



ENERGY IN TRANSITION



TABLE OF CONTENTS

LETTER FROM THE CEO	01
LETTER FROM THE CHAIR	02
WHO WE ARE	04
AQUISTORE – ASSURING THE SAFETY OF SEQUESTERED CO ₂	05
HEAVY OIL RESEARCH NETWORK (HORNET)	06
IMPACTS	07
INDEPENDENT AUDITOR’S REPORT	09
FINANCIALS	10

LETTER FROM THE CEO

The beginning of 2022 proved to be a significant transition for me, as I arrived to take up my new position as CEO and President of PTRC on February 14th.

After 15 years at SaskPower, I arrived with a keen awareness of the successes of PTRC's CCUS projects, and in particular the global importance of the Aquistore CO₂ Deep Saline Storage Project, which was receiving captured CO₂ from SaskPower's Boundary Dam CCS Facility.

Arriving with just six weeks left in the company's fiscal year, I found PTRC's excellence in CCUS had fortuitously anticipated the federal budget in April of 2022 and the announcement of over two billion dollars in investment tax credits for the development of new CCUS projects in Canada. While just outside of the timing of this 2021-22 annual report, I would be remiss not to mention it here.

Talk about being blessed with sudden opportunity and building on the superlative CCUS initiatives in PTRC's history. Could I be offered a better start to my tenure?

The fiscal year 2021-2022 saw the PTRC continue its strong Heavy Oil Research Network (HORNET) program, with no fewer than twelve projects approved for funding totalling over \$1.2 million. Much of that research is focused on cyclic solvent injection as a more energy efficient and less emissions-intensive technology to improve heavy oil recovery. And PTRC's research dollars at the universities we support was often effectively doubled via the Mitacs program. Since 2018 an additional \$2 million has been leveraged by students in PTRC-funded projects for their training and development.

And then, of course, there is Aquistore. Work was completed by the University of Alberta on modeling the use of CO₂ at the site for geothermal energy production, and the Aquistore Annual Meeting – held virtually in the fall of 2021 – highlighted



results for industry and academic partners on seismic imaging and ongoing site monitoring.

PTRC also took the step this March of registering with the Canadian Council for Aboriginal Business (CCAB) to become "PAR" committed. This commitment – "progressive aboriginal relations" – has seen us connect with different indigenous groups like the First Nations Power Authority, and continue our strong relations with the First Nations University of Canada where we established an ungraduate science scholarship between 2018 and 2021. Additional collaborations are planned in fiscal year 2022-23.

I would like to also take the opportunity to thank my skilled staff at the PTRC for helping me transition into this new role, and for their technical expertise and commitment to work. We were emerging from the pandemic when I arrived, and are for the most part back in the office. Meeting and getting to know them has been a pleasure. Thanks to my Board of Directors who continue to support the company, as our importance in the energy mix of the future becomes apparent.

I would personally like to thank Innovation Saskatchewan for their ongoing financial support of Energy research at the PTRC. Canada's energy future looks to be shaped more and more by the PTRC's visionary work.

A handwritten signature in black ink that reads "Ranjith".

Ranjith Narayanasamy
CEO and President
PTRC

LETTER FROM THE CHAIR

The mark of any successful organization is its ability to recognize opportunities, draw on its strengths, and transform those strengths into impact in a changing marketplace.

In the case of the PTRC, it may be that its considerable strengths as an RD&D manager and program director have begun to payoff in interesting, and some might argue, unexpected ways.

The PTRC has always been a leading organization in carbon capture, utilization and storage (CCUS) RD&D, with the extensive Weyburn-Midale CO₂ EOR project under its belt, and the ongoing Aquistore field site and research program still drawing international partnerships and investment. However, for a few years prior to, and during the pandemic it had begun to look like international interest in CCUS had started to wane.

With oil and other commodity prices falling, the investment required to advance CCUS became constrained. To the credit of PTRC's management and leadership, the company maintained its eyes on the prize, so to speak – continuing its commitment to CO₂ measurement, monitoring and verification research at Aquistore, and funding its Heavy Oil Research Network program with a commitment to more efficient oil recovery in Canada with a reduced environmental footprint.

Now, just as the pandemic subsidies and new tax incentives have been introduced for CCUS, the PTRC is finding interest in its work and expertise is again on the rise. Site visits to the Aquistore site have skyrocketed, PTRC's expertise in subsurface management is being tapped for opportunities beyond oil and gas (such as geothermal development), and the organization's research is helping companies reduce their greenhouse gas emissions to meet their Environmental, Social and Governance (ESG) goals.



None of this would be possible without the committed work of PTRC's small but dedicated staff, and my fellow board members who continue their support of this unique organization. I would like to take this opportunity to thank the PTRC's recently retired CEO, Mr. Dan MacLean, for his five years of stewardship, which came to an end in January, 2022. The PTRC's new CEO, Mr. Ranjith Narayanasamy, joined us near the end of the fiscal year and has already hit the ground running, including new initiatives such as committing the organization to "progressive aboriginal relations" under the Canadian Council for Aboriginal Business.

The PTRC's future rests in its strong RD&D past and how it can be applied today, and in the future, to assist the energy world in its transition to a net-zero future. I am pleased, and honoured, to be playing a role in that transformation.

A handwritten signature in black ink that reads "Kristal Allen".

Kristal Allen
PTRC Board Chair
Partner, MLT Aikins LLP



The PTRC's future rests in its strong RD&D past and how it can be applied today, and in the future, to assist the energy world in its transition to a net-zero future.

Kristal Allen
PTRC Board Chair
Partner, MLT Aikins LLP



WHO WE ARE

The Petroleum Technology Research Centre is a not-for-profit corporation founded in 1998 to facilitate research, development and demonstration projects that reduce the carbon footprint and increase the production of subsurface energy. PTRC seeks to support industry, governments and research providers to realize their environmental, social and governance needs.

VISION

Be the leader in research and innovation to develop sustainable and environmentally responsible energy

MISSION

Be the incubator, accelerator and developer of research and innovation to reduce the carbon footprint and increase the production of subsurface energy

PTRC has built upon our experience in CO₂ enhanced oil recovery and storage by supporting additional subsurface energy initiatives, like geothermal energy, cyclic solvent injection processes for heavy oil, and the expansion of CO₂ utilization and storage initiatives. This annual report provides details of our most recent activities up to March 31, 2021.

AQUISTORE

Assuring the Safety of Sequestered Carbon Dioxide



It has been an eventful year at the Aquistore field test site near SaskPower's Boundary Dam Carbon Capture Facility near Estevan, Saskatchewan. Several new research projects were begun – along with theoretical work around the possibility of CO₂ stored at the site being employed for geothermal electricity generation.

In the early days of the project – prior, in fact, to any CO₂ being injected at the site – a crosswell seismic study was done between the injection and observation well to create a baseline between the two, to help characterize in the injection formation. After six-and-a-half years of CO₂ injection, a second cross well survey was done in December 2021. Crosswell tomography provides a look at the CO₂ distribution/saturation between the wells, which helps to calibrate flow simulations. Crosswell data can also be calibrated with the extensive 3D time-lapse seismic results that have been conducted at the site, to improve estimates of capacity parameters in the reservoir.

Aquistore continued to deploy novel pressure monitoring techniques, petrophysics, and other kinds of data collection, ultimately providing details on the monitoring in a 2021 report to SaskPower, which the company uses as part of its annual reporting to Saskatchewan's Ministry of Energy



Crosswell geophones about to be deployed.



From left: Don White (Geological Survey of Canada), Zeinab Movahedzadeh (PTRC) and Erik Nickel (PTRC).

and Resources, confirming the safety and efficacy of CO₂ storage at the site. To date, no evidence of CO₂ leakage to the surface has been identified and the field site continues to be admired, globally, as a centre for testing novel and improving established measurement and monitoring tools.

The work done modelling CO₂ circulation for the purposes of geothermal energy generation (a project funded by the Swiss Government) has captured the imagination of companies thinking of harnessing geothermal heat for both electricity generation and heating. We are very proud to be able to deliver these results, and optimistically hope that one of the new utilizations for stored CO₂ going forward will be harnessing heat from deep within the earth.

The PTRC would like to thank SaskPower for its continued support of the Aquistore program. These sorts of projects work best when communications and collaboration are put first. PTRC would also like to acknowledge the support from industry sponsors like Mosaic and Australian National Low Emissions Coal (ANLEC) R&D, both of whom have funded important research. Aquistore remains a local Saskatchewan project with global impact and influence.

HORNET

PTRC's Heavy Oil Research Network Continues Solvent and CCUS Work



The PTRC approved just over \$1.2 million in research funding for twelve research projects looking at novel and more energy efficient processes for use in heavy oil recovery. Once again, a significant portion of projects awarded funding are looking at the use of CO₂ and other solvents in heavy oil formations to improve recovery rates, and lessen emissions from processes that require steam and other high energy

technologies. Results from projects are presented twice yearly to industry and government representatives at the HORNET technical advisory group meetings. PTRC would like to thank both Cenovus and Canadian Natural Resources Ltd. for their ongoing support of HORNET. 2021-22 saw one of the two yearly meetings happen in-person at the Petroleum Club in Calgary, for the first time in two years.

FUNDED PROJECTS: 2021-22

Institution	Project Description
Perm Inc. and University of Regina	<ul style="list-style-type: none"> Oil Recovery and CO₂ Storage Potential in Post-CHOPS Reservoirs with Mobile Water
University of Regina	<ul style="list-style-type: none"> Investigation of the Effects of Water-in-Oil Emulsion on CSI Recovery Performance from Microscopic Perspectives Integrating Reservoir System Information for the Cyclic Solvent Injection (CSI) Process to Support Post-CHOPS Field Development A Micro-optical Investigation of Cyclic Solvent Injection (CSI) Introducing a Novel Introducing a Novel Scaling Approach Microfluidic Investigation of Solvent Dissolution and Exsolution Kinetics and Oil Remobilization in Immobile Oil Zones An Innovative Approach to Optimize Heavy Oil Recovery Using a Novel Synthesized Liquid Catalyst
University of Regina and Saskatchewan Research Council	<ul style="list-style-type: none"> Integrated Reservoir Simulation Model and Optimization of CO₂-based CSI Processes
Saskatchewan Research Council	<ul style="list-style-type: none"> Foamy Oil Properties Matrix Phase IV Steam Plus Flue Gas Injection for Post-CHOPS Foamy Oil Stabilizer Cyclic Solvent Recharge (Dual Core) Stage 3 HORNET Database and the Application of Artificial Intelligence and Machine Learning for Heavy Oil EOR

IMPACTS

Mitacs Research Funding and the PTRC



PTRC's funding of universities in Canada has, since 2018, allowed those institutions to access additional funds through the Mitacs Program. Mitacs is a government funded not-for-profit that works with businesses and institutions of higher learning to train graduate, post-graduate and post-doctoral researchers via industry-funded work projects and programs.

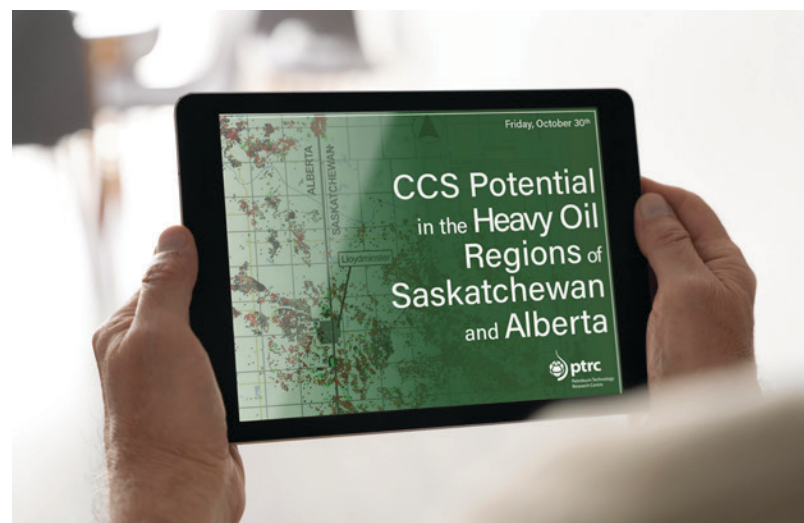
PTRC is an eligible matched-funding company with Mitacs, and our approved research projects at different universities provide direct funding from PTRC that can then be matched – on a one-to-one, but sometimes two-or-three-to-one level – with additional dollars from Mitacs. Projects need to show direct economic and social impact in Canada to be approved for Mitacs funds, and are peer-reviewed before being approved.

Four years of funded research at five different Canadian universities (totally just over \$2 million dollars from PTRC) has been increased to just over \$4.4 million for student researchers, and has led to the training of more than 75 highly qualified personnel, who have in turn found work within industry and academe. PTRC is proud of this impact on research and development at Canadian universities.

Pandemic: Virtual Communications and Engagement

PTRC staff transitioned back to in-person work in early 2022. The company has the good fortune of office space that allows each member of our staff the benefit of a small private office, and that added confidence in the decision to return to work.

PTRC's presence in the world of CCUS and enhanced oil recovery did not lapse or take a holiday in fiscal year 2021-22. The company hosted no fewer than seven webinars stretching over the life of the COVID pandemic, with attendance at some of those webinars topping out at 350 attendees. Participants from around the world joined us online – Japan, UAE, China, the United States, many EU member countries, and Australia. Our outreach and communication never waived. We kept a continuous presence in the world of RD&D.



IMPACTS

Geothermal and Energy Integration Work for Evolution Growers



As part of our commitment to help Indigenous-led businesses in the province, and to support energy sources that help Canada meet its net-zero 2050 targets, PTRC funded a research program with the University of Regina looking at optimizing energy use at greenhouses being proposed for the Estevan, Saskatchewan area. Derrick Big Eagle, owner of Evolution Growers, has established a start-up company looking into providing locally sourced vegetables via greenhouses powered by non-emitting energy sources. PTRC provided \$40,000 in seed money to the U of R to assist this Indigenous-led business develop its clean energy sources, including geothermal and solar power. The project is also looking into AI (artificial intelligence) technologies to help switch energy sources at the proposed buildings.

PTRC Joins the Canadian Council for Aboriginal Business



Canadian Council for
Aboriginal Business 

As part of its commitment to the Truth and Reconciliation Commission of Canada's 94 calls to action, in March of 2022 PTRC joined the Canadian Council for Aboriginal Business (CCAB) as a company committed to "progressive aboriginal relations (PAR)". Over the course of the next three years PTRC will work on its relations with First Nations communities and individuals by providing knowledge and awareness training to our staff, examining procurement policies, and sponsoring Indigenous-led initiatives and conference. In fiscal year 2021-22, the company made its final installment establishing the PTRC's Science Scholarship at the First Nations University of Canada, which has been awarding scholarships totaling \$2000 since 2019.



PTRC supporting the Every Child Matters Initiative ►

INDEPENDENT AUDITORS' REPORT



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, 2022, 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, 2022.

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 July 20, 2022.

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*.

July 20, 2022
Regina, Saskatchewan

FINANCIAL REPORT

SUMMARY STATEMENT OF FINANCIAL POSITION, CONSOLIDATED

For the year ended March 31, 2022

(C\$000s)	2022	2021
Assets		
Cash	1,129	1,034
Investments	2,036	2,740
Other assets	785	324
Total assets	3,950	4,098
Liabilities		
Deferred revenue	1,028	1,398
Other liabilities	584	405
Total liabilities	1,612	1,803
Net assets	2,338	2,295
Total liabilities and net assets	3,950	4,098

SUMMARY STATEMENT OF OPERATIONS, CONSOLIDATED

For the year ended March 31, 2022

(C\$000s)	2022	2021
Revenue recognized		
Funding revenue	3,775	3,576
Grant revenue	129	160
Unrealized gain (loss) on investments	(104)	130
Other	53	10
Total revenue recognized	3,853	3,876
Expenses		
Projects	3,022	3,189
Operations	788	654
Total expenses	3,810	3,843
Excess of revenue over expenses	43	33

SUMMARY STATEMENT OF NET ASSETS, CONSOLIDATED

For the year ended March 31, 2022

(C\$000s)	Internally restricted net assets	Unrestricted net assets	2022	2021
Opening balance	–	2,295	2,295	2,262
Excess of revenue over expenses	–	43	43	33
Transfer of net assets	900	(900)	–	–
Ending balance	900	1,438	2,338	2,295

SUMMARY STATEMENT OF CASH FLOWS, CONSOLIDATED

For the year ended March 31, 2022

(C\$000s)	2022	2021
Net cash from operating activities	(\$606)	(\$552)
Net cash used in investing activities	701	(130)
Increase (decrease) in cash resources	95	(682)
Cash, beginning of year	1,034	\$1,716
Cash, end of year	\$1,129	\$1,034

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, 2022 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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