



Background on clean technology projects

**Climate Change and
Emissions Management
(CCEMC) Corporation**

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ccec.ca

Climate Change and Emissions Management (CCEMC) Corporation announces \$46 million in funding for Carbon Capture and Storage and Cleaner Energy Projects

Projects valued at more than \$327 million

The Climate Change and Emissions Management (CCEMC) Corporation announced plans to fund six carbon capture and storage and greening energy projects on July 12. The following project summaries include descriptive information provided by project proponents as well as media contact information.

The CCEMC applies a standard methodology to estimate emissions reductions and as a result, CCEMC estimates may differ from those of project proponents. Where possible, the CCEMC identifies the estimated GHG emissions reductions over 10 years. In some cases, a project's potential emissions reductions will be recognized after technology is commercialized.



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Proponent: Cenovus Energy Inc.

Project: Chemical Looping Steam Generator – 10 MW Pilot

Location: Christina Lake, an oil sands property operated by Cenovus and jointly owned
with ConocoPhillips

CCEMC funding: \$10 million

Total project value: \$62 million

Estimated GHG emissions reductions over 10 years: 53,000 tonnes.

If the pilot is successful, Cenovus anticipates this technology could be further deployed in Alberta and result in significant emission reductions (approximately one megatonne of CO₂ equivalent over 10 years).

Cenovus is a Canadian oil company. It is committed to applying fresh, progressive thinking to safely and responsibly unlock energy resources the world needs. Operations include oil sands projects in northern Alberta, which use specialized methods to drill and pump the oil to the surface, and established natural gas and oil production in Alberta and Saskatchewan. The company also has 50 per cent ownership in two U.S. refineries.

The Chemical Looping Steam Generator – 10 MW Pilot is the world's first and largest field pilot that will use chemical looping combustion technology to generate steam in the oil sands. Cenovus uses steam to heat and soften the oil underground so that it can be pumped to the surface. The new steam generator will be carbon capture ready and lower the cost of capture when compared to a conventional steam generator with post-combustion carbon capture. It will also be more energy efficient and reduce NO_x emissions when compared to a conventional steam generator.

The goal of the project is to prove that chemical looping technology is a commercial option for steam generation in the oil sands. If successful, the technology could provide a lower-cost option for Alberta energy producers to reduce carbon emissions and meet Alberta's carbon reduction strategy.

Note to media:

Cenovus has B-roll of the Christina Lake oil sands facility. It is available for download at:
<http://dl.dropbox.com/u/11993196/Jaime/6430%20Cenovus-320x240%20H264.mov>

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Proponent: Husky Energy

Project: Lashburn CO₂ Capture Demonstration Project

Location: Lashburn, about 35 kilometres east of Lloydminster

CCEMC funding: \$2.955 million

Total project value: \$10 million

Future potential for GHG emissions reductions

If successful, the application of this technology in Alberta could result in significant emission reductions (1 Megatonnes) by 2021.

Husky Energy is one of Canada's largest integrated energy companies. It is headquartered in Calgary, Alberta, Canada and is publicly traded on the Toronto Stock Exchange under the symbol HSE and HSE.PR.A.

Husky Energy employs a combination of technological innovation, sound project management, and prudent investment to deliver responsible resource development. Accordingly, the Company is studying the development of a CCEMC supported demonstration CO₂ emissions reduction project called the Lashburn CO₂ Capture Demonstration Project. The advancement of the project is contingent on securing additional funding participants, as well as final company and regulatory approvals.

The project has the potential to reduce greenhouse gas emissions by capturing carbon dioxide produced from a steam assisted gravity drainage facility and storing it at a nearby oil production field. By integrating new process equipment with existing infrastructure, the aim of the project is to capture approximately 35 tonnes of CO₂ a day from a steam generator, transport it by pipeline to an existing compression facility, and inject it into a partially depleted oil reservoir. Project success may provide an opportunity for use in larger applications in Alberta.

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Proponent: Imperial Oil

Project: Cyclic Solvent Process pilot

Location: Cold Lake, Alberta, with potential for future application in other oil sands project locations

CCEMC Funding: \$10 million

Total project value: \$100 million

Future potential for GHG emissions reductions

Imperial is anticipating that the emission reductions from commercialization of this technology could result in 1.2 megatonnes per year over the period of 2022 to 2031.

Imperial Oil is one of Canada's largest corporations and a leading member of the country's petroleum industry. The company is a major producer of crude oil and natural gas, Canada's largest petroleum refiner, a key petrochemical producer and a leading marketer with coast-to-coast supply and retail service station networks.

Imperial Oil continues to progress development of Cyclic Solvent Process (CSP) technology. CSP is an in-situ recovery process that injects an organic solvent instead of steam to recover bitumen. By eliminating steam generation, the need for a water source is eliminated and greenhouse gas (GHG) generation is significantly reduced. Also, the environmental impact at the surface is minimized by using horizontal wells. Imperial has committed \$100 million for a three-well demonstration pilot, currently under construction at Cold Lake and expects start-up in late 2013.

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Proponent: Inventys Thermal Technologies Inc.

Project: VeloxoTherm™ CO2 Capture Project at Joffre

Location: Nova Chemicals Corporation's Joffre Petrochemical Plant, Joffre, Alberta

CCEMC funding: \$3.068 million

Total project value: \$6.136 million

Future potential for GHG emissions reductions

Inventys estimates the emission reduction from the application of this technology associated with CCS could result in the capture and storage of 1 megatonnes of CO₂e over the next ten years. Estimates have assumed a capture rate of 90 per cent and that there is an energy and corresponding emissions requirement attributed to the distribution and compression of CO₂ prior to storage.

Inventys is commercializing the lowest cost and most energy efficient technology for capturing post-combustion CO₂ from industrial flue gas streams. Our proprietary VeloxoTherm™ process uniquely enables CO₂ capture at a cost that unlocks enormous and lucrative opportunities including CO₂ Enhanced Oil Recovery (EOR) and Carbon Capture and Storage (CCS). Our goal is to rapidly create enterprise value by securing a considerable share of the CO₂ EOR value chain and ultimately providing a key solution for significantly reducing GHG emissions. Inventys is currently working on several pilot plant demonstration projects and partnering with some of the world's largest energy and manufacturing companies to rapidly deploy the technology. Inventys is a Canadian controlled private corporation based in Burnaby, British Columbia that has received equity investment from prominent venture capital and an international strategic investor.

Inventys is proposing to design, manufacture, and install a VeloxoTherm™ CO₂ capture pilot plant at Nova Chemicals Corporation's petrochemical plant in Joffre, Alberta. The plant will capture CO₂ that is currently being emitted to the atmosphere from the combustion of natural gas in a steam boiler and potentially transporting and utilizing the CO₂ in Penn West Petroleum's Joffre EOR CO₂ flood. CO₂ produced from the combustion of natural gas is challenging to capture for conventional processes due to the low concentration of CO₂ in the flue gas. The VeloxoTherm™ process uses novel continuous rotary adsorption technology that is more capital and energy efficient than conventional CO₂ capture techniques. The VeloxoTherm™ process could provide a cost effective solution for CO₂ capture from a wide variety of sources including coal power plants, natural gas power plants, and steam generators used for steam assisted gravity drainage (SAGD) projects in the oil sands.

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Proponent: MEG Energy Corp.

Project: Heavy Crude Quality Improvement

Location: Alberta Industrial Heartland region

CCEMC funding: \$10 million

Total project value: \$100 million

Future potential for GHG emissions reductions

Should this project be successful, the emission reduction from the application of this technology could result in the capture and storage of 1 megatonne of CO₂e over the next ten years.

MEG Energy Corp. is a Canadian oil sands company focused on sustainable in situ development and production in the southern Athabasca oil sands region of Alberta. Since its launch in 1999, MEG has assembled a large, high quality resource base and established itself as one of the most efficient operators in the oil sands industry. MEG is publicly traded on the Toronto Stock Exchange.

MEG is developing an innovative process to efficiently convert bitumen into a crude oil suitable for transport by pipeline without the requirement for diluent. A unique combination of mild-intensity processes is applied to the bitumen, resulting in high yields and a reduction in greenhouse gas emissions associated with conventional upgrading. By eliminating the need for light hydrocarbon diluents, the process also effectively increases the product volume that can be transported through existing pipeline infrastructure.

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Proponent: N-Solv Corporation

Project: N-Solv BEST Pilot Plant at Suncor Dover

Location: Suncor Dover Facility, Fort McMurray, Alberta

CCEMC funding: \$10 million

Total project value: \$49 million

Estimated GHG emissions reductions over 10 years: 130,390 CO₂e.

Once the technology has been proven at the pilot stage, an additional 70,000 tonnes by 2021 is estimated to result from adoption of the technology in Alberta.

N-Solv Corporation is a privately-owned Canadian corporation founded in 2003. It is owned by Hatch Ltd., Enbridge Inc., and Nenniger Inc., and is headquartered in Calgary, Alberta. N-Solv was founded with the objective of developing and commercializing an in-situ gravity drainage process that utilizes warm solvent vapor as its working fluid. N-Solv holds a significant intellectual property portfolio of patents, both granted and pending and know-how related to the technology; the portfolio is accessible to clients via licensing.

The BEST (Bitumen Extraction Solvent Technology) Pilot Plant will demonstrate N-Solv technology at field scale and is the collaboration of N-Solv Corporation and Suncor Energy, with support from Sustainable Development Technology Canada (SDTC). Suncor's Dover lease in the Athabasca is the host site for the 500 barrel-per-day facility, comprising a 300-m horizontal wellpair and a surface plant for processing produced hydrocarbons. The N-Solv process uses the proven horizontal well technology developed for the steam-assisted gravity drainage (SAGD) process, but differs significantly in that it does not use any water. Instead, N-Solv uses warm propane or butane, which is injected as a vapor, and condenses underground, washing the valuable compounds out of the bitumen. The science of the N-Solv process has been validated at the laboratory scale and now requires field piloting in order to demonstrate commercial readiness. The process is expected to produce a lighter, partially upgraded, and hence, more valuable, oil product and may recover more resource from each well at lower capital and operating costs than existing in-situ processes.

The GHG benefits associated with the technology are derived from two sources: extraction emissions (those associated with liberating oil from the ground) and from a significant reduction in downstream upgrading requirements (and consequently, energy consumption). Once demonstrated at field scale, N-Solv has the potential to deliver GHG reductions while contributing \$35 billion of incremental value to the Alberta economy. Also, the process uses no water, lessening the oil sands' demand on this scarce resource and adding greater flexibility to plant siting. Construction of the BEST pilot began in early May 2012 and is scheduled for completion by December 2012; solvent injection and first oil production is expected for the second quarter of 2013.

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