

## Annual Report 2017/2018

Meeting the Challenges of Sustainability & Productivity in a New Energy World



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### Corporate Information

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## Our Company

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.

## **Our Focus**

#### Heavy Oil



Since 1998 the PTRC has been facilitating enhanced oil recovery research leading to demonstration projects, with a particular focus on improving the recovery from Saskatchewan's (and Canada's) difficult-to-access heavy oil reserves.

#### Tight/Light Oil



The PTRC is meeting the challenge of enhanced oil recovery (EOR) in the Bakken and other light and tight oil plays in western Canada, by working with our industry partners and Innovation Saskatchewan to develop field trials of new technologies that seek to stimulate reservoirs and move horizontal well production to secondary and tertiary recovery.

#### CO<sub>2</sub> Utilization & Storage



The PTRC has over 18 years of experience managing CO<sub>2</sub> monitoring and storage projects, including Weyburn-Midale CO<sub>2</sub>-EOR and the ongoing Aquistore deep saline CO<sub>2</sub> storage happening near SaskPower's Boundary Dam carbon capture facility.

### **Board of Directors** 2017 - 2018

The PTRC is governed by a Board of Directors comprising members from the four founding partners, and industry leaders from oil and gas operations in western Canada. Current Board members for fiscal year 2017-2018 are listed to the right.

#### **Robert Scammell** In-coming Chair Independent Director

#### **Brian Watt**

**Out-going Chair** Husky Energy

**Randy Brunet** Partner MLT Aikins

#### Ed Dancsok

Assistant Deputy Minister Petroleum and Natural Gas Development Saskatchewan Ministry of the Economy

### 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 of oil and gas production.

### **STRATEGY**

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



Michael Crabtree Vice-president, Energy Saskatchewan Research Council

Esam Hussein Dean of Engineering and Applied Sciences University of Regina

Yesid Puerto Chief Reservoir Engineer Canadian Natural Rescources, Ltd.

Kari Harvey Chief Operating Officer Innovation Saskatchewan

**Cecile Siewe** Director General CAMMET Energy - Devon Natural Resources Canada

### Management Letters



### Letter from the Chair

*I am about to enter my first year as* Chair of the Board of Directors, and I'd like to take this opportunity to thank Brian Watt, Chair of the PTRC Board for the last four years, who recently retired from Husky Energy.



### Letter from the CEO & President

One of the great things about my job at the PTRC is that I get to see, in real time, how challenges faced by our industry partners lead to the transformation of the kind of research we do.

He passed along a vibrant and energized group of individuals to help direct the future activities of the PTRC, and I will be committed to providing the same sort of stewardship for the company during my own tenure as Chair.

This year has seen developments in the way the PTRC approaches its mandate. It remains committed to the efficient and effective recovery of Saskatchewan's often difficult-to-access oil reserves, but it has focussed - particularly in its applications for federal funding from Western Diversification and newly announced federal initiatives on green growth - on important research that will improve the environmental impacts of extraction. Reductions in emissions and water use, and the lessening of land disturbance through our research program has become more important.

The approval by Western Diversification of \$800,000 in funding for a new industrial scale CT-scanner - which is to be housed in the Saskatchewan Research Council's Energy Division - is one success for the PTRC that will enhance our researcher partners' capabilities to understand rock formations at a microporous level, potentially improving the placement and drilling of wells.

As well, for the first time PTRC began to act as a private sector partner for our funding of university researchers, allowing professors to access

hundreds of thousands of dollars in additional money through the federal MITACS program. This program - which matches PTRC's funding to pay a portion of the salaries of graduate students and post-graduates - has meant that universities can sometimes double the available funding for their PTRC research. I point this out because such matched funding is something not explicitly captured by PTRC financial statements, but it represents a significant benefit that we provide to universities.

I'd like to commend the PTRC's CEO, Dan MacLean, and his dedicated staff for an exciting year of research, and I congratulate them for their successes in securing funding from our industry sponsors (CNRL, Husky and Devon). Those industry partners, along with the Government of Saskatchewan through Innovation Saskatchewan, are strong supporters of the PTRC's work, and I thank them all for their continued support.

Rob Scammell

Refammell

Chair, PTRC Board of Directors

Whether that's in heavy oil, CO<sub>2</sub> storage or in the increasingly important tight/light oil, applied research at the PTRC relies critically on the input of our sponsors and stakeholders, and the application of their field experiences to our research agendas.

Our research in 2017-2018 was full of exactly these kinds of intersections between field challenges, researcher innovation, improvements to our research programs, and the tools being acquired to help realize our twin goals of improved recovery and lessened environmental impacts.

Our Heavy Oil Research Network saw a number of exciting projects go forward and results from earlier research began to bear fruit. Some of the most exciting findings were from a collaboration between the University of Calgary and the Canadian Light Source (Synchrotron) in Saskatoon where high-intensity x-rays were used to image the creation of foamy oil bubbles - a process that had never been filmed or imaged in real-time before. The core holder that Dr. Ian Gates created to allow the Light Source to film the process was made of special polymers that allow the synchrotron's rays to penetrate the container.

PTRC was successful in its application to receive \$800,000 is supplemental funding from the Government of Canada through Western Economic Dan MacLean Diversification to purchase an industrial-scale CTscanner. The scanner will examine rock cores and other kinds of samples at the microporous level. It has been installed in the PTRC building in the



Saskatchewan Research Council's Energy Division labs. Staff for both SRC and the University of Regina are training on the device for projects in fiscal year 2018-2019.

Good research inevitably requires innovative infrastructure. PTRC worked with SaskPower staff on planning the replacement of tubing on the Aguistore injection well. The well, which reached 6 years of age in 2018, is in need to maintenance and improvements (some of the temperature and pressure sensors no longer worked, for example). The rework is planned for May of 2018. CO2 injection totals remained unchanged for the first half of the fiscal year as the carbon capture plant completed maintenance work. Injection began again in late 2017 and an additional seismic run in March of 2018 (at 142,000 tonnes) showed clear amplitudes of the plume in the Deadwood formation more than 3.2 km underground.

An organization is only as good as its people, and I remain supported by an expert staff and exceptional Board of Directors. To my employees, and to the Board, I say thank you. I remain committed to research and development that moves the needle on recovery rates and lessens the environmental impacts of our hydrocarbon resources.

**CEO** and President



### Research Highlights



## Projects

New Industrial X-Ray CT-Scanner

### 02 Tight/Light Oil Program: Returning to the Viking

PTRC secured \$800,000 in funding from Western Economic Diversification Canada for the purchase and installation of a highresolution industrial-scale CT-scanner. The installation -- complemented with additional funding from SRC (\$416,000) and the University of Regina (\$200,000) - is supported by some \$600,000 in approved HORNET research projects that are to begin in both 2018 and early 2019. This instrument will greatly enhance Saskatchewan's research in both heavy and light enhanced oil recovery, via the examination of rock core samples at a micro-pore level. Such research will aid industry in identifying where to drill in the field, and what technologies to apply based on rock characteristics identified by the scanner. Experiments require the development of a plastic holding device for the core samples, which SRC is currently developing.

In the past, PTRC's main areas of research and development have focused on heavy oil, which is still the largest hydrocarbon resource in Saskatchewan. This year, through the provision of an additional \$500,000 in funding from Innovation Saskatchewan, PTRC has begun the development of a tight/light oil program focusing on technologies and processes that could be field trialed in locations like the Bakken and Viking formations in the south of the province. The first discussions were undertaken this year between PTRC and the Saskatchewan Research Council, which has drawn together a consortium of smaller industry players currently operating in the Viking formation, to test different surfactants and additives to improve recovery. PTRC worked with both SRC and the Saskatchewan Geological Survey over ten years ago on a study that helped characterize much of the Viking formation. This new research will draw from that earlier knowledge, and work with field players to design possible trials of new processes to improve recovery.

03 Moving Forward on Cyclic Solvent Injection (CSI)

One of the focuses of PTRC's Heavy Oil Research Network (HORNET) has been bench-scale and numerical modeling work to optimize cyclic solvent injection processes in CHOPS and post-CHOPS reservoirs. Cyclic solvent injection is just as its name suggests - the injection of solvent into depleted reservoirs and a period of soaking, followed by solvent and oil extraction. This process repeats (thus, extraction becomes "cyclic"). In 2017-18, PTRC-funded research examined pressure gradients and gravity drainage data from actual solvent injection fields to better understand how the physics of CSI works. This study, combined with laboratory testing of CSI processes using different solvents like CO2 and methane, has led PTRC and its heavy oil industry sponsors to consider field trials involving different solvents and process configurations. CSI field trials are being discussed, and may begin before the end of 2020.

### 04 Aquistore Completes a Third Seismic Shoot since Injection Began

In March of 2018, Aquistore researchers completed a seismic shoot at the field site, using three different reception methods to help create an image of CO<sub>2</sub> in the reservoir 3.2 km below the surface. The project's 620-geophone seismic array, a downhole vertical seismic profile using a distributed acoustic fibre-optic line, and near surface distributed acoustic sensing (DAS) lines all received seismic waves that were set off from vibroseis vehicles and small dynamite charges. Earlier computer models of the plume are compared to the created image to confirm that the direction and movement of the CO<sub>2</sub> is in line with expected outcomes. Images from the March shoot (141 kT) are compared to earlier ones taken in the past two years (36 kT and 102 kT). PTRC's use of DAS lines for subsurface imaging has attracted significant investment and partnerships with mining and oil companies interested in discovering how the technology might reduce the costs of seismic imaging.



### 05

Aquistore AGM in Ottawa Integrates Research Results from over 30 Different Monitoring and Verification Technologies

The sheer volume of data and results that are provided from scientific field research poses a significant challenge for project managers. Aquistore is no different. With over 30 measurement, monitoring and verification technologies in operation at the field site, making sure that relevant data and findings are shared between researchers is crucial. Each year the Aquistore project hosts an annual general meeting where researchers share their findings to uncover ways in which the project's data complements or accentuates the overall work program. The Aquistore AGM – held September 11-13, 2017 in Ottawa – saw researchers networking with fellow scientists and industry and government sponsors. Researchers conducting public assurance monitoring measuring ground water, soil gas, seismic activity and potential ground deformation/ shifts - compared their results and found that deep CO<sub>2</sub> injection at the site is not in any way affecting the biosphere. Discussions about the most recent seismic imaging at the site and computer modeling of the reservoir done before injection led scientists to conclude the CO<sub>2</sub> is not moving in ways that are unexpected.



Aquistore Results Published in the International Journal of Greenhouse Gas Control (IJGGC)

As part of a commitment to disseminate its non-confidential research findings, PTRC collaborated with the editorial board of the IJGGC to produce a online supplement with results from the first few years of measurement and monitoring at the Aquistore project. 8 papers included work on risk assessments, 3D and 4D seismic profiling, passive seismic monitoring, soil gas measuring and other areas of interest. More information on the supplement can be found at the IJGGC site: *https://www. sciencedirect.com/journal/internationaljournal-of-greenhouse-gas-control/specialissue/108NZ2CBHX4* 

## Financials



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## 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, 2018, 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, 2018.

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 26, 2018.

### 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 26, 2018 Regina, Saskatchewan



Chartered Professional Accountants

# Petroleum Technology Research Centre Inc. Condensed Consolidated Statement of Financial Position For the year ended March 31, 2018

(C\$000s) Assets Cash Other Assets Total Assets

Liabilities and net assets Deferred revenue Other liabilities Total liabilities

Net assets

Total liabilities and net a

Petroleum Technology Research Centre Inc. Condensed Consolidated Statement of Operations and Unrestricted Net Assets For the year ended March 31, 2018

(C\$000s) Revenues recognized Government of Saska Government of Canad Industry funding Other funding Total revenue recognized

Expenses Projects Operations Total expenses

Excess of revenue (expe

Unrestricted net assets,

Unrestricted net assets,

2018	2017
\$6,509	\$6,143
1,103	902
7,612	7,045
3,822	4,218
1,128	97
4,950	4,315
2,662	2,730
\$7,612	\$7,045
	2018 \$6,509 1,103 7,612 3,822 1,128 4,950 2,662 \$7,612

	2018	2017
atchewan funding	\$1,556	\$1,821
ida funding	824	48
	2,070	1,713
	162	124
d	4,612	3,706
	2,859	2,210
	1,821	1,572
	4,680	3,782
ense)	(68)	(76)
beginning of year	2,730	2,806
end of year	\$2,662	\$2,730

Petroleum Technology Research Centre Inc. Condensed Consolidated Statement of Cash Flows For the year ended March 31, 2018

(C\$000s)	2018	2017
Net cash from operating activities	\$373	\$1,357
Net cash used in investing activities	(7)	-
Increase in cash	366	1,357
Cash, beginning of year	6,143	4,786
Cash, end of year	\$6,509	\$6,143

### 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, 2018 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.

## Collaborations

Canadian Natural Resources Ltd Chevron Devon Canada Energy and Environmental Research Centre (EERC) GeoForschungsZentrum (GFZ) Geological Survey of Canada Global Carbon Capture and Storage Institute Golder and Associates GroundMetrics Illinois Basin – Decatur Project Innovation Saskatchewan Institut national de la recherche scientifique (INRS) IEAGHĠ Japan Oil, Gas, Metals National Corporation (JOGMEC) Lawrence Berkley National Labs (USDOE) Natural Resources Canada Optasense Perm Inc. Prairie CO2 Reduction Partnersip (PCOR)

Saskatchewan Geological Survey Saskatchewan Ministry of Environment Saskatchewan Ministry of the Economy Saskatchewan Research Coun SaskPower Schlumberger Scottish CCS St. Francis Xavier University ble Development Technologies Canada (SDTC) CS Research Centre States Department of Energy (USDOE) University of Alberta University of Bristol University of Calgary University of Ottawa University of Regina University of Saskatchewan University of Strathclyde University of Texas Bureau of Economic Geo Weatherford

