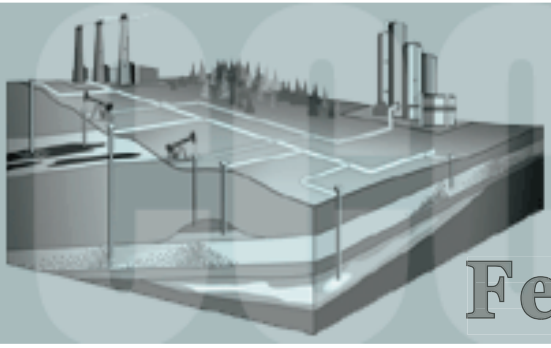

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facilitation . outreach . workshops . project support . technology advancement

February 2007, Newsletter

CANADIAN CO_2 CAPTURE & STORAGE TECHNOLOGY NETWORK

Canada Launches ecoEnergy Technology Initiative

OTTAWA — The Honourable Gary Lunn, Minister of Natural Resources, and the Honourable John Baird, Minister of the Environment, announced the ecoEnergy Technology Initiative—a $230-million investment in the research, development and demonstration of clean-energy technologies.

“Canada is an emerging energy superpower,” said Minister Lunn. “But our real challenge is to be a clean-energy superpower. To do this, we must address the fact that the greatest source of untapped energy is the energy we waste. We must also increase our use of renewable energy and develop the science and technology to make conventional energy cleaner.”

“As part of our environmental agenda, Canada’s New Government is introducing this important initiative to protect Canadians’ top priority—the environment—while building a competitive and sustainable economy,” said Minister Baird.

While Canada’s Clean Air Act forms the backbone of the government’s environmental plan, the ecoEnergy Technology Initiative will foster the next generation of clean technologies to break through to emissions-free energy production and energy use.

The $230-million ecoEnergy Technology Initiative will accelerate the development and market-readiness of technology solutions in clean energy.

It will ensure that Canadians and future generations have clean air, water, land and energy. This is real change for real results.

“Canada’s New Government encourages industry and the provinces to further invest in science and technology to deliver real results for the production of clean energy,” said Minister Lunn.

The new Initiative is a focused, integrated approach built

UPCOMING EVENTS

March 12 - 13, 2007
IEA GHG Wellbore Integrity Network Meeting

March 25 - 28, 2007
Meeting of CSLF Policy and Technical Groups

April 17 - 20, 2007
London Convention, 2nd meeting,Intersessional Technical Working Group on CO2 Sequestration in Sub-seabed Geological Formations

April 17-20, 2007
IEA EXCOM meeting, Amsterdam

April 19 - 20, 2007
GW18: Earth Summit for Global Warming Mitigation

May 2 - 4, 2007
CARBON EXPO 2007

May 7 - 18 2007
United Nations Climate Change Convention, 1st sessional period

May 7-10, 2007
World of Coal Ash 2007

May 7 - 10, 2007
NETL Sixth Annual Conference on Carbon Capture & Sequestration

May 15 - 17, 2007
Third International Conference on Clean Coal Technologies

IN THIS ISSUE

on key priorities that include carbon dioxide sequestration, clean coal, clean oil sands production and renewable energy. Priorities will be further developed with provinces and industry partners through consultations.

The following media backgrounders are available at www.nrcan.gc.ca/media:

The CANMET Energy Technology Centre (CETC) Ottawa (Bells Corners), Ontario

Clean-Energy Science and Technology (S&T)
The Government commitment to energy science and technology

Or, visit the EcoEnergy Website at:
http://www.eco-energy.gc.ca/

Carbon Sequestration & B.C.'s Speech from the Throne

The Honourable Iona Campagnolo, Lieutenant Governor, at the Opening of the Third Session, Thirty-Eighth Parliament of the Province of British Columbia,
February 13, 2007

Exerpt referencing CO_2 Capture & Storage:

" . . . Your government's comprehensive climate change and energy strategies will rest on a number of defining principles.

The new energy plan will require British Columbia to be electricity self-sufficient by 2016.

A new personal conservation ethic will form the core of citizen actions in the years ahead. Conservation provides huge benefits at minimal cost.

All new and existing electricity produced in B.C. will be required to have net zero greenhouse gas emissions by 2016.

That target may be unprecedented in North America, but it is achievable and realistic in B.C.

Under the new energy plan, British Columbia will reduce greenhouse gas emissions from the oil and gas industry to 2000 levels by 2016.

That will include a requirement for zero flaring at producing wells and production facilities.

The energy plan will require that at least 90 per cent of our electricity comes from clean, renewable sources.

Effective immediately, British Columbia will become the first jurisdiction in North America, if not the world, to require 100 per cent carbon sequestration for any coal-fired project.

That means no greenhouse gas emissions will be permitted for coal-fired electricity projects anywhere in British Columbia.

Your government will look to all forms of clean, alternative energy in meeting British Columbians' needs in our provincial economy.

Bioenergy, geothermal energy, tidal, run-of-the-river, solar, and wind power are all potential energy sources in a clean, renewable, low-carbon future.

Your government will pursue British Columbia's potential as a net exporter of clean, renewable energy.

A new $25-million Innovative Clean Energy Fund will be established to encourage the commercialization of alternative energy solutions and new solutions for clean remote energy that can solve many challenges we face right here in B.C. . . . "

The entire speech from the throne can be found at:
http://www.leg.bc.ca/38th3rd/4-8-38-3.htm

Interest Develops in a New High Efficiency Alternative Clean Coal Power Generation Technology For CO_2 Capture and Sequestration

The ThermoEnergy Corporation from Hudson, Massachusettes has been working with the Combustion Optimization Group of CANMET to develop the basic design and optimize performance of a new high efficiency cycle called the ThermoEnergy Integrated Power System (TIPS). Recently the CANMET report entitled "Feasibility

Study of the ThermoEnergy Integrated Power System (TIPS) Process" was prepared that determined the basic performance figures for this novel system.

The TIPS process is a new generation power cycle that appears to have many technical and economic advantages over existing clean coal technologies currently identified in both Canada and the USA used for CO_2 capture and sequestration.

The CANMET study identified methods for optimizing the system to take full advantage of its thermodynamic benefits over other cycles. As detailed in the report, TIPS has the following quantifiable advantages over existing clean coal technologies:

- Increased steam cycle efficiency by approximately 8% compared with ambient cycles.
- Increased boiler efficiency by approximately 10 compared with ambient air and oxy-fuel technologies.
- Reduced auxiliary power consumption by approximately 35% of ambient oxy-fuel cycles attributed to product recover train and air pollution control devices.
- TIPS recovers liquid CO_2 at ambient temperatures. This results in a savings of approximately 50 MW_e (for a typical 500 MW_e power station) in the cost of multi-stage compression and refrigeration used within ambient oxy-fuel technologies.
- Improved fuel burnout for a similar residence-time furnace operating at ambient pressure.
- Significant reduction in furnace and heat exchanger sizes.
- The TIPS cycle efficiency is less influenced by high moisture fuels (e.g. lignite, biomass).
- Improved effectiveness of scrubbing for air pollution control.
- Reduced sizing of the scrubber and flue gas condenser compared with ambient pressure technology.
- Improved capital and operating economics over existing carbon capture and sequestration technology.

The foremost technical hurdle to the TIPS technology is that the furnace needs to operate at elevated pressure. The technology to do this has been developed during the pressurized fluid bed combustor (PFBC) initiatives throughout the 1990's. PFBCs have recently fallen out of favor due to problems with the gas turbines. TIPS avoids this problem, because it does not use a gas turbine within the cycle but can take advantage of similar furnace technology previously developed within the PFBC programs. Also, operational pressurized furnaces in the USA, Japan, Spain and Sweden for a number of years.

Figure 1 – Group photograph; (From Left to Right): Ligang Zheng (CANMET), Greg McRae (MIT), Herman De Meyer (Reaction Systems Engineering), Alex Fassbender (ThermoEnergy), Richard Pomalis (CANMET) and Bruce Clements (CANMET).

CANMET identified the TIPS technology as being a strong contender for the next generation of power cycles and began working with ThermoEnergy in 2002, when a basic cycle layout and analysis were done. At that time ThermoEnergy realized that CANMET had developed first-of-a-kind detailed furnace models which were required for development of the TIPS technology. This was the basis for the partnership. These models were used in the design and development of the first ambient oxy-fuel cycles and defined in detail how these systems needed to be configured to operate.

Since the time of this original TIPS cycle work, interest in the USA has grown in attempts to find sustainable and less complex technologies for clean coal power generation. There is also a growing concern in the USA about the limited choices for alternative technological options to integrated gasification combined cycle (IGCC).

Recently in Boston the design team met to review the initial performance figures and determine the next steps in getting this exciting technology deployed. In attendance at the Boston meeting were Alex Fassbender (Thermoenergy Corporation), Herman De Meyer (Reaction Systems Engineering) and Gregory McRae (MIT).

Alex Fassbender from ThermoEnergy (formerly from Pacific

Northwest Laboratories which is a U.S. national laboratory located in Washington state) invited two key international experts in clean coal technology to review the report and participate in the meeting and discussions.

Dr. Herman De Meyer is a process simulation and development expert currently from Reaction Systems Engineering, Berkshire, U.K. He was previously the chief process development engineer from Bayer Chemicals in Belgium.

Dr. Gregory McRae is a chemical engineering professor from MIT in Boston and the current Hoyt C. Hottel professor. He is a leading advisor to the U.S. clean coal program and sits on U.S. Environmental Protection Agency review panels, two National Research Council committees, Member of Advisory Board of the Combustion Research Facility at SANDIA and on the U.S. DOE Science Advisory Board for Advanced Scientific Computing.

The current work done by CANMET was funded by ThermoEnergy through a U.S. DOE grant through NETL. ThermoEnergy believes that the CANMET report's findings will present a strong enough case to obtain major funding for major future development.

ThermoEnergy hopes to design and build a small demonstration plant within the next three years.

For More Details Contact:
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Bruce Clements, CANMET-Ottawa, Clean Electric Power Generation, Combustion Optimization Group, Ottawa, Ontario, (613) 943-8881

Zama Acid Gas Project Plains CO2 Reduction (PCOR) Partnership

For nearly 40 years, carbon dioxide (CO_2) has been successfully injected into underground oil formations to improve oil production. This standard oil field practice is called CO_2 flooding or CO_2 enhanced oil recovery (EOR). The injection of CO2 into geological formations, such as oil fields, may also be a means of reducing greenhouse gas emissions into the atmosphere. Through the Plains CO_2 Reduction (PCOR) Partnership, the Energy & Environmental Research Center (EERC) is partnering with Apache Canada Ltd. to simultaneously demonstrate the use of acid gas for oil field flooding and the use of underground pinnacle reef structures for the long-term storage of the CO_2-rich acid gas. Additional, key project participants include Natural Resources Canada, the Alberta Department of Energy, the Alberta Energy and Utilities Board, and Alberta Geological Survey.

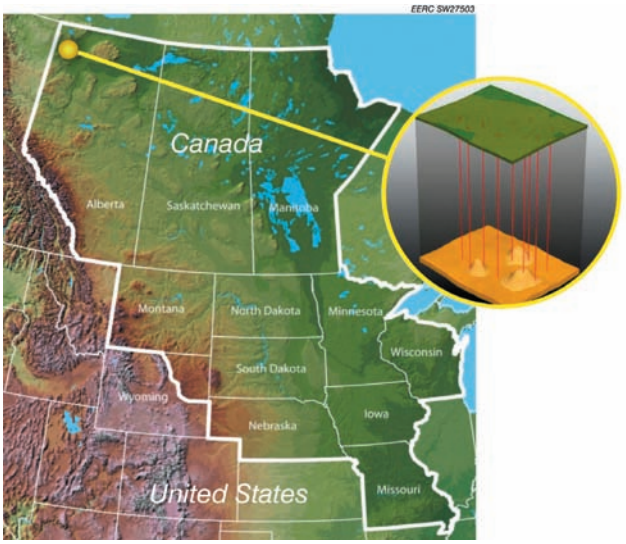

Figure 1. Map showing the PCOR Partnership region and the location of the Zama acid gas project where acid gas from natural gas processing plants in northern Alberta, Canada, will be injected into an oil-producing zone in an underground pinnacle reef structure.

The Zama Field Demonstration (Figure 1) is one of four PCOR Partnership CO_2 sequestration validation projects and is one of several projects being conducted under Phase II of the overall U.S. Department of Energy National Energy Technology Laboratory's Regional Carbon Sequestration Partnership Program.

Background

Atmospheric concentrations of CO_2, a greenhouse gas, have been increasing for the last 100 years. Controlling CO2 from human activities is an important means of addressing global climate change.

Both CO_2 and hydrogen sulfide (H_2S) are coproduced with solution gas and nonassociated natural gas from pinnacle reef structures of the Zama field operated by Apache Canada Ltd. in northwestern Alberta, Canada. Treating this natural gas for downstream marketing results in the production of an "acid gas" by-product stream largely composed of CO_2 and H_2S. In the past, a portion of this acid gas, not disposed of in underground formations, was processed to convert the H_2S to elemental sulfur. The CO_2 from this portion of the acid gas was then vented to the atmosphere. The Zama field demonstration will simultaneously 1) improve oil recovery in the Zama field, 2) sequester CO_2, and 3) eliminate the accumulation of elemental sulfur on the surface.

Project Details

Apache Canada Ltd. is providing the acid gas and the injection wells for the demonstration and will be responsible for initial injection, continual recovery and reinjection of acid gas during the demonstration, separation and recovery of the produced hydrocarbons, and monitoring after the demonstration phase.

The EERC will plan and implement the monitoring, mitigation, and verification (MMV) proceedures that will provide a road map for the development of further CO_2 and acid gas injection projects. The geology of the pinnacle reef (Figure 2) is well understood and offers an excellent opportunity to test and refine geologic CO_2 sequestration MMV protocols that can be applied to CO_2 and acid gas sequestration opportunities in the future.

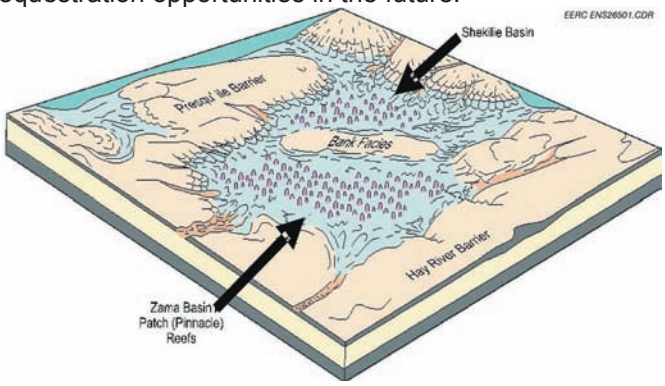

Figure 2. Pinnacle reefs are self-contained underground hydrocarbon reservoirs each similar in size and shape to the Superdome in New Orleans. There are nearly 700 oilfilled pinnacle reef "superdomes" in the Zama area that could be used to store CO2-rich gas.

Project Benefits

The natural gas production and processing operations in the Zama oil and gas field currently release about 37,500 tons of CO_2 to the atmosphere each year (18,000 tons of carbon). If the entire acid gas stream produced at Zama were to be injected, these emissions could be reduced to near zero. In addition, acid gas injection will increase the production of oil from the Zama field and add additional years of productivity from infrastructure that is largely in place.

The injection zone is well monitored to ensure protection of groundwater resources. The current Zama natural gas operation has resulted in significant reduction of the operating costs that were associated with the sulfur plant. Further revenue is generated from the EOR project.

This value-added approach could be used to manage CO_2-rich acid gas streams at many of the more than 1300 gas processing plants in North America as well as others worldwide. A demonstration of this scale will result in a win-win situation for researchers, PCOR partners and, most importantly, the environment.

Figure 3. Apache Canada Ltd. gas injection site in Zama, Alberta, Canada.

For Project Overview, MMV and Commercial Issues:

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Update on the IEA-CSLF Workshops on Near Term Opportunities for Carbon Capture and Storage

Issues and Opportunities Workshop

This event was held in the United States, San Francisco in August 2006. The goal of this workshop was to identify current issues and barriers to the implementation of near term CCS projects as they pertain to the following topics:

- Technical Issues
- Commercial/Financial Issues

- Legal and Regulatory Issues
- Public Education and Outreach Issues
- International Mechanisms

A discussion paper on the findings of the workshop is in the process of being finalized and will be available shortly.

The presentations from the San Francisco Issues and Opportunities Workshop can be viewed at http://www.cslforum.org/aug222006.htm

Assessment Workshop

This event will be held in Norway, June 21 - 22, 2007. The objective will be to continue the dialog started in San Francisco and assess the specific issues and opportunities identified in the first workshop. The assessment will consider the options for embarking on and advancing near-term opportunities and the suite of conditions necessary for deployment of CCS.

Recommendations Workshop

This workshop will be held in Canada in November of 2007. The findings of the previous two workshops will be considered in developing proposed final recommendations for presentation by the IEA and CSLF to the G8 meeting scheduled for Japan in 2008. The workshop will lay out the technical, economic, regulatory and fiscal conditions necessary for near-term deployment of CCS, and provide policy recommendations on how to create these conditions, including further international collaboration needed for effective early deployment.

UN Climate Change Conference Nairobi 2006 (COP 12)

Parties to the UN Climate Change Convention and Kyoto Protocol met November 6-17, 2007 at Nairobi, Kenya. The Canadian delegation consisted of Federal officials from Foreign Affairs, Environment, Natural Resources, Industry and the Canadian International Development Agency (CIDA). Representatives from the Governments of Québec, Alberta, Nunavut as well as First Nations also attended.

Given its potential to significantly reduce global GHG emissions, CCS has within the last few years become an increasingly prominent subject of negotiation within this forum. Leading up to the Nairobi meeting, discussions on CCS within the United Nations Framework Convention on Climate Change (UNFCCC) had been progressing along 2 tracks – first, the Intergovernmental Panel on Climate Change (IPCC) Special Report on CCS and second, CCS as a Clean Development Mechanism (CDM) project activity.

IPCC Special Report:

After difficult negotiations in Montreal at COP 11 in 2005, discussion on the IPCC special report wrapped up in Nairobi, much to the satisfaction of Canada and other like minded countries. In Montreal, countries formally noted that the report provides a comprehensive assessment of the scientific, technical, environmental, economic and social aspects of CCS and acknowledged that CCS is one of many options to reduce global greenhouse gas emissions. At the spring 2006 negotiating session in Bonn, a workshop was organized to inform country negotiators who otherwise would have had little exposure to the report's findings. NRCan experts Dr. Carloyn Preston and Bill Reynen presented and participated actively in the subsequent discussions. Their valuable contribution was acknowledged by the UNFCCC secretariat, who asked them to provide technical advice to the secretariat at another CCS-related workshop 2 days later regarding the CDM. The IPCC also presented their 2006 Guidelines for National GHG Emissions Inventories, which includes, for the first time, methodologies for CCS related emission reductions.

Before concluding deliberations in Nairobi, some countries unsuccessfully sought to re-open negotiations to bring forward discussion of the 2006 IPCC Greenhouse Gas Inventory Guidelines ahead of negotiations planned for later in 2007. It was agreed that inventory discussions at the Bonn spring 2007 session would be within the context of the 2006 Guidelines overall, not just the CCS portion.

Clean Development Mechanism (CDM):

Unfortunately, negotiations on CCS as a CDM project activity did not conclude in Nairobi. The CDM is a market based mechanism under the Protocol which gives developed countries with targets the flexibility to seek out the least cost emission reductions by purchasing credits from emission reduction projects in developing countries. This helps them to enhance their sustainable development while reducing overall global emissions.

The top four CDM host countries [Brazil, China, India and Mexico] account for 70% of all projects and 74% of the estimated CDM average annual emission reductions over

the 2008-2012 Kyoto commitment period (source: http://cdm.unfccc.int/Statistics). Thus, these countries wield significant market clout.

Due to the potentially substantial storage capacity of CCS, some countries view CCS as a threat to the demand, hence price, for international credits as developed country buyers pursue domestic CCS on a large scale. In addition, some developing countries fear competition from other developing countries with suitable geology coupled with economically attractive opportunities for enhanced oil/gas/coal bed methane recovery. These countries would then become dominant emission reduction credit suppliers and may have the potential to squeeze out other CDM project types and host countries. Some countries are also of the opinion that CCS does not meet the socio-economic objectives of CDM.

Since the CDM Executive Board could not reach a consensus on how to account for CCS activities last year, the decision was put to country negotiators in Nairobi under the Kyoto Protocol, which excludes the United States and Australia. Despite best efforts to conclude discussions, the final decision has been postponed until the end of 2008.

In the interim, the Nairobi decision calls for submissions first from international organizations (due May 31, 2007), on the following issues:

- Long-term physical leakage (seepage) levels of risks and uncertainty;
- Project boundary issues (such as reservoirs in international waters, several projects using one reservoir) and projects involving more than one country (projects that cross national boundaries);
- Long-term responsibility for monitoring the reservoir and any remediation measures that may be necessary after the end of the crediting period;
- Long-term liability for storage sites;
- Accounting options for any long-term seepage from reservoirs;
- Criteria and steps for the selection of suitable storage sites with respect to the potential for release of greenhouse gases;
- Potential leakage paths and site characteristics and monitoring methodologies for physical leakage (seepage) from the storage site and related infrastructure for example, transportation;
- Operation of reservoirs (for example, well-sealing and abandonment procedures), dynamics of carbon dioxide distribution within the reservoir and remediation issues; and
- Any other relevant matters, including environmental impacts.

Parties are to then take these submissions into consideration and provide their own views to the UNFCCC secretariat by September 21, 2007. Toward the end of 2007, countries will formulate recommendations with a view to taking a decision at the following session a year later.

This decision could postpone the use of the carbon market as a financial incentive for CCS in developing countries as project developers will not have certainty about the viability of emission reduction credits until the end of 2008, after which they may only have four years of credits to sell. It also remains uncertain whether credits will be retroactively granted for 2008.

Next Steps:

NRCan will work with its colleagues and stakeholders to formulate the Canadian submission due in September. Canada will also leverage synergies within its bilateral and multilateral relations as well as other international fora, such as the Carbon Sequestration Leadership Forum (CSLF), International Energy Agency (IEA) and both the G8 Leaders Summit and Gleneagles Dialogue on Climate Change, Clean Energy and Sustainable Development. These processes can help to ensure alignment with the UNFCCC, influence those who wish to see CCS excluded under the CDM and facilitate a consistent, coordinated international response to the climate change challenge that views CCS as an option within a broad portfolio of emission reduction opportunities.

Further information:
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International Environment Policy Division, Natural Resources Canada

Saskpower's Clean Coal Project Update

http://www.saskpower.com/cleancoal/

Initial site for potential clean coal unit announced

SaskPower will focus further engineering efforts for its Clean Coal Project on expansion of the Shand Power Station near Estevan. Should the project proceed, Shand will be the location for the first clean coal unit.

As part of its Clean Coal Project, SaskPower was exploring two regions for development of potential clean coal units - the Estevan area and the Coronach/Willow Bunch area.

"The decision to base future engineering work on the Shand site was made after thorough assessment of both potential locations," SaskPower President and CEO Pat Youzwa said. "The site for a potential clean coal unit needs to meet a number of equally important criteria."

When the impacts of local coal characteristics, mining costs, carbon dioxide (CO2) transportation, transmission system interconnection, cooling water, and provision for existing coal supply agreements are considered, initial deployment at the Shand site presents a number of advantages - which include both capital and lifecycle cost savings - over initiating the technology at the Poplar River site near Coronach.

Plans to proceed at the Shand site are pending successful negotiations with key stakeholders in the Estevan area. The Poplar River Power Station near Coronach will be reconsidered if problems occur with development of the Estevan site.

"SaskPower recognizes that host communities play an important role in ensuring successful operation of all our facilities," Youzwa added. "We remain committed to ensuring the viability of the Poplar River Power Station near Coronach.

In 2005-06, SaskPower invested $130 million to rebuild Poplar River Power Station Unit 2. SaskPower also plans to rebuild Unit 1 in the coming years.

If successful, the advanced clean coal unit will be the first of its kind in a utility scale application in the world. A decision on whether to proceed with the project will be made in mid-2007, with an in service date of 2011.

For more information, contact:
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(888) 536-0000 (Toll-free)

For up-to-date news on CCS please visit The Frontpage of our website

Canada's CO_2 Capture & Storage Technology Roadmap is on-line at:
www.co2trm.gc.ca

If you have an article, project updates, photos, etc., you would like featured in our next Newsletter please email it to:
Donna Baskin
dbaskin@nrcan.gc.ca

We hope to publish bi-monthly.

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