THE QUÉBEC GOVERNMENT ADOPTED A POSITION IN FAVOUR OF BIO-REFINING AS EARLY AS 2008. ITS GREEN PAPER ENTITLED FORESTS: BUILDING A FUTURE FOR QUÉBEC DISCUSSED THE IMPORTANCE OF HAVING AN INDUSTRIAL DEVELOPMENT STRATEGY FOCUSED ON HIGH VALUE-ADDED PRODUCTS FROM SECTORS SUCH AS BIO-REFINING AND GREEN CHEMISTRY. THIS SAME ORIENTATION WAS INCLUDED IN THE 2012-2017 STRATEGY TO TRANSFORM QUÉBEC’S FOREST PRODUCTS INDUSTRY IN ORDER TO DEVELOP NEW PRODUCTS AND NEW MARKETS.

A WAY FORWARD FOR THE FOREST SECTOR

Québec’s pulp and paper industry is currently in the throes of a crisis due to the declining demand for newsprint, stock paper and writing paper. Its competitive position has been adversely affected, and companies in the sector now face stiff competition.

At the same time, the international community’s concerns regarding climate change have encouraged us to review the methods we use to produce and process fuels and other materials, in order to reduce their carbon footprint. Many industrial sectors now want to use biosourced molecules and green chemistry. The wood processing sector provides an excellent example of the market’s movement towards greener, more environmentally-friendly products. The pulp and paper industry is ripe for what has become an unavoidable technological shift. Québec’s pulp and paper mills are located in the regions, close to the forest resource. In addition, if the mills are to survive, they will need to use different processes, including bio-refining, to produce second-generation bio-fuels, high value-added bio-products, and bio-materials.
WHAT IS BIO-REFINING?

Bio-refining is similar to the petroleum refining process – in other words, it is a series of industrial procedures used to convert wood into a variety of commercial chemical products. In a bio-refinery, the main chemical components produced from wood (cellulose, hemicelluloses, lignin and extractives) are used to make value-added products such as bio-fuels, special chemical products, basic raw materials for other industries, and precursors for plastic materials and other polymers. Bio-refining activities are therefore a complement to and a diversification of the pulp and paper industry.

For example, the Tembec plant in Témiscaming, described later in this document, is a bio-refinery that produces commercial pulp, specialty cellulose, phenolic resin, lignosulfonates and ethanol. There are many other bio-refining activities compatible with pulp and paper production, including:

- Carbonation and pyrolysis of bark, sludge and wood waste to produce manufactured gas and bio-fuel.
- Biochemical processing of solid waste and effluent to produce precursors for use in making biodegradable plastics.
- Production of phenol by chemically processing dissolved lignin.
- Fermentation of dissolved hemicellulose waste to produce ethanol.

A BIO-REFINERY IN QUÉBEC

A pilot project for crystalline nanocellulose – CelluForce (Windsor)

CelluForce is a joint enterprise founded in July 2010 by Domtar and FPInnovations. On January 26, 2012, CelluForce inaugurated the first-ever crystalline nanocellulose demonstration plant on the Domtar pulp and paper mill site in Windsor. The $44.4 million project is expected to produce one metric ton of crystalline nanocellulose per day. The Ministère des Ressources naturelles (now known as the Ministère des Forêts, de la Faune et des Parcs) has invested $10.2 million in the project, and Natural Resources Canada has invested $23.2 million. Domtar, for its part, has invested $11 million. The project has created approximately 30 operations jobs. In addition, several researchers and other scientific employees from FPInnovations will continue to develop the potential offered by new applications of, and new products developed from, crystalline nanocellulose.

This is the first world-class demonstration plant capable of producing crystalline nanocellulose. The product is a significant element in the development of renewable industrial and consumer products from wood fibre. CelluForce is continuing its activities, and is collaborating with different industries throughout the world through technical cooperation agreements.

Crystalline nanocellulose, a nanomaterial with many unique and different properties, can be extracted economically from wood, an abundant, renewable, recyclable and environmentally safe resource, via a process patented by FPInnovations.

Crystalline nanocellulose can be used not only to enhance the performance of existing products, but also to create new products. It improves the solidity, durability and resistance of products and reduces damage caused by wear and tear, abrasion and sunlight. It also has antioxidant properties.

CelluForce is the first world-class demonstration plant capable of producing crystalline nanocellulose.
Properties of crystalline nanocellulose

Thanks to its many different properties and forms, crystalline nanocellulose can be used for a variety of purposes. For example, one of its most spectacular features is its ability to create flexible, iridescent film that is easy to handle, in colours that can be adjusted very precisely. As a result, it has revolutionized a number of applications, including safety papers, packaging, plastics, cladding, cosmetics and many others.

Crystalline nanocellulose also helps to improve resistance and strength, and reduce damage from wear and tear, humidity and ultraviolet rays. It can therefore be used as an additive in paints, in the production of new and improved construction products, and in components for the transportation industry.

A pilot plant for the production of composite materials – Tembec (Témiscaming)

In April 2011, Tembec announced that it would be building a pilot plant to produce a composite material. The project uses an innovative process patented by Tembec, and the material itself is made from commercial pulp, lignosulfonates and modified phenolic resin from Tembec's Témiscaming plant.

The pilot plant cost is $8.4 million. The Québec and Canadian governments will each contribute $3.45 million. The project has created approximately 20 jobs during the construction phase and five other permanent jobs at the operational phase.
Tembec’s composite material has excellent strength-to-weight and durability characteristics when exposed to extreme temperatures and humidity. In addition, it is highly resistant to wood-eating insects such as termites. The Témiscaming pilot plant will produce railway ties to replace existing wood-based, creosote-treated ties. The composite material could also be used for other applications, especially in ecologically sensitive environments.

Other applications such as automotive components, land and marine transportation infrastructure and electrical energy generation and transmission infrastructures will also be considered in the future.

**A mill to reuse fly ash produced by Kruger’s cogeneration plant in Bromptonville**

The new plant will reuse fly ash produced by the company’s cogeneration plant, which was previously sent to a landfill site. The project is valued at more than $2 million, and the Ministère des Ressources naturelles (now known as the Ministère des Forêts, de la Faune et des Parcs) has granted a subsidy of $832,000. Potential applications include cement substitute products, farm compost and the production of activated biocarbon.

**OUTLETS IN A NEW ECONOMY**

Bio-refining therefore appears to offer considerable promise. Québec’s pulp and paper industry is ideally positioned to take advantage of developments in the new bio-economy, and the Ministère des Forêts, de la Faune et des Parcs is currently working with several promoters on other bio-refining projects in Québec.

For further information on bio-refining, please visit the following website:

[Mrn.gouv.qc.ca/forets/entreprises/entreprises-transformation-strategie-bioraffinage.jsp](mrn.gouv.qc.ca/forets/entreprises/entreprises-transformation-strategie-bioraffinage.jsp)