

# INNOVATION, ALLIANCES & SUSTAINABILITY

**2019 - 2020 ANNUAL REPORT**



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## ABOUT US

The Petroleum Technology Research Centre (PTRC) is a not-for-profit corporation founded in 1998 by the Government of Saskatchewan, the Government of Canada (Natural Resources Canada), the University of Regina, and the Saskatchewan Research Council. It is located in the Innovation Place Research Park in Regina, Saskatchewan. The PTRC facilitates and manages research and development (R&D) and field demonstration projects in enhanced oil recovery and carbon-dioxide utilization and storage.

## VISION

To be the organization of choice for collaborative petroleum research in Saskatchewan and Canada.

## MISSION

To initiate and deliver research programs to enhance the efficiency and reduce the environmental impacts of oil and gas production.

## STRATEGY

To initiate and coordinate oil and gas research with cumulative unrisks potential to deliver 5 billion barrels of incremental oil reserves over the next 5 years.



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# A LETTER FROM THE CHAIR

**CO<sub>2</sub> STORAGE AT AQUISTORE IS  
EQUIVALENT TO ELIMINATING  
EMISSIONS FROM 75,000 VEHICLES  
FOR ONE YEAR.**

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This past fiscal year, I became Chair of the PTRC's Board of Directors after nearly 5 years as a contributing Board member. Our previous Chair, Mr. Rob Scammell, guided the organization through an unprecedented period of transition that has seen the company emerge stronger, transformed, and ready to meet the challenges of an energy landscape that is in constant flux and change.

PTRC is in the midst of redefining its vision, mission and goals, but the fundamentals of the company remain committed to the Province of Saskatchewan's Growth Plan, released in November 2019, that recognizes the importance of resources sectors – including oil and gas – to the province's prosperity and future. That industry, however, does not exist in a vacuum from the social and environmental challenges that our country faces, and PTRC's research has been shifting focus to help our partners and stakeholders meet those challenges.

In 2019-20 the Heavy Oil Research Network, sponsored and facilitated by PTRC, has funded projects at the University of Regina, University of Saskatchewan, and the Saskatchewan Research Council. These projects are particularly focused on reducing the energy inputs and emissions from heavy oil recovery processes through cyclic solvent injection. Advancing solvent recovery means that less CO<sub>2</sub> is emitted from traditional thermal recovery processes like steam-assisted gravity drainage (SAGD) and also helps optimize recovery from existing wells, leading to reductions in land disturbance and the drilling of new wells before existing ones are optimized.

PTRC's ongoing CO<sub>2</sub> utilization and storage work – indeed, the past 20 years have gained the company an international reputation for its expertise in this area – continues apace, with the Aquistore project attaining a new milestone of over 250,000 tonnes of CO<sub>2</sub> stored some 3 km underground. This is equivalent to eliminating emissions from 75,000 vehicles for one year. The scientific and engineering research committee (SERC) that guides Aquistore is made up of the most recognized experts in the world in the measurement and monitoring of subsurface CO<sub>2</sub>, and the project continues to draw funding and collaborations from as far away as Australia, Japan, and Europe.

In addition, the Weyburn-Midale CO<sub>2</sub> EOR project, originally sponsored and facilitated by PTRC from 2000 to 2016, has injected and stored approximately 40 million tonnes of CO<sub>2</sub> to support enhanced recovery in the two oil fields. This is equivalent to eliminating the emissions from 10 million vehicles – a major, direct and practical contribution to the reduction of CO<sub>2</sub> in the atmosphere. These projects are great examples of PTRC's objective to make real and measurable environmental contributions and not just move projects forward. They are also great examples of Saskatchewan and Western Canadian cooperation, ingenuity and innovation.

All forms of "energy from the earth" are now potential focuses for the organization, with European partners contributing towards a study to ascertain if CO<sub>2</sub> at Aquistore could be an effective carrier of heat-to-surface for geothermal electricity generation. This is just one aspect of a dynamic company willing to investigate all possibilities before it.

As shown in all of its projects, PTRC takes a small budget and leverages it into a large project and also manages and supports it to make sure research gets done and provides real, direct and practical value.

I'd like to take this opportunity to thank Dan MacLean, whose ongoing leadership at the PTRC is taking the company in new and exciting directions, and the PTRC staff for their continuing commitment, even in the face of the COVID pandemic. I wish the company and all researchers under its funding and direction the best in 2020.

Randy Brunet

Chair of the Board,  
Petroleum Technology Research Centre



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# A LETTER FROM THE CEO & PRESIDENT

I AM PROUD PTRC CONTINUES TO  
MAKE A DIFFERENCE IN THE R&D  
WORLD, AND IN GLOBAL EFFORTS  
TO REDUCE EMISSIONS.

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The PTRC is a comparatively small organization for the weight it pulls. Our staff totals seven people – in addition to a summer or engineering-student-in-training as needed – and we have employed the very best to meet the demands placed upon us. We don't just manage R&D programs. We help identify the needs of clients and build research programs that address key challenges faced by operators, industry and policy makers.

My employees have expertise in enhanced oil recovery and CO<sub>2</sub> storage, are professional geologists and engineers, have backgrounds in communications and writing, and all contribute to the economy, environment, and social fabric of Saskatchewan and Canada. I say this at the start of this annual report because the world changed for everyone this year. Near the end of the PTRC's fiscal year (March 31, 2020) the entire country went on a general lockdown with the arrival of COVID-19. PTRC employees moved to a work-at-home approach and, I am proud to say, have continued to advance our programs.

The PTRC's building, in the Innovation Place Research Park beside the University of Regina, is a busy and bustling place most days. The faculty of the University's Petroleum Systems Engineering Department, most of its graduate students, along with the Energy Division of the Saskatchewan Research Council, occupy the PTRC building along with the PTRC itself. Both U of R and SRC have research laboratories and advanced equipment in the building. When lockdown happened on March 14th, the PTRC became virtually deserted.

In spite of these adverse conditions, the PTRC flourished in 2019-20. In a competitive Request for Proposals (RFP) completed in February, 2020, the Heavy Oil Research Network approved 9 projects for funding totalling 1.2 million dollars. Also in February, Aquistore completed its sixth seismic shoot to image the CO<sub>2</sub> plume 3300 metres underground after 270,000 tonnes of injection. Ongoing monitoring at the site continues to show the CO<sub>2</sub> remains safely stored in the Deadwood Formation. Exciting opportunities continue to present themselves at Aquistore, including a preliminary study to determine if injected CO<sub>2</sub> can be an effective carrier of heat for geothermal power.

In addition, PTRC launched a new website in 2019, and increased our presence on social media platforms and other public spheres. Six short films about Aquistore and the impacts of our enhanced oil recovery research were completed and launched on our YouTube page and have had, combined, thousands of views. We have developed a new approach to getting word out about our research, including webinars and participation in national and international panels. We are assisting our research partners in making sure projects go forward despite travel restrictions for graduate students and distancing requirements in labs and work places.

I am amazed by the resilience and commitment of my staff, and the organizations we fund. The ongoing work to help the oil industry in Canada become more efficient and less environmentally impactful is ongoing. I am proud PTRC continues to make a difference in the R&D world, and in global efforts to reduce emissions.

Dan MacLean

CEO and President

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# PTRC HIGHLIGHTS 2019-2020

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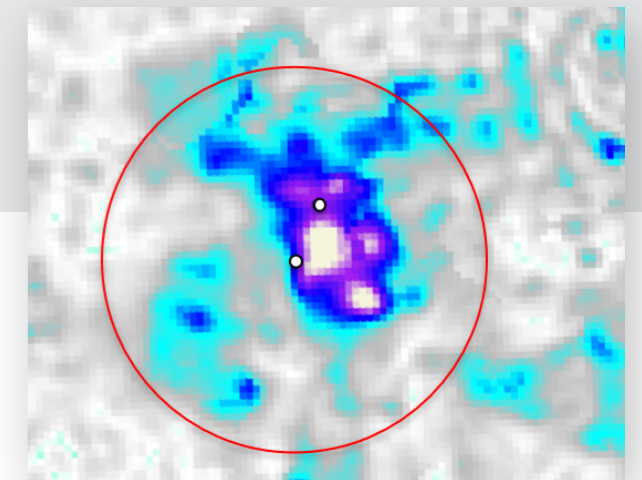
## 01

### AQUISTORE EXPANDS ITS INTERNATIONAL REACH AND IMPACT

PTRC's Aquistore project continues to provide SaskPower – the owners of both the Boundary Dam Carbon Capture Facility and the injection site – ongoing monitoring data that is assuring both the general public and regulatory bodies that the CO<sub>2</sub> is remaining safely stored 3.3 km underground in the Deadwood sandstone and brine formation.

Ongoing measurements at site include groundwater, soil gas, and passive seismic measurements using geophones and fibre optic technologies, all of which show that the CO<sub>2</sub> is remaining in the formation and acting as expected. In February 2020, just prior to the arrival of pandemic restrictions, a full seismic shoot was conducted at the site as injected CO<sub>2</sub> surpassed 270,000 tonnes. The images produced from that shoot demonstrate the ability to show the plume's development and placement within the target formation.

New and exciting work has also been conducted in 2019-20, including salt precipitation studies by both the University of Alberta and University of Melbourne. With the injection well experiencing variable CO<sub>2</sub> injection rates, examining the extent of salt scaling under varying injection scenarios helps to inform other planned projects what to expect regarding geochemical behaviour of reservoir fluids as they interact with supercritical CO<sub>2</sub>. Another new project – sponsored by Australia National Low Emissions Coal R&D (ANLEC) in partnership with the CO<sub>2</sub> Capture Project (CCP4) – conducted electromagnetic and gravity surveys at the Aquistore observation well. Borehole-to-surface electromagnetic surveying work was completed in the summer of 2019 and the analysis of results will be completed by the end of 2020. Silicon Microgravity (SMG) conducted prototype field trials of their 3-axis borehole gravity technology in the observation well. The ultimate goal of this work is to offer a CO<sub>2</sub> plume and reservoir surveillance technology to replace more expensive and time-consuming monitoring technologies. When modelled, these techniques may prove to be novel ways of imaging movement of CO<sub>2</sub> at depth, and reinforce Aquistore's status as the world-leading CO<sub>2</sub> measurement and monitoring field site.



# 02

## HEAVY OIL RESEARCH NETWORK HELPS INDUSTRY LESSEN ENVIRONMENTAL IMPACT

The fall in oil prices over the past year has had a direct impact on research at the PTRC. Despite the acquisition of much of Devon Energy by CNRL (both of whom are contributors to PTRC's research funding), the Heavy Oil Research Network continued its program of research. HORNET approved 12 projects at the beginning of 2019 for funding, with a particular focus on solvent injection enhanced oil recovery, wormholed reservoirs, and foamy oil production. A full list of projects that began work early in fiscal year 2019-20 is provided below.



Approved Projects for 2019-2020
Cyclic Solvent Injection Simulations in Non-Wormholed Regions (Phase 3)
Foamy Oil Drive
Foamy Oil Properties Matrix for Cyclic Solvent Injection
Polymer Flooding Database
Cyclic Solvent Recharge from Non-Wormholed Regions
Effect of Solvent Type and Wormhole Thief Zones on CSI Gravity Mechanisms
Utilization of Advanced HPHT Microfluidics for Non-Equilibrium Phase Studies
Superoleophobic Coating for High Efficiency Oil and Water Separation
Hot-Water Flooding, Steam Flooding, and Hot-Water-Alternating-Steam Injection
Novel Ionic Liquids for Heavy Oil Recovery
Analyzing the Linkage between Lab-Scale CSI Tests and Pilot Tests for CO <sub>2</sub> -based CSI
Comparison Study between Ethane-Based and CO <sub>2</sub> -Based CSI Processes

These ongoing areas of research are particularly important for improving the efficiency of heavy oil recovery and lessening the amount of energy required to produce oil – both goals that are needed in the current economic climate. This research, in turn, means reductions in field impacts as existing wells are optimized, fewer new wells are drilled, and less CO<sub>2</sub> is emitted in recovery processes. Final reports for most of these projects have been submitted to PTRC and shared with our industry clients.

PTRC completed an additional request for proposals (RFP) in HORNET in January of 2020, which saw nine full projects accepted for funding and an additional three 'incubation' projects approved. While the launch of these projects has been delayed in some cases because of the COVID-19 pandemic – owing to restrictions placed on travel for students returning to universities – PTRC expects these new projects to be in full gear by fall of 2020. The total budget for the twelve projects approved in January 2020 is almost \$1.2 million.

# 03

## TIGHT-LIGHT OIL RESEARCH ABOUT TO MOVE TO FIELD



Photo courtesy of the Saskatchewan Research Council

PTRC has been financing the Saskatchewan Research Council's Viking Phase 6 Multi-Client Program since 2018. This important study – which includes industry partners from many of the small-to-mid-sized companies with operations in the Viking field in southern Saskatchewan – is looking at the use of solvents, surfactants and proppants

during injections. The importance of this work for optimizing existing wells in the area, particularly in the face of falling oil prices, is particularly important. SRC submitted interim reports on the research in mid-November of 2019, including analyses on rock fracturing that was conducted using the CT-scanner funded in part through the PTRC and Western Economic Diversification. The program hopes to move key findings to the field, particularly those related to injection processes, in the next two years.

# 04

## WILLISTON BASIN PETROLEUM CONFERENCE A MAJOR SUCCESS



PTRC reconfigured the Williston Basin Petroleum Conference for 2019, building upon previous successes with technical and scientific sessions and reducing the trade show component of the program. The conference, which alternates between Canada and North Dakota on alternating years, was moved into downtown Regina's

Saskatchewan Conference Centre, and featured both business and technical conference streams. Over 350 people attended. Featured speakers included Brad Wall, former Premier of Saskatchewan, and Gary Doer, former Canadian Ambassador to the United States and past Manitoba Premier. Topics ranged from investment strategies in oil and gas, to policy decisions that could help or hinder the industry in Canada and the United States. A core analysis workshop was also provided by the Saskatchewan Geological Society, and PTRC hosted a tour of the Aquistore site for interested participants as the conference came to a close.

With the WBPC event in Bismarck, North Dakota cancelled in 2020 because of the COVID pandemic, PTRC is working with the North Dakota Petroleum Council to shift their event to 2021, meaning the future version of the conference in Canada will be occurring in even numbered years, with May 2022 expected to be the next Canadian event.

# FINANCIAL REPORT

## 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, 2020, the summary statements of operations, unrestricted 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 for the year ended March 31, 2020.

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 22, 2020.

### 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 22, 2020  
Regina, Saskatchewan

VIRTUS GROUP LLP  
Chartered Professional Accountants

## Petroleum Technology Research Centre Inc. Condensed Consolidated Statement of Financial Position For the year ended March 31, 2020

(C\$000s)	2020	2019
<b>Assets</b>		
Cash	\$ 1,716	\$ 3,451
Investments	2,610	2,582
Other assets	722	299
<b>Total assets</b>	<b>5,048</b>	<b>6,332</b>
<b>Liabilities and net assets</b>		
Deferred revenue	2,433	3,644
Other liabilities	353	176
<b>Total liabilities</b>	<b>2,786</b>	<b>3,820</b>
<b>Net assets</b>	<b>2,262</b>	<b>2,512</b>
<b>Total liabilities and net assets</b>	<b>\$ 5,048</b>	<b>\$ 6,332</b>

## Petroleum Technology Research Centre Inc. Condensed Consolidated Statement of Operations and Unrestricted Net Assets For the year ended March 31, 2020

(C\$000s)	2020	2019
<b>Revenue recognized</b>		
Government of Saskatchewan funding	\$2,378	\$1,823
Government of Canada funding	-	20
Industry funding	2,125	1,489
Other funding	248	249
<b>Total revenue recognized</b>	<b>4,751</b>	<b>3,581</b>
<b>Expenses</b>		
Projects	3,756	2,744
Operations	1,245	987
<b>Total expenses</b>	<b>5,001</b>	<b>3,731</b>
<b>Excess of revenue (expense)</b>	<b>(250)</b>	<b>(150)</b>
<b>Unrestricted net assets, beginning of year</b>	<b>2,512</b>	<b>2,662</b>
<b>Unrestricted net assets, end of year</b>	<b>\$ 2,262</b>	<b>\$ 2,512</b>

Petroleum Technology Research Centre Inc.  
Condensed Consolidated Statement of Cash Flows  
For the year ended March 31, 2020

(C\$000s)	2020	2019
Net cash from operating activities	(\$1,703)	(\$458)
Net cash used in investing activities	(32)	(109)
Increase in cash	(1,735)	(567)
Cash, beginning of year	3,451	4,018
Cash, end of year	\$ 1,716	\$3,451

## 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, 2020 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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