ptrc
Sustainable Energy

25 YEARS OF ENERGY INNOVATION

ANNUAL REPORT 2022-2023

Aquistore CO_2 Deep Saline Storage Project
(2009 to present)

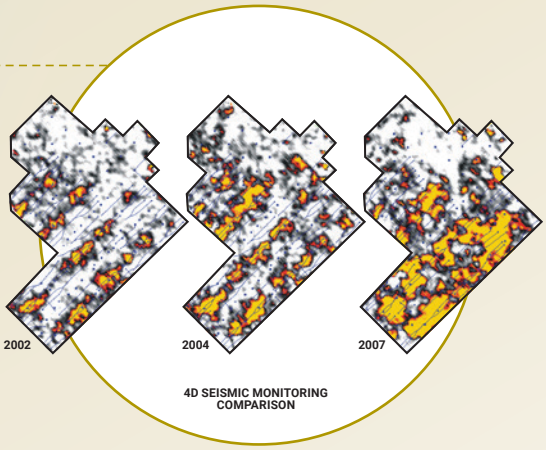
Aquistore

Energy Innovation
(Now and into the future...)

Geothermal Heating and Energy Production
(2021 to present)

Weyburn-Midale CO_2-EOR Project
(2000 to 2015)

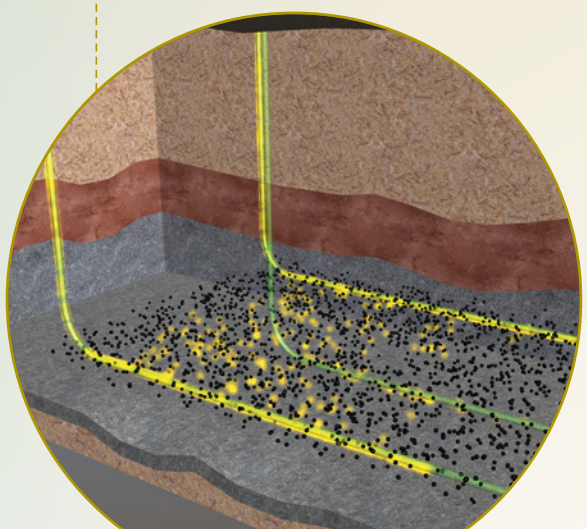
IEA GHG WEYBURN-MIDALE CO_2 MONITORING AND STORAGE PROJECT

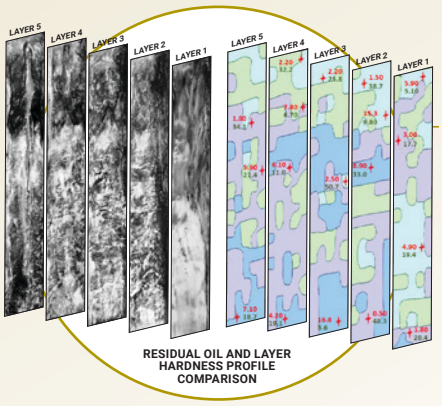


4D SEISMIC MONITORING COMPARISON

Joint Implementation Vapour Extraction Field Demonstration (JIVE)
(2005 to 2011)

JIVE
JOINT IMPLEMENTATION VAPOUR EXTRACTION





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HORNET
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LETTER FROM THE CEO

The future looks bright for PTRC, and I've been pleased to lead the company in new energy directions...

2022-2023 marked my first full year as CEO of the PTRC. I arrived to takeover the position just one month before the end of the previous fiscal year in February 2022, and the year that followed offered an opportunity not just to review and acknowledge the past 25 years of this great organization, but also to investigate the exciting opportunities that PTRC's knowledge and expertise has created going forward.

This annual report is an acknowledgement of past successes, even as it details great new projects begun in 2022-23. Aside from the ongoing work in the Heavy Oil Research Network – with 12 new projects approved totaling approximately $1.2 million in funding, with an additional $300,00 to $400,000 in matching Mitacs funds for universities – the PTRC continues to be a world leader at our Aquistore CO_2 Deep Saline Storage Project. As hub CO_2 storage proposals in both Alberta and Saskatchewan began to rev-up, PTRC staff were frequently called upon to review aspects of these new projects, and offer input on risk assessments and public outreach. PTRC was also awarded a contract through the Asian Development Bank to manage and complete a pre-feasibility study for CO_2 storage in Vietnam. This was a first for the company and was completed successfully in January, 2023.

More importantly, and building on the company's past two-and-a-half decades of geological knowledge of the subsurface, PTRC completed two feasibility studies on the possibility of using geothermal heat in both the cities of Regina and Estevan. The Regina project – examining the possibility of a geothermal system to heat the city's new downtown aquatic centre – has since moved past feasibility and into applications for federal infrastructure funds to pay for a FEED study and completion of the facility, including wells. PTRC continues to be engaged with this project as it heads towards construction in the next few years.

WE have also continued our efforts to achieve certification in the Progressive Aboriginal Relations program of the Canadian Council for Aboriginal Business, and are engaged with the First Nations Power Authority (FNPA) in securing funding for a program that will examine clean fuel alternatives for members of the FNPA. This funding has been secured and we will be participating in developing these clean fuel outreach activities.

The future looks bright for PTRC, and I've been pleased to lead the company in new energy directions, with an eye on the importance that established energy sources play in keeping Saskatchewan and Canada at the forefront of innovation. I would like to thank the ongoing support of the PTRC's Board of Directors in the past year, and my excellent and dedicated staff, without whom none of these successes would have been possible.

Ranjith Narayanasamy
CEO and President
PTRC

LETTER FROM THE CHAIR

For 25 years the PTRC has been ahead of the energy curve in Canada.

The article in this annual report about Frank Proto, the company's first Board Chair, indicates just how soon after its creation the PTRC began to take chances on subsurface R&D that few companies had done before.

When Pan-Canadian decided to begin CO_2 injection at the Weyburn oil field at the end of the 1990s, PTRC was there to design and implement a monitoring and measurement program that would confirm and validate, both for the company and for provincial regulators, the long-term tracking and containment of CO_2. Out of that monitoring R&D arose the largest international project in the world examining CO_2 utilization and storage with support from the European Union, the United States, Asia, Australia and Canada.

Within five years of the start of Weyburn research, PTRC established another field demonstration program in 2005 with Nexen, CNRL and Husky to examine the injection of different solvents in heavy oil fields, thus reducing CO_2 emissions from Steam Assisted Gravity Drainage (SAGD) projects. The Joint Implementation of Vapour Extraction (JIVE) program used solvents instead of steam to extract oil from four different heavy oil fields in Saskatchewan and Alberta, offering the potential for significant CO_2 emissions reductions. Husky (now Cenovus) continues to use different solvents, including CO_2, in some heavy oil fields to this day.

I bring up these two early projects to demonstrate that PTRC has been innovative in the energy space and the reduction of CO_2 throughout its existence. This year, 2022-23, has seen the beginning of additional projects, including pre-feasibility studies on geothermal heat for buildings in Regina and Estevan, and increasing interest on the part of companies in Alberta and Saskatchewan (with major set-point green-house gas emissions) to tap the PTRC's subsurface expertise to help plan CO_2 storage hubs.

On behalf of the PTRC's Board of Directors, I'd like to congratulate the PTRC's CEO, Ran Narayanasamy, and his dedicated and expert staff on pushing forward with ongoing research like the Aquistore CO_2 Deep Saline Storage Project, which continues to draw international attention. As the world once again turns toward PTRC – with carbon capture and storage incentives in Canada, US and internationally becoming established – the company has much to offer.

Randy Brunet
PTRC Board Chair
Partner, MLT Aikins LLP

PTRC Staff Photo
(back, left to right): Erik Nickel, Ran Narayanasamy, Brittney Musleh, Matt Nasehi
(front, left to right): Haley Solie, Norm Sacuta, Marziyeh Kamali, Zeinab Movahedzadeh, Wanda Russell

WHO WE ARE

PTRC Sustainable Energy is a not-for-profit research, development and demonstration (RD&D) company, founded in 1998 that facilitates projects to reduce the carbon footprint and increase the production of subsurface energy.

PTRC brings together private and public sector funding to develop projects that help companies and research groups meet their environmental, social and governance (ESG) needs, while assuring that Canada retains its leadership in energy innovation and the retaining of highly qualified personnel.

Progressive Aboriginal RELATIONS COMMITTED
Canadian Council for Aboriginal Business

PTRC is a member of the Progressive Aboriginal Relations (PAR) program with the Canadian Council for Aboriginal Business, and is striving to address Canada's Truth and Reconciliation Commission's 92 calls to action. We support a diverse workforce, and continue to build relationships with energy partners across industry, academe, government and Indigenous groups.

In 2022-23 PTRC passed the first phase of PAR certification, and hopes to have achieved "bronze" status as a supporter of Indigenous businesses by the spring of 2025.

First Nations Power Authority™

PTRC established a working relationship the First Nations Power Authority and secured funding for an outreach program on clean fuels that will begin in late 2023.

VISION: TO BE A WORLD LEADER IN R&D

An interview with PTRC's first Board Chair Frank Proto

PTRC is celebrating its 25th year in 2022-23. From its beginnings as an enhanced oil recovery R&D program developer and manager, to its current status as one of the world's most important repositories of knowledge and data about CO_2 storage, the company has grown beyond its original vision.

No one is more aware of this than the company's first Board Chair, Frank Proto. Speaking from his retirement home in Kelowna, BC, Proto expanded of the original vision for the PTRC at the foundation of the company in 1998. He was the President and CEO of Wascana Energy at the time. Proto moved into the chairmanship of PTRC in 1999 shortly after its incorporation as a not-for-profit.

"There were 5 key individuals involved in the creation of the PTRC," said Proto. "Member of Parliament Ralph Goodale, Will Olive [a lawyer in the Regina Industrial Development Corporation], the Honorable Marty Klyne [from Regina Economic Development], Dr. Amit Chakma who was VP of the University of Regina and Dean of Engineering, and myself. Of course, there were also others in those early days crucial to the formation of the company, such as Malcolm Wilson [then a professor at U of R] and Eldon Laudermilch [Minister of Intergovernmental Affairs for the Saskatchewan Government]."

It was Laudermilch and Goodale who reached collaboration and funding agreements between the federal and provincial governments that assured the PTRC would be established – including the building of the PTRC's building in the Innovation Centre complex beside the U of R.

"We had a vision. We knew what was already available for oil and gas research in Alberta – a natural gas research group in Calgary, and a heavy oil sands group out of Devon, Alberta – but no one was really doing any research on mid-grade and lower grade oils prominent in Saskatchewan, especially in the Lloydminster and Swift Current areas. The good Saskatchewan oil fields in the Estevan and Weyburn areas had been in operation a long time, but returns from those better crudes were also waning and we really wanted to find ways to get better recovery. That was initially at the root of the PTRC."

So PTRC began with certain economic motivations – like better oil recovery – but being next door to the research monoliths in Alberta, including the two large universities and the Alberta Research Council, meant that there was also a need to create the capacity to do energy research in Saskatchewan. And for the last twenty-five years the PTRC has been at the forefront in creating capacity to conduct energy research at Saskatchewan's post-secondary institutions.

And it wouldn't take long for enhanced oil recovery R&D to move into CO_2 utilization and storage. In 2000 the Weyburn oilfield, then under the ownership of Pan Canadian, began to transport CO_2 up from North Dakota for CO_2-EOR. It was, as Proto said, "a gift for us" in terms of research. With the assistance of the USDOE, and the Governments of Canada, Saskatchewan and Alberta, the Weyburn CO_2 Monitoring and Storage Project was born. Over the next 15 years, more than $80 million dollars in research at dozens of organizations around the world placed PTRC at the centre of carbon capture and storage R&D.

"We set ambitious goals we wanted to reach within the first five years of PTRC's existence – the main thing is that we wanted to be known within five years as a leader in the world in at least one area of research. And that happened mainly because of Weyburn."

ENHANCED OIL RECOVERY A HISTORY (1998 TO PRESENT)

PTRC's Foundational R&D

PTRC's enhanced oil recovery (EOR) research programs have taken various forms over the past 25 years, and in the opening two years of the company's existence EOR was referred to simply as the "core" research of the company. In these early years, funding from both the Government of Canada and Saskatchewan's Ministry of Industry and Resources was specifically earmarked for fundamental research at Saskatchewan institutions like the Saskatchewan Research Council, University of Regina and University of Saskatchewan. The reasons were two-fold: to help improve recovery from Saskatchewan's difficult-to-access heavy oil reserves, and to help build capacity to conduct R&D and train engineers and geologists at Saskatchewan institutions.

As that capacity expanded and strengthened in the province, EOR began to take new and exciting directions for the PTRC.

Sustainable Technologies for Energy Production Systems (STEPS)

In 2008, taking advantage of a new program with the Government of Canada, PTRC applied to become one of four inaugural Business-Led Networks of Centres of Excellence that were to be awarded in 2009 by Industry Canada. These "centres of excellence" were to bring together private and public sector funds for the purpose of advancing different industries in areas of environmental improvement – in the case of PTRC, reducing the water, land and emissions impact of hydrocarbon recovery.

In 2009, STEPS was awarded $10.5 Million in federal funds over four years (subsequently matched by the Government of Saskatchewan) to conduct research across the country in EOR and hydrocarbon-related R&D. By 2013, when the program came to an end, some 200 research projects at 12 universities across the country were completed, and hundreds of students in engineering, geology, economics, and other disciplines trained.

In a federal review of STEPS in 2014, the program was identified as the most successful of the four business-led centres of excellence for wedding private and public sector goals.

HORNET (Heavy Oil Research NETwork)

After 2013, heavy oil research began to transform back into a more focused R&D program (HORNET) specifically looking at issues of concern to the heavy oil reservoirs in Saskatchewan and Alberta: cold heavy oil production with sand (CHOPS), waterfloods with additives, reservoir characterization, and the use of CO_2 in extraction processes. As the industry amalgamated in the 2010's so too did industry input into the HORNET program, with CNRL and Cenovus taking learnings from the HORNET program to the field.

By 2018, PTRC was now leveraging matched funding from the federal Mitacs program to double research budgets at universities, and in 2022-23 some $400,000 in additional funds were directed to researchers for the development of graduate and post-graduate expertise. This fiscal year, 12 research projects were approved for funding totaling $1.2 million dollars.

AQUISTORE

New Directions, New Interest

This fiscal period the total CO_2 stored at the Aquistore site surpassed the milestone of over 500,000 tonnes. The frequency and amount of injected CO_2 increased as the capture plant at SaskPower's Boundary Dam facility improved its efficiency and operations. CO_2 injected at Aquistore in the previous fiscal year, during the pandemic, dropped because repairs to the capture facility's compressor were delayed by supply chain issues.

Research during 2022-23 geared up, with bi-annual ground water and soil gas sampling around the site continuing, and repairs/maintenance of the broadband stations (measuring seismic activity) completed. In addition, Japan Organization for Metals and Energy Security (JOGMEC) continued testing of its set point seismic source at the site, and agreed to pay for the installation of new surface fibre optic cables to be used during an upcoming seismic shoot, which will measure and image the CO_2 plume in the reservoir. That seismic shoot is planned for the 2023-24 fiscal year.

PTRC also began work with SaskPower on an application to convert the current license for the Aquistore well from a research permit to a commercial operating permit through an application process with the Government of Saskatchewan. That work is ongoing and will be completed in 2024.

JOGMEC staff visiting the Aquistore Site

Finally, Aquistore welcomed The Mosaic Company as an industry partner in the research being conducted at Aquistore. This is just the first example of the rising company interest in Aquistore and its research findings, which are important across potential CO_2 hub proponents elsewhere in Canada and around the world. PTRC's past 13 years of research work at Aquistore is now highly in demand in these new projects, and confidential partnerships/consulting agreements were established with several companies developing CO_2 storage sites.

Asian Development Bank Project: Pre-feasibility Study for Petro Vietnam

In October of 2022, PTRC was chosen by the Asian Development Bank (ADB) to manage and direct a pre-feasibility study on a possible CO_2 storage pilot project in Vietnam. Aquistore and the data accumulated during that project, along with PTRC's research experience at the Weyburn CO_2-EOR project, were cited as the main reasons it was chosen to manage the program. A final report and presentation were completed in January 2023, with recommendations for a possible storage pilot in the north of the country at a depleted gas field. PTRC was paid $70,000 for its work on this report.

25 YEARS OF CO_2 AND SOLVENT DEPLOYMENT IN THE FIELD

Weyburn-Midale CO_2 Monitoring & Storage Project (2000 to 2015)

Those familiar with the PTRC, and its history, will recognize this important RD&D project for its first-of-a-kind examination of CO_2 stored underground, its location in a depleted oil reservoir, and the suite of measurement and monitoring activities that were tested to help validate long-term storage and utilization deep underground.

Although examining the injection of CO_2 in an oil field for EOR purposes, and not in a deep saline formation like the PTRC's other bell weather project Aquistore, the publications and findings have helped to inform other projects around the world. Aside from the four major publications (pictured below) almost 300 peer-reviewed papers and conference presentations relating the science of safe and effective CO_2 storage were also published in journals. While completed, the project's findings continue to be used by the current owners of the Weyburn field (Whitecap Resources) to help plan their own future CO_2 hub storage locations in Saskatchewan.

Joint Implementation of Vapour Extraction — JIVE (2005 to 2011)

JIVE was jointly an R&D and demonstration project looking into the use of solvents in heavy oil fields – rather than extraction processes like Steam Assisted Gravity Drainage (SAGD) that use a lot of natural gas to produce hot water. Solvents tend to react better with heavy oil because they can become miscible (they can mix) with the oil, thin it out, and bring it to surface without producing tons of CO_2 in the process because no heat is being added to the reservoir.

JIVE tested different kinds of solvents at three different field sites in Saskatchewan and Alberta – owned by heavy oil producers Nexen, Husky and CNRL – to see if solvents were an effective extraction method. Results varied with different solvents (methane, propane, butane and CO_2 were all tested) but the effects of the program have had long-term impacts for the industry. Husky's success using CO_2 during JIVE led to the implementation of an industrial-scale demonstration project at its Edam field, with millions of incremental barrels produced, and with significantly fewer emissions as compared to SAGD operations. With more heavy oil operations looking to reduce their emissions, the capture and use of CO_2 and the reduction of produced steam in the extraction process could lead to a net-zero future.

THE FUTURE: GEOTHERMAL AND COMPRESSED AIR ENERGY STORAGE (CAES)

Geothermal

In March of 2023, Regina City Council unanimously approved the development of a new aquatic centre for the city's downtown that would include a geothermal energy system to heat the proposed pool and building. The pre-feasibility study for that geothermal system was managed and completed by the PTRC in 2022-23.

Geothermal is an excellent fit for the PTRC. Having studied the stratigraphic layers and characterized many of the geologic formations in southern Saskatchewan, PTRC's accumulated knowledge of the subsurface led to a research program to identify suitable sources of heat for the proposed new building, and the best design to distribute that resource at surface.

Working with several companies, and in consultation with geologists with backgrounds in geothermal R&D, PTRC's final report combined subsurface science, drilling options, construction overview, and budget range for the new building.

The City of Regina has applied for project funding for the aquatic centre and geothermal project from the Investing in Canada Infrastructure Program (ICIP) and should hear on that funding by late 2023. It is likely PTRC will continue to be utilized by the city for a FEED study and project consultation should it go forward.

Compressed Air Energy Storage (CAES)

Compressed Air Energy Storage (CAES) also began to emerge as an area of R&D for PTRC R&D in 2022-23.

CAES technology has been proven at the industrial scale in Germany and the United States, and Saskatchewan is particularly blessed with the ideal geology to develop CAES energy projects. CAES involves powering a compressor to store large volumes of air at depth in purpose-built salt caverns to later be released through a turbine during periods of high power demand. The amount of power CAES could provide would be dependent on the size of the storage caverns and the capacity of the compression and generation equipment.

Just as geothermal research fit into PTRC's future because of the company's experience with characterizing the subsurface for CO_2 storage and the HORNET program, so too does CAES. The first stage, after meetings with consultants in 2022-23 is to complete a whitepaper for dissemination to government groups and energy producers, both in Saskatchewan and in Canada. That whitepaper is expected to be completed in late 2023.

Possible geothermal production locations examined by PTRC downtown in Regina

a. Regina Sportsplex
b. Old Taylor Field Stadium location
d. Dewdney Avenue rail yards

INDEPENDENT AUDITORS' REPORT

VIRTUS GROUP
Chartered Professional Accountants & Business Advisors LLP

To the Members,
Petroleum Technology Research Centre Inc.

Opinion // The summary financial statements, which comprise the summary statement of financial position as at March 31, 2023, the summary statements of operations, net assets and cash flows for the year then ended, and related notes, are derived from the audited financial statements of **Petroleum Technology Research Centre Inc.** for the year ended March 31, 2023.

In our opinion, the accompanying summary financial statements are a fair summary of the audited financial statements, which were prepared in accordance with Canadian accounting standards for not-for-profit organizations.

Summary Financial Statements // The summary financial statements do not contain all the disclosures required by Canadian accounting standards for not-for-profit organizations. Reading the summary financial statements and the auditor's report thereon, therefore, is not a substitute for reading the audited financial statements and the auditor's report thereon.

The Audited Financial Statements and Our Report Thereon // We expressed an unmodified audit opinion on the audited financial statements in our report dated August 1, 2023.

Management's Responsibility for the Summary Financial Statements // Management is responsible for the preparation of the summary financial statements based on the audited financial statements prepared in accordance with Canadian accounting standards for not-for-profit organizations..

Auditor's Responsibility // Our responsibility is to express an opinion on whether the summary financial statements are a fair summary of the audited financial statements based on our procedures, which were conducted in accordance with Canadian Auditing Standard (CAS) 810, *Engagements to Report on Summary Financial Statements*.

August 1, 2023
Regina, Saskatchewan

FINANCIAL REPORT

SUMMARY STATEMENT OF FINANCIAL POSITION, CONSOLIDATED

For the year ended March 31, 2023

(C$000s)	2023	2022
Assets		
Cash	1,070	1,129
Investments	1,897	2,036
Other assets	1,034	785
Total assets	4,001	3,950
Liabilities		
Deferred revenue	1,657	1,028
Other liabilities	704	584
Total liabilities	2,361	1,612
Net assets	1,640	2,338
Total liabilities and net assets	4,001	3,950

SUMMARY STATEMENT OF OPERATIONS, CONSOLIDATED

For the year ended March 31, 2023

(C$000s)	2023	2022
Revenue recognized		
Funding revenue	3,335	3,775
Grant revenue	4	129
Unrealized gain (loss) on investments	(139)	(104)
Other	359	53
Total revenue recognized	3,559	3,853
Expenses		
Projects	3,018	3,022
Operations	1,239	788
Total expenses	4,257	3,810
Excess of revenue over expenses	(698)	43

SUMMARY STATEMENT OF NET ASSETS, CONSOLIDATED

For the year ended March 31, 2023

(C$000s)	Internally restricted net assets	Unrestricted net assets	2023	2022
Opening balance	900	1,438	2,338	2,295
Excess of revenue over expenses	–	(698)	(698)	43
Ending balance	900	740	1,640	2,338

SUMMARY STATEMENT OF CASH FLOWS, CONSOLIDATED

For the year ended March 31, 2023

(C$000s)	2023	2022
Net cash from operating activities	($188)	($606)
Net cash used in investing activities	129	701
Increase (decrease) in cash resources	(59)	95
Cash, beginning of year	1,129	1,034
Cash, end of year	$1,070	$1,129

SUMMARY FINANCIAL STATEMENTS

The summary financial statements are derived from the audited financial statements, prepared in accordance with Canadian accounting standards for not-for-profit organizations, as at March 31, 2023 and for the year then ended.

The preparation of these summary financial statements requires management to determine the information that needs to be reflected in them so that they are consistent in all material respects with, or represent a fair summary of, the audited financial statements.

Management prepared these summary financial statements using the following criteria:

(a) The summary financial statements include a statement for each statement included in the audited financial statements;

(b) Information in the summary financial statements agrees with the related information in the audited financial statements;

(c) Major subtotals, totals and comparative information from the audited financial statements are included; and

(d) The summary financial statements contain the information from the audited financial statements dealing with matters having a pervasive or otherwise significant effect on the summary financial statements.

The audited financial statements of Petroleum Technology Research Centre Inc. are available upon request by contacting the organization.

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