of wood in non-residential construction, including mid- and high-rise buildings. In support of this initiative, FPInnovations launched the Technical Guide for the Design and Construction of Tall Wood Buildings to provide architects and designers with the guidance and support needed to better understand the unique matters to be addressed when developing and constructing tall wood buildings.

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**THE FOOD INDUSTRY**

Cellulose can be used as a texturizer and stabilizer in food products, for example making dairy products such as chocolate gelato creamier. Research continues in such areas as developing anti-bacterial papers and wraps to brown food in the microwave.
Packaging utilizing bio-reactive properties would extend shelf life, monitor freshness and improve food safety. These new “intelligent” materials could also identify allergens such as peanuts.

The Canadian forest products industry, led by FPAC, is diversifying into higher-value niche areas such as bio-energy, bio-chemicals, nano-technology and advanced construction materials. More than ever, this kind of innovation is fundamental to improving the competitiveness of Canada’s forest sector in the global marketplace. There are also opportunities to set the stage for long-term prosperity while reducing overall environmental impact. Right now Canada is scoring many world firsts and is well positioned to lead the international race and take market advantage of the remarkable new range of products that can be made from renewable wood fibre. But many other countries are in the race and stepping up efforts to discover and develop pioneering products from wood fibre.

THE KEY IS TO BUILD ON EXISTING MOMENTUM.

Canada is in the enviable position of having what may be the best fibre resource in the world — our vast, varied and high-quality renewable forests that are sustainably managed. Canada has also developed an enviable innovation system with strategic help from government and a culture of working together that is now paying dividends.

Continuing to fund programs such as TFT, IFIT, and academic research is essential to spurring further breakthroughs. If we can build on recent success, Canada can truly lead the pack in game-changing technology and eco-friendly materials. And that can only be good for Canada’s future prosperity and job creation.
FOREST PRODUCTS ARE

→ A $58 BILLION INDUSTRY.

→ 235,000 DIRECT JOBS IN OVER 200 COMMUNITIES FROM COAST TO COAST.

→ $26.6 BILLION IN EXPORTS.

The Forest Products Association of Canada (FPAC) provides a voice for Canada’s wood, pulp, and paper producers nationally and internationally in government, trade, and environmental affairs. FPInnovations is a not-for-profit world-leading R&D organization that specializes in the creation of scientific solutions in support of the Canadian forest sector’s global competitiveness.