

carbon capture journal

CO2 injection
begins at Ketzin
- first onshore
storage in
Europe

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Issue 4



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How to win the PR war on CCS

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How ready is 'capture ready'?

The HTC Solution to carbon emissions

Surface Deformation Monitoring for CCS

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Front cover:
Opening the valves to start CO2 injection at Ketzin.
(from left: Prof. Dr. Dr. h.c. Reinhardt



Hüttl (GFZ-Executive Board), Bernd Lück (mayor of Ketzin), Dr. Klaus Freytag (President of the state institute for mining, geosciences and Natural Resources of the state of Brandenburg), Michael Richter (State Secretary in the ministry of economics of the State of Brandenburg, in the background) and Dr. Wolfgang Heidug (General Manager CO2 Policy, Shell International und founder of the project CO2SINK). See pg. 25 (Photo: ©GFZ)

Leaders

Global CO2 Summit - IEA calls for CCS push in India and China

The IEA's Chief Economist talked about the forthcoming World Energy Outlook and the 'new world energy order' at the Global CO2 Summit in London, 12-13 June **2**

SaskPower seeks partners for CCS project

Saskatchewan Power Corporation intends in July to issue a request for proposals soliciting partners for its lignite-fuelled Boundary Dam integrated carbon capture and sequestration (ICCS) project **4**

The HTC Solution to carbon emissions

Canadian company HTC Pureenergy has developed a complete modular carbon management system that enables CO2 to be captured, stored and transported **5**

Projects and policy

How to win the PR war on CCS

Supporters of carbon capture and storage need to adopt American-style campaigning tactics to end the current stalemate over funding, says Geoff Beattie, Managing Director of Cohn & Wolfe Global Consultancy **8**

How ready is 'capture ready'?

Building new unabated fossil-fuelled power plants creates a risk of carbon lock-in, unless the plants can be guaranteed to be complemented with carbon capture and storage systems as soon as the technology becomes available, says Nils Markusson, Research Associate, School of Geosciences, Edinburgh University **10**

New interactive database of CCS sites around the world

The Scottish Centre for Carbon Storage has developed a free interactive resource for researchers, industry and all interested in CCS which locates proposed CCS sites worldwide and details basic project information **12**

DOE seeks to invest up to \$1.3 billion in restructured FutureGen

The U.S. Department of Energy has released a Funding Opportunity Announcement to solicit public support on the demonstration of multiple commercial-scale IGCC or other clean coal power plants with CCS **13**

UK government announces CCS competition shortlist

BP Alternative Energy International Limited, EON UK Plc, Peel Power Limited and Scottish Power Generation Limited were selected from nine contenders **13**

Separation and capture news

Sargas and Fortum complete CO2 capture test

Scandinavian power group Fortum and Norwegian clean energy company Sargas have published the final result of their work on a experimental pilot project for capturing CO2 from coal power production at the Värtaverket plant in Stockholm **19**

Transport and storage

Surface Deformation Monitoring for CCS MMV Activities

As pilot injections ramp up to a million tons a year or more, we have to start thinking about how we can cost effectively monitor very large projects for the long term, says Glenn R. McColpin, Director of Business Development, Pinnacle Technologies **20**

Germany begins CO2 storage at Ketzin

The GFZ German Research Centre for Geosciences has begun pumping CO2 underground for the first time in Europe as part of an EU project called CO2SINK **25**

Yorkshire bids to reduce UK carbon emissions

A new report led by Yorkshire Forward and some of the UK's largest energy and industrial companies shows how a unique CCS network could be developed for the region **25**

Agency.

On 14 February 2006, Calvert and his industry and resources minister highlighted to Vice President Dick Cheney Saskatchewan's key role as a secure and reliable energy supplier to the United States. They stressed Saskatchewan's estimated 19 billion barrels of heavy oil, and welcomed US investment in new technologies to stimulate recovery of this resource.

Calvert claims that SaskPower today needs far firmer Boundary Dam project funding.

"We mistrust the federal Government's \$240 million commitment for Boundary Dam. We believe this money is tied to unspecified actions Ottawa expects from Saskatchewan," said Calvert.

On April 2, Saskatchewan NDP Critic for the Crown Investments Corporation and SaskPower Kim Trew asked the Saskatchewan Party to illuminate federal Boundary Dam CCS project financing, "Where is the due diligence on this file? Where is the memorandum of understanding?," needed Trew.

Nuclear uncertainties

Calvert attributes CCS uncertainties at SaskPower partly to the utility's long-silent preparations for a publicly-controversial choice of nuclear electricity supply.

Canadian Broadcasting Corporation rumoured on May 9, "SaskPower nuclear reactor report stirs up northern debate," citing a shadowy "consultants report prepared for SaskPower and obtained by the CBC."

The Saskatchewan Party government's minister for the Crown Investments Corporation Ken Chevaldayoff told CBC's reporter, "the government will be working with the private sector."

Just as Ball persistently affirms the viability and merits of coal-based CO₂ injection into nearby oilfields of southeastern Saskatchewan within a uranium resource province, Calvert also advocates for hydrocarbon energy and jobs in a heterogeneous party.

The former NDP deputy premier Duane Lingenfelter, in his subsequent capacity as vice president at Calgary-Alberta based petroleum firm Nexen Canada Ltd. began a campaign in 2005 for a Candu nuclear reactor in Saskatchewan.

Saskatoon Star-Phoenix reported on 26 October 2005 that Lingenfelter won qualified support from the leaders of the Saskatchewan Party and Saskatchewan Liberal Party.

The years-long internal arguments for nuclear electricity at SaskPower, which surfaced in their 2006 annual report (CCJ 3, p 7) peaked on June 17, with a Saskatoon communiqué from Bruce Power, a leading Canadian nuclear industry operator, partly owned by uranium miner Cameco Corporation of Saskatoon.

On June 27, Canadian Nuclear Safety Commission announced a forthcoming public hearing on Cameco's application to amend the construction license of its troubled Cigar Lake uranium mine in northern Saskatchewan.

Bruce Power's CEO appeared publicly on June 17 with Chevaldayoff and Lyle Stewart,

Regina's Minister of Enterprise and Innovation.

Stewart claimed, "Saskatchewan needs clean, affordable and reliable power to meet the future needs of a growing province. We would like to welcome Bruce Power to our province and look forward to the results of the 'Saskatchewan 2020' feasibility study, which we hope will lead to the creation of a nuclear option for our province."

NDP critic for Enterprise and Innovation Frank Quennell, attacked, "Without conducting any review of their own and after having promised to conduct such a review ... the government has decided that they want a nuclear reactor and they want a privately owned nuclear reactor."

Calvert summarised to CCJ, "We believe that any steps toward nuclear technology introduction should be publicly debated. Saskatchewan cannot successfully implement two major new electricity-generation technologies simultaneously."



"We mistrust the federal Government's \$240 million commitment for Boundary Dam" - Lorne Calvert, former Saskatchewan Premier

carbon
capture
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The HTC Solution to carbon emissions

Canadian company HTC Purenergy has developed a complete modular carbon management system that enables carbon dioxide to be captured, stored and transported to oil fields for enhanced oil recovery (EOR) and to other storage locations for sequestration

Jeff Allison, Senior Vice President, HTC Purenergy

It is getting so that you can't go a single day without watching, reading or hearing about global warming and climate change. The debate about this issue is becoming somewhat academic, in terms of its impact on industry.

As governments become convinced that there is an issue, and that the public mood favours action, new public policy becomes almost inevitable.

In Britain, policy will be based on the report by Sir Nicholas Stern, former chief economist at the World Bank, who warned of a \$3.68[USD] trillion potential cost if greenhouse gases are not sharply curtailed. He refers to the shift to a "low carbon global

economy" accomplished through taxation, regulation of emissions, and carbon emission trading. The report has been endorsed and accepted by U.K. government, who are now receiving guidance from none other than global warming crusader Al Gore.

With a Democrat-controlled Congress in Washington, and Britain leading the charge for emission reductions in the E.U., new regulation limiting emissions seem a matter of if not when. Companies that own, operate, and build large industrial plants, and especially coal-fired power plants, will be facing increasing pressure to sharply curtail CO₂ emissions.

About HTC Purenergy

A Canadian company – HTC Purenergy has developed a complete carbon management system that enables carbon dioxide to be captured, stored and transported to oil fields for enhanced oil recovery (EOR) and to other storage locations for sequestration. When enhanced oil recovery is involved, economic returns can be made from CO₂ at a cost per ton that makes CO₂ capture and EOR an economic reality.

The U.S. Department of Energy has estimated that the potential for incremental oil production in the U.S. from EOR is 43 billion barrels. The current reported proven

CO2 capture process – technical description

1. The CO2 source flue gas from the emitter plant is transferred through the duct to the CCS Purenergy Plant. Prior to entering the plant, the flue gas is cooled to optimize the absorption process.

2. To enhance the movement of the flue-gas into the absorber tower, a blower is located in the flue gas duct.

3. The blower pushes the flue-gas into the bottom of the absorption tower and upward through the tower packing material. The solvent mixture of water, amines and other chemicals cascade down through the tower and typically absorbs 85-90% of the flue gas.

4. Once captured by the solvent the CO2 is transferred from the absorber to the top of the stripper tower, where the solvent is heated to enhance the release of CO2. The solvent containing the absorbed CO2 cascades down the stripper column through the packing material as steam and released CO2 flows upwards.

5. The CO2 is directed to the dehydration and compression stages and on to pipeline transportation.

6. The solvent flows from the bottom of the stripper to the re-boiler (heat-exchanger) where the solvent is cooled and the heat from this exchange is transferred to the steam to be used again in the stripper tower CO2 de-sorption process. The heat to operate the system is from an external source. (Normally emitter plant steam or a stand-alone steam system).

7. The “CO2-Lean” solvent solution leaves the boiler and is recycled back to the absorber tower, where it once again absorbs CO2.

reserves in the United States are just 28 billion barrels. So enhanced oil recovery is like discovering America’s oil fields all over again. At just \$47 (USD) dollars per barrel the potential oil to be recovered would be worth over two trillion dollars.

The market for Clean Coal Technology

In the United States, coal-fired electrical generating plants account for over half (about 52%) of all of the electricity being generated today. In China, over 80% of electricity is generated by burning coal.

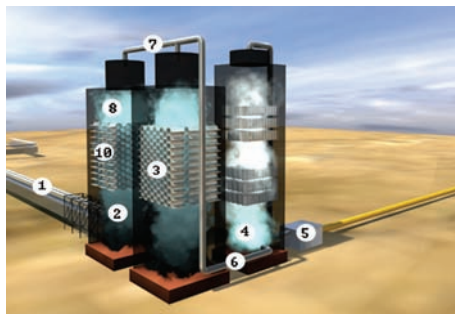
There is no crisis of supply or concern about reserves when it comes to coal. The U.S. is estimated to have a 250-300 year supply at current consumption rates. It is minable and secure within American bor-

ders, and the locations of reserves are well known.

Energy forecasters are now saying that by 2012, over 800 new coal-fired generating plants will come online in the United States, China, and India alone.

This would produce an estimated 2.7 billion tons of new CO2, an issue that needs to be dealt with. This newly produced CO2, however, has the potential of being a new commodity source that can be used and sequestered in enhanced oil recovery projects.

CO2 Capture



The world's first pre-engineered, modular design, CO2 capture system, factory built by HTC Purenergy. The system is truck transportable and is pre-built to site requirements of regional and global electricity producers, industrial processors and other large CO2 emitters.

The carbon dioxide that is generated in the combustion of coal can be captured from the flue gases that normally escape from smoke stacks and become greenhouse gases in our atmosphere.

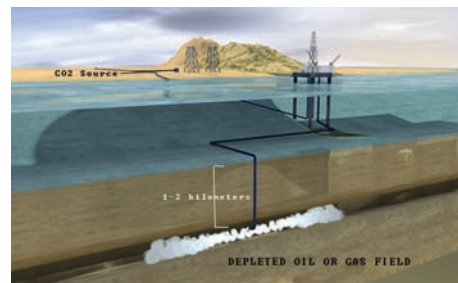
The Greenhouse Gas Technology Centre at the University of Regina is home to the International Test Centre (ITC) for CO2, as well as HTC Purenergy’s product development center. This group is well known for their CO2 capture expertise and carbon management abilities.

Engineers at the centre have been developing new and best practices in carbon capture and sequestration for over a decade. Inside the ITC CO2 capture research centre is a natural gas turbine flue gas CO2 capture demonstration pilot plant, and a short distance away in Estevan Saskatchewan, a coal fired flue gas pre-commercial scale demonstration plant.

The combination of laboratory-controlled technology development and field-tested CO2 capture at a working plant is unique in the world, and gives the group an in depth knowledge of the CO2 capture process.

CO2 Sequestration

If the objective is simply to remove and dispose of the CO2, it can next be sequestered



CO2 sequestration in offshore saline aquifers or abandoned natural gas or oil fields

in deep underground geological formations including the spaces left by depleted oil and natural gas wells, naturally occurring saline aquifers, or in unmineable coal beds.

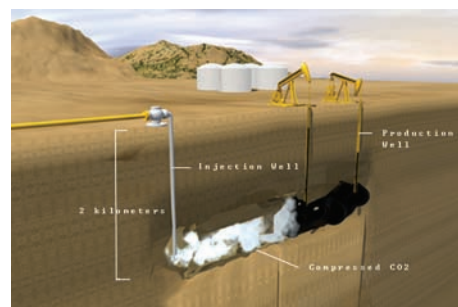
All of these formations are proven stable, in strictly controlled projects such as the offshore Sleipner field in Norway and the enhanced oil recovery fields in Weyburn, Canada.

Governments are just beginning to consider or implement limitations on CO2 emissions from large industrial emitters such as power plants.

Norway has applied a \$50USD carbon tax. The governments of Australia and Canada are also providing matching grants to industry to encourage development of carbon dioxide reduction technologies.

So the world has begun to commoditize CO2, both as a corporate liability, and potentially as an asset for those companies that decide to react to their governments CO2 mitigation programs.

Enhanced Oil Recovery – CO2 as a profit centre?



When is CO2 really worth something measurable? When it is tied to another commodity - crude oil.

The cost to either retrofit a coal burning plant or build a new one with clean coal technology is substantial, and rising with material and labour costs. Seen as only a capital cost, this must be accounted for by raising the price of the power generated.

In a de-regulated electricity market, the potential price increases require consumer consensus. Therefore to improve the

Return on Investment of clean coal technology, the bridging solution is all about EOR.

EOR is a practice that has grown with the decline in conventional new oil reserves and the increase in the world price. These factors have caused oil producing companies to become very interested in so-called "mature" oil fields that had ceased to be economical to tap using conventional production technology.

The experience gained in the EOR fields to date in Canada suggests that injecting one ton of carbon dioxide will increase production by five to seven barrels of incremental additional oil. So at costs of capture of \$25-40USD per tonne, CO₂ usage for EOR becomes an investment, not just a cost.

Putting it all together

HTC is a public company founded with the objective of finding markets for its acquired and newly developed energy technologies, created and refined at the Greenhouse Gas Technology Centre in Regina.

The core of HTC's product offering is a proprietary suite of technologies which it has aggregated from different sources world-wide.

Among them is a CO₂ modeling, design and simulation process it calls the HTC CCS Feed Engine, which essentially allows HTC to design the most efficient method of capturing CO₂ for the customer, using their existing plant facilities.

In addition, it holds intellectual property rights to a number of product lines including designer solvents, packing materials and process flow designs that make the CO₂ capture process more energy efficient.

Recently the company launched the world's first modular, pre-engineered CO₂ Capture System, called the "Purenergy CCS™ CO₂ Capture System"

The Purenergy CCS™ CO₂ Capture System is a stand alone system that will capture CO₂ from the flue gas exhaust of power plants, oil and gas processing facilities and large industrial emitters. The captured CO₂ will be used for CO₂ enhanced oil recovery or be stored geologically.

The Purenergy CCS™ CO₂ Capture System is pre-engineered, pre-built and modularly constructed by HTC's strategic partners Pinnacle Industrial Services of Regina and NuVision Industries of Carseland Alberta Canada using technologies developed and validated for over 12 years at the University of Regina.

The system is capable of capturing up to 2,500 tons per day of CO₂, and because of its modular design, will be able to be manufactured, shipped and erected at the

emitter sight at a much lower cost than other systems that have to be custom built on site. If additional volumes of CO₂ are required at a later point in time, then additional modules can be added.

HTC will feature a new Thermal Kinetics Optimization TKO™ process as a part of the Purenergy CCS™ CO₂ Capture System.

The TKO process improves the capture process through heat recovery, thermal balancing and optimised process flow.

The primary advantage of this newly patented system is that it directly reduces the largest single cost of CO₂ capture – the use of power plant steam – to a ratio of below 1 unit steam required to 1 unit CO₂ captured.

"The new TKO process has shown to reduce steam consumption by up to 30%, which is a significant breakthrough in driving down the cost of CO₂ capture compared to existing commercial technologies," said Lionel Kambeitz, HTC's Chairman & CEO.

"The Purenergy CCS™ CO₂ Capture System is a stand alone system that will capture CO₂ from the flue gas exhaust of power plants, oil and gas processing facilities and large industrial emitters."

"This new Capture System enhancement will make HTC's Purenergy CCS™ CO₂ Capture System a world leader in energy efficiency and simplicity of design," he said.

HTC's EOR engineers also have access to the knowledge gained from the largest enhanced oil recovery project in the world using man made CO₂, the Encana oil field near Weyburn, Saskatchewan.

Carbon dioxide has been injected into that field since 2001, resulting in the resurrection of what was once considered a nearly expired reserve that has been pumping oil since 1954.

HTC's "Team CO₂" worked on the original design of the Weyburn project, as well as jointly developing the protocols that are currently being used world-wide for CO₂ enhanced oil recovery.

Out of their EOR work, Team CO₂ is helping to develop the CO₂ sequestration risk assessment protocols that are currently being used by many groups.

Asked to comment on their current

product offering, Lionel Kambeitz, HTC CEO, said, "We have pulled together the science of CO₂ capture, the science of EOR and with the recent announcement of the University of Regina being named as the new Home of the 'Global Performance Assessment Centre' (GPAC), HTC will be able to offer a complete suite of CO₂ capture, enhanced oil recovery, sequestration and risk assessment solutions. That's an exciting product offering that is not currently available from many companies in the world today."

Moving forward

Jeff Allison and Lionel Kambeitz are passionate, not just about the environmental significance of CO₂ capture technology (a 700 MW clean coal power capture system would remove approximately as much CO₂ from the air as taking about one and half to two million cars off the road), but also about the strong business case for combining CO₂ capture with enhanced oil recovery.

"Commercial solutions are the catalyst to problem recognition and remedial action," said Kambeitz, who came to the world of carbon solutions from an environmental entrepreneurial background.

"We believe we can translate this technology into a very profitable reality, and positively impact global warming at the same time."

The company is currently providing CO₂ capture and sequestration engineering to large emitters, and has worked with a number of large EPC utility contractors who see the necessity of a defined carbon management strategy for new build carbon generating projects.

"We are doing business with companies who have decided that reducing emissions will be part of their strategic operating plan," said Kambeitz. "I'm exploring the potential for new partnerships, both as carbon management product providers and in terms of potential project development partners"



About the company

HTC is a public company traded on Canada's Canadian Venture Exchange with offices in Canada, Australia, and the United States.

Additional information on the company is available on their website at:

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