

The Algal Carbon Conversion Project (The Algae Project)

At Canadian Natural Resources Limited (Canadian Natural), we believe in innovative partnerships that leverage technology to reduce our environmental footprint. The Algal Carbon Conversion Project is an excellent example. We have partnered with the National Research Council of Canada (NRC) and Pond Biofuels Inc. to turn algae and carbon dioxide (CO₂) emissions into fuel that could be used for jet planes. At Canadian Natural, we call this “the Algae Project”. Technologies will be leveraged in innovative ways that will not only reduce CO₂ emissions but also create value added products while delivering significant environmental benefits.

John Parr, Vice President of Thermal Projects at Canadian Natural, says the concept is simple. “We will put carbon dioxide (CO₂) and waste heat from our oil sands facilities into large tanks with algae and treated waste water and create photosynthesis with LED lights. We will then press the algae to release the bio-oil that can be used for jet plane fuel or blended into our heavy oil or synthetic crude oil (SCO). The leftover biomass can then be used to feed livestock and for land reclamation.”

Each tonne of algae can reduce CO₂ emissions by 1.8 tonnes and will yield 0.3 tonne of

biofuel and 0.7 tonne of biomass products that can be used as fertilizer, livestock feed and as an input into other premium products. The process will also release 1.3 tonnes of oxygen to the atmosphere.

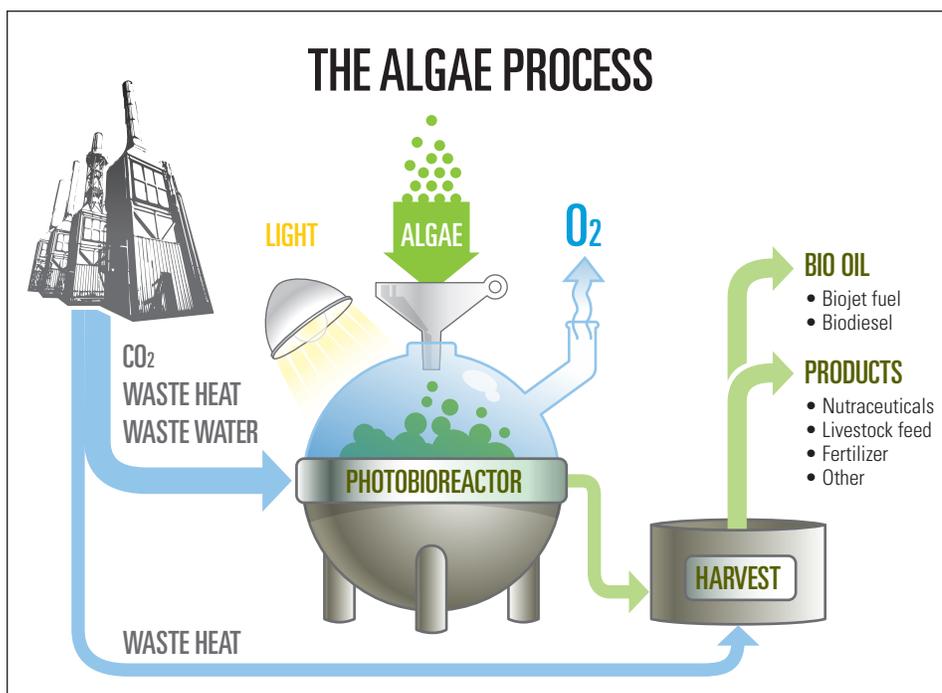
The goal of the Algae Project is to construct a pilot-scale bio-refinery. The partners will then operate the facility to determine optimized parameters for emissions reductions as well as the best path forward to full scale commercialization.

The demonstration facility will be built at Canadian Natural's Primrose South (Primrose)

operations and we expect to begin operations by the end of 2013. The project partners are investing approximately \$19 million over three years to pilot a commercially viable and environmentally sustainable solution to convert CO₂ emissions and other source pollutants such as nitrogen dioxide (NO₂) and sulfur dioxide (SO₂) into biofuel. Based on the results of the Algae Project, commercial facilities will be built at Canadian Natural's Horizon Oil Sands Operation (Horizon) as well as at Primrose.

Joy Romero, Vice President of Technology Development at Canadian Natural, says, “The best way to reduce greenhouse gas emissions is to develop and apply commercially viable technology. This is what the Algae Project is all about; we’re turning waste carbon and heat into valuable biofuel. If we can scale this technology, the potential for real emission reductions is substantial. The Algae Project has the potential to reduce emissions by 15% at Horizon. At our Primrose operations, we could reduce emissions by 30% or more. Overall, we expect to reduce over 1.5MM tonnes of CO₂ equivalent emissions which is comparable to removing the emissions of up to 300,000 vehicles off the road.”

The results from this pilot will be shared with the other oil sands producers through COSIA, Canada's Oil Sands Innovation Alliance. Sharing this innovation with industry will help accelerate the pace of environmental performance improvement in the oil sands.





MEDIA SHEET

Canadian Natural's investments in technology and innovation Commitment to environmental excellence

Advancing innovation

The people of Canadian Natural continue their research into technologies that offer improved environmental performance in our operations. In 2011, we invested more than \$300 million in research and development to minimize our environmental footprint, increase resource recovery and lower costs. We also share what we learn.

Many of Canadian Natural's investments are in projects where the technology and innovation will be shared with Canada's Oil Sands Innovation Alliance (COSIA) in keeping with their mandate to accelerate the pace of environmental performance improvements in the oil sands.

To date, COSIA's 14 members have shared 450 technologies which represent \$700 million in execution costs. Canadian Natural is participating in all four environmental priority areas: water, tailings, greenhouse gas reduction and land management. We are leading seven projects including the Algae Project, tailings management technologies, and the CO₂ sequestration and water treatment projects highlighted below.

- **CO₂ treatment of tailings pond – a Carbon Capture Sequestration (CCS) project**

By adding purchased waste CO₂ into our tailings lines, Canadian Natural is sequestering CO₂, reducing the footprint of Horizon's tailings pond, and reducing the amount of fresh water required for bitumen processing. The CO₂ creates a chemical reaction that allows the solids in the tailings pond to settle more quickly and release clear, warm water for recycling. Canadian Natural will have a CO₂ capture facility from our upgrader's hydrogen plant that will be operational by 2017.

- **Water Treatment Pilot reduces use of fresh water**

The foundation of our water management strategy is to minimize our impact on water resources by reducing fresh water use, increasing water recycling, and where possible, using brackish (saline) water. Canadian Natural was the first in the industry to complete a basal water treatment facility through the Water Treatment Pilot Project. We took water that is both high in salinity (dissolved salt content) and hardness and explored treatment technologies. The pilot project generated data to identify options for a desalination water treatment facility at Horizon. Canadian Natural has also advanced industry knowledge for the cost effective treatment of tailings water. In the long run, this will help us to reduce fresh water use.

Applying technologies throughout Canadian Natural

In order to meet the world's energy needs responsibly we continue to find innovative ways to limit the impact on the environment. Our goal at Canadian Natural is to unleash our best minds to advance the research and application of technologies across our entire operation to protect wildlife, reduce CO₂ emissions and improve resource recovery. Some of that innovation includes:

- A state-of-the art bird deterrent system at Horizon – we were the first oil sands operator to implement radar-controlled Long Range Acoustic Devices to keep waterfowl away from the tailings pond. The system is 97.5% effective in responding to waterfowl approaching tailings ponds.
- Heat integration at our Horizon and Primrose operations – we use cogeneration, which is the simultaneous production of electricity and heat energy from a single fuel source, as an efficient way to meet steam and electricity demands. By recycling the waste heat for re-use, we help reduce greenhouse gas emissions because our energy consumption is lower than it would be if we produced electricity and heat energy separately.
- A leading edge polymer flood in our Pelican Lake operations, the largest in North America – we have pioneered polymer flooding to increase resource recovery of our oil reservoir by up to 25%. The process involves using a non-toxic thickener that is dissolved in water to increase its viscosity. The polymer solution is injected into the reservoir to displace crude oil and increase recovery.

Canadian Natural is a senior oil and natural gas production company, with continuing operations in its core areas located in Western Canada, the U.K. portion of the North Sea and Offshore Africa.
www.cnrl.com



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