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A GIANT LEAP FOR MANKIND!

ONE SMALL STEP FOR MAN...
A GIANT LEAP FOR MANKIND!
WHEN PURIFICATION IS SYNONYMOUS WITH INNOVATION

Plants consume CO$_2$ during photosynthesis, and they do not tolerate dust and contaminants well. BBA designed all the equipment used in the project: a pretreatment process to condition the CO$_2$ prior to its capture by the CO$_2$ Solutions technology, and the equipment that dries and compresses the CO$_2$ between capture and delivery to the greenhouse, to avoid the need to decontaminate it a second time. Even better, the compressor operates without oil to preserve the high degree of food grade purity of the CO$_2$ required by the plants.

THE WHOLE IS GREATER THAN THE SUM OF ITS PARTS

The technology used to extract the CO$_2$ from effluent gases involves the addition of enzymes to a carbon-capture solution. The enzymes must be prepared before being injected into the process. Through the use of applied sciences, particularly chemical engineering, BBA designed the equipment at the heart of this technology—a unique concept—to be integrated into CO$_2$ Solutions’ patented technology.

KEEPING AN "INDUSTRIAL LUNG" ALIVE

This project, which creates a kind of "industrial lung", is based on technology developed through 20 years of research, using carbonic anhydrase, an enzyme usually found in the human living respiratory tract. BBA’s challenge was to design equipment that has operating conditions that allow these enzymes to perform. By combining an enzymatic component with a chemical process, the team has clearly pushed back the limits of engineering.
Foreseeing that the client's needs would increase with time, BBA proposed designing double-capacity facilities. These would operate solely during the day and additional storage tanks would be installed later, in accordance with the client’s needs. From a financial point of view, this concept was ideal, but it presented a significant challenge in operational terms: how to handle the daily startup and shutdown of the equipment.

To overcome this challenge, BBA developed a smart monitoring device that interacts bidirectionally between the carbon-capture plant and the greenhouses, thereby combining two very different scientific fields. The facility was designed to start up and shut down each day without the presence of an onsite operator—a solution that was perfected through trials and the development procedures conducted beforehand in a CO$_2$ Solutions pilot plant.

SEEING THE OPPORTUNITY IN EVERY DIFFICULTY

On one side: a pulp and paper plant that continuously produces greenhouse gases (GHGs) and CO$_2$. On the other: living plants that follow their natural growth curve, awakening in the morning and gradually increasing their CO$_2$ consumption before reducing it at sundown. The challenge: combining these two realities in an optimal manner.

The initial concept called for a carbon-capture facility with a nominal capacity of 15 tonnes per day. Because the CO$_2$ was only to be used by day, nighttime production was collected in storage tanks.
INSPIRED BY NATURE, GUIDED BY OUR CONVICTIONS

The notions of economic growth and environmental protection have long been considered antagonistic, but things are changing. The objective of today’s industrial players is to develop projects that are both economically and ecologically viable.

This project opens up many possibilities by demonstrating the viability of CO₂ capture and conversion. It reconciles the shared interests of two different industries, agri-food and pulp & paper, and opens the way to a sustainable future for present and future generations.

PAVING THE WAY TO ANOTHER DIMENSION

Generally, to derive a useful product from CO₂, the oxygen in the molecule must be replaced with hydrogen to create hydrogenated carbon chains (an expensive chemical process). However, in the facilities at Saint-Félicien, this process is carried out naturally by plants through photosynthesis. This means it is now possible to give new life to our GHG emissions, transforming them into valuable material, just as in nature. This project paves the way to a circular economy by creating wealth differently while respecting our planet.

STIMULATING THE QUÉBEC ECONOMY

This project, for the most part completed by workers in the region—from manufacturing purification columns to construction—testifies to entrepreneurial dynamism.

Through uninterrupted year-round production, Les Serres Toundra plans to create over 400 sustainable jobs, thereby reversing a falling regional demographic trend. The country will, as a result, increase production of homegrown produce and reduce vegetable imports.

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ENVIRONMENTAL BENEFITS

IMPROVING FOOD PRODUCTION BY RECYCLING WASTE

This project provides an opportunity for RFP to reduce its emissions and for Les Serres Toundra to stop burning methane to produce CO₂. The facilities can capture 30 tonnes per day (5,500 tonnes annually), equivalent to the emissions that 1,750 cars would produce if they each travelled once around the earth (i.e., 21 million kilometres¹).

The idea of recycling our air emissions to grow vegetables opens the door to other projects aimed at reducing our environmental footprint. On top of this comes a reduction in the environmental impact of transporting food, with Les Serres Toundra eventually producing a sufficient quantity of cucumbers to meet the province consumption, bringing the producer ever closer to the consumer.

PRODUCE MORE, CONSUME LESS.

Since the RFP plant was already eco-efficient and integrated in terms of energy, it was important to take existing infrastructure into account and prevent the installation of this new carbon capture project from increasing the company’s overall energy consumption.

BBA therefore designed a highly energy-efficient heating system that makes use of energy coming from an intermittent flow of wastewater. RFP, Les Serres Toundra and CO₂ Solutions are now completely integrated, in energy terms, thus minimizing their overall consumption of both water and energy.

¹ https://www.epa.gov/greenvehicles/greenhouse-gas-emissions-typical-passenger-vehicle
At the end of the project, CO₂ Solutions President Evan Price declared: “This first commercial carbon-capture unit in Québec is truly a major step forward for our company and for our partners: Resolute Forest Products and Les Serres Toundra. Because the same technology can be applied to all the world’s sources of combustion gas, this is an achievement that will prove very helpful in the greatest challenge of our time: reducing GHGs.”

In summary, to paraphrase the words of Neil Armstrong: This project may be one small step for humans, but it is surely a giant leap for mankind!
BROADER THINKING. ON-POINT ENGINEERING.

**BBA** has been providing a wide range of consulting engineering services for nearly 40 years. Today, its engineering, environmental and commissioning experts team up to quickly and accurately pinpoint the needs of industrial and institutional clients. The firm’s expertise is recognized in the fields of energy, mining and metals, biofuels and oil and gas. With 12 offices across Canada to provide clients with local support and field presence, BBA is recognized for providing some of the industry’s most innovative, sustainable and reliable solutions.

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