



PTAC

**PETROLEUM  
TECHNOLOGY  
ALLIANCE  
CANADA**



**ANNUAL REPORT 2017**

# PTAC TECHNOLOGY AREAS

## IMPROVE OIL AND GAS RECOVERY

- Bitumen Recovery from Carbonate Reservoirs
- CO<sub>2</sub> Enhanced Hydrocarbon Recovery
- Coalbed Methane, Shale Gas, Tight Gas, Gas Hydrates, and other Unconventional Gas
- Conventional Heavy Oil, Cold Heavy Oil Production with Sands
- Conventional Oil and Gas Recovery
- Development of Arctic Resources
- Development of Remote Resources
- Emerging Technologies to Recover Oil Sands from Deposits with Existing Zero Recovery
- Enhanced Heavy Oil Recovery
- Enhanced Oil and Gas Recovery
- Oil Sands and Enhanced Oil Sands Recovery
- Tight Oil, Shale Oil, and other Unconventional Oil

## REDUCE CAPITAL, OPERATING, AND G&A COSTS

- Capital Cost Optimization
- Cost Reduction Using Emerging Drilling and Completion Technologies
- Cost Reduction Using Surface Facilities
- Digital Technologies: Automation, Artificial Intelligence, Blockchain, IOT, Analytics, Cyber Security
- Eco-Efficiency and Energy Efficiency Technologies
- Reduce Operating Costs Related to Energy and Chemical Consumption
- Technologies to Reduce Waste Energy

## IMPROVE VALUE-ADDED PRODUCTS

- Gasification
- Hydrocarbon Upgrading
- Hydrogen Generation
- Integration Petrochemicals, Refining, and Value-Added Opportunities
- Pipeline Transportation: Leak Detection, Spill Management, Nanotechnology for Flow Drag Reduction, Use of CO<sub>2</sub> as Diluent
- Transportation

## MANAGE ENVIRONMENTAL IMPACTS

- Air Quality
- Alternative Energy
- Ecological
- Emission Reduction / Eco-Efficiency
- Energy Efficiency
- Methane Detection, Reporting and Reduction Technologies
- Moving Towards a Low Carbon Economy
- Orphan Wells
- Reclamation/Remediation
- Resource Access
- Water
- Wellsite Abandonment

## ADDITIONAL PTAC TECHNICAL AREAS

- e-Business
- Digital Technologies
- Genomics
- Geomatics
- Geosciences
- Health and Safety
- Instrumentation/Measurement
- Nano Technologies
- Operations
- Photonics
- Production Engineering
- Remote Sensing
- Reservoir Engineering
- Security
- Telecommunications

## PTAC NETWORKS

- Alberta Upstream Petroleum Research Fund
- Clean Bitumen Technology Action Plan
- Methane Emissions Reduction Network
- Pipeline Network
- Pipeline Technology Action Plan
- Remote Sensing Network
- Resource Emission Management Technology Action Plan
- Support for Small and Medium-Sized Enterprises
- Technology for Emissions Reductions and Eco-Efficiency
- Tight Oil and Gas Innovation Network

# MESSAGE FROM THE BOARD

In 2017, our stakeholders were immersed in discussions surrounding international and local commitments to address climate change, the adoption of mandated emissions reduction targets, resource transportation challenges, finding solutions to reduce costs, and rapid shifts in the technology landscape. PTAC's ever-growing programs, partnerships, and collaborative projects helped bridge the gap between these seemingly competing priorities and demands. This past year, a surge in enrollment culminated with the highest PTAC membership levels in a decade, a signal that our industry is embracing the PTAC model of collaborative applied research and technology development to ensure a sustainable, responsible, and economically feasible Canadian hydrocarbon energy industry both now and in the future.

While methane-reduction was a major driver for research and technology development in 2017, PTAC concurrently pursued projects to improve oil and gas recovery, manage environmental impacts, improve value-added products, and reduce capital, operating, and G&A costs. In total, 48<sup>1</sup> new PTAC projects were launched in 2017, expanding our slate of active projects to a total of 98<sup>2</sup> ongoing initiatives. Thirty projects were also brought to completion in 2017, all of which are helping pave the way for a future low carbon economy, and significantly reducing environmental impact and cost, while adding value and increasing reserves and production. Increased support for field pilot demonstrations also helped bridge the gap that often prevents innovative technologies from advancing into the marketplace. In fact, seven of the new 2017 projects were launched in partnership with PTAC's ongoing Small & Medium Enterprise (SME) program. By heeding market pull rather than technology push, PTAC maintained alignment with industry needs and selected appropriate research and development projects in a variety of technology areas.

Methane emissions reductions continued to dominate the discourse among government, industry, and regulators in 2017. Mandated targets of reducing emissions by 45% (from 2012 levels) by 2025 spurred industry to seek innovative solutions. PTAC responded, bringing to bear our unique position as a trusted neutral-facilitator skilled at uniting diverse stakeholders in a common vision. Through 22 years of collaborative technology development, PTAC's consortia have developed numerous technologies that currently have the collective technology capacity, with future full industry uptake, to reduce overall methane emissions by over 30%<sup>3</sup>. Although this is significant progress towards achieving the technology capacity needed to meet the 2025 targets, there is still much work to be done. In 2017, PTAC launched 17 methane-related projects, established a new network

and information hub, and continued to participate in the Methane Emissions Reductions Oversight Committee, which was founded by the Alberta Energy Regulator to meet methane emissions reductions targets.

Expanding upon the existing Methane Research Planning Committee, an Alberta Upstream Petroleum Research Fund (AUPRF) subcommittee focused on accelerating research and technology development projects to support timely regulatory development, PTAC established the Methane Emissions Reduction Network. This network draws upon established PTAC committees and consortia to create an ideal platform that accelerates the commercialization of relevant, critical, and cost-effective methane-reduction technologies. The Methane Emissions Reduction Network will allow all stakeholders to freely access information related to methane initiatives and encourage and equip them to work together to align priorities, identify and address gaps, and avoid duplication.

The Methane Emissions Reduction Network's goal for 2017, was to unite and align R&D priorities for all stakeholders (i.e., Canadian oil and gas producers, innovators, technology providers, academia, R&D providers, financial institution, government, etc.) working on methane related initiatives. The Network serves as a central space to address gaps and accelerate the commercialization of relevant, cost effective technologies, which will assist in the effort to reduce methane emissions by 45% by 2025.

Our **VISION** is to help  
Canada become a global  
hydrocarbon energy  
technology leader.

The Methane Network began to work on the creation of a new online portal called the Methane Hub in 2017. The Methane Hub seeks to provide a "one-stop-shop" for methane detection, mitigation, and reporting which will allow industry stakeholders to get a quick, clear snapshot of all methane R&D and technology development in their area of interest, including previous studies, work currently underway, and what other players are working on in the area. The Network is working closely with CAPP and AUPRF committees on this project, and is set to fully launch in the first half of 2018.

<sup>1</sup> 32 AUPRF-funded and 16 non-AUPRF-funded. <sup>2</sup> 70 AUPRF-Funded and 28 non-AUPRF-funded. <sup>3</sup> It is important to differentiate between technology capacity and actual market uptake. Complete market uptake often takes years, if not decades, largely due to the time required for technology acceptance within an organization. This includes gaining acceptance from the executive level through to field operators, competition with other business opportunities, building a corporate innovation culture with respect to the adoption of new technologies, and assigning capital resources.

As the methane agenda touches a wide variety of industry areas, categories that once delineated PTAC's technology areas shifted as 2017 programs and projects realized the many benefits of increased cross-portfolio cooperation. One of PTAC's major initiatives, the 'Advanced Methane Detection, Analytics, and Mitigation' (AMDAM) cluster project, was launched under the NRCan Clean Energy Innovation program, a new formal partnership between Natural Resources Canada, PTAC, and others to support research to detect and reduce methane emissions in oil and gas production. The AMDAM initiative proved a catalyst for several joint-initiatives between PTAC's TERE program and AUPRF, as well as other technology area crossovers. The purpose of this project bundle is to demonstrate a portfolio of near-commercial clean technologies for the detection, analytics, and mitigation of methane emissions in the upstream oil and gas sector. All seven AMDAM projects are currently underway and will complete in 2019.

This past year, PTAC was proud to be one of the leading forces in the establishment of the Clean Resource Innovation Network (CRIN). CRIN unites Canada's oil and gas industry, innovators, technology vendors, academia, research institutes, financiers and government to promote investment in research and development. By aligning priorities, addressing gaps and incenting innovation, CRIN hopes to accelerate the commercialization of ground-breaking technologies. Innovation areas will be selected for the highest transformational impact and environmental improvements, while capturing domestic and international sales opportunities for small and medium enterprises. This will drive economic growth to ensure Canada's continued prosperity with new high-value jobs through spinoffs and economic diversification. Proposed technology focus areas include novel approaches to: carbon reduction, water use, methane emissions quantification and abatement, digitization, hydrocarbon extraction, well abandonment and site remediation. CRIN's mission to equip and empower Canada's oil and gas sector to deliver energy with a lower environmental footprint and higher productivity provides a competitive advantage and helps position our country to be the global leader in delivering clean, reliable, and affordable energy to the world. This goal aligns perfectly with PTAC's mission and vision. PTAC manages CRIN's methane portfolio, is an active member of the CRIN Executive Steering Committee, and continues to play a key role in expanding the network's outreach within industry. In 2017, PTAC began developing the CRIN Roadmap to establish a common understanding of the various innovation and research initiatives underway in Canada's clean tech and energy innovation.

PTAC continued to connect our expanding roster of members by reporting project results, providing opportunities for collaboration, sharing knowledge, and building our member community. PTAC's new website, launched in 2017, is providing members with better access to industry news, research and technology development opportunities, and PTAC projects, programs, and events. PTAC also hosted 30 events that ranged from small-scale technology information sessions and workshops to grand technology showcases and industry-wide conferences. These events brought together more than 1600 individuals from a variety of stakeholder groups, creating an enriching learning and networking environment for all participants.

PTAC has long advocated that the future of our industry depends upon collaborative innovation, and in 2017 we took the opportunity to reflect upon the impact of our more than 20 year history of R&D, and technology development. Having launched more than 600 projects since our inception, selecting only a few success stories was a challenging task as all projects have made significant contributions to improve environmental impact, safety, and financial performance of our industry. Following much consideration and consultation, some of the projects that were selected included: the Distributed Energy Efficiency Project Platform (DEEPP) by Cap Op Energy, the Low Pressure Vapour Combustor by Black Gold Rush Industries Ltd, the REMVue® AFR and SlipStream® Technologies by Spartan Controls, and the Solar Chemical Injection Pump by Trido Industries Inc. Collectively, these initiatives have: reduced GHG emissions by more than 850,000 tonnes of CO<sub>2</sub> per year, which is equal to taking 160,000 cars off the road annually, created a value savings for industry totaling over \$16M in operating costs, and created dozens of new jobs. We invite you to read more about these initiatives in the new 'Success Stories' section, included in this Annual Report.

Looking back at the challenges and opportunities of 2017, we are pleased to have so many exciting success stories to share, and so many PTAC members to share them with. This is due in no small part to the dedicated volunteers who serve on PTAC's Board of Directors, technical steering committees, networks, and project committees. Thank you for choosing PTAC's unique collaborative model to address challenges and develop innovative solutions for our industry.

**Soheil Asgarpour**  
Ph.D., FCAE, FCIM, P.Eng.  
President

**Randy Cormier**  
Chairperson

Our **MISSION** is to facilitate innovation, collaborative research and technology development, demonstration and deployment for a responsible Canadian hydrocarbon energy industry.

# KEY ACCOMPLISHMENTS

As the Canadian oil and gas industry began to stabilize in 2017, PTAC continued to align collaborative technology and R&D initiatives with industry drive to explore and adopt cleaner energy production in a low carbon economy. PTAC launched **48 new research and development projects and project phases** across all four PTAC technology areas.

## PROGRAMS

Working with our partners, PTAC continued to facilitate the Alberta Upstream Petroleum Research Fund (AUPRF), the Pipeline Abandonment Research Program, and the Small and Medium-sized Enterprises (SME) Innovation Program. Each of these programs helped launch new projects and encouraged collaboration that benefitted the Canadian hydrocarbon energy industry.

### AUPRF

PTAC continued to manage the Alberta Upstream Petroleum Research Fund (AUPRF) Program in 2017, addressing high-priority issues in Alberta's oil and gas industry. AUPRF facilitated 32 peer-reviewed environmental research projects on air, water, remediation and reclamation, biodiversity, and well-abandonment. Overall, the Program awarded \$3.1M in funding for research and technology development projects in 2017, leveraging significant additional project funding for a total of more than \$10.7M. The program contributed significantly to helping industry reduce costs, improve ease of operations, increase social license, and reduce regulatory impact on risk.

Given Provincial and Federal commitments to substantially reduce methane emissions by 2025, AUPRF prioritized methane-related research for 2017. The collaborative, multi-stakeholder AUPRF Methane Research Planning Committee (MRPC) continued to accelerate research and technology development projects that support timely regulatory development. Cognizant of the focus on methane in 2017, the MRPC fostered increased understanding between regulators and industry operators to help enable the fast-tracking of development activities, avoid the cost of adversarial hearings, and ensure a common understanding of the environmental impact of hydrocarbon development. The MRPC also explored projects offering solutions to help manage the extensive costs associated with new methane regulatory compliance.

The AUPRF Program continues to be a valuable asset to industry. The program's Reclamation and Remediation

Research Committee (formerly the Soil and Groundwater Research Committee) recently implemented three projects that collectively realized between \$15M-\$35M, in annual industry savings. AUPRF invested a combined total of just \$765K in these three projects. AUPRF also helped launch the Alberta Water Tool in 2017, an application that provides all stakeholders with open access to detailed hydrology information for every stream, river and lake in west-central Alberta. In 2017 alone, the Alberta Water Tool realized savings of more than \$5M. In total, these four AUPRF projects saved industry a minimum of \$20M in 2017. The program's track record clearly demonstrates that we can reduce costs while addressing and resolving social and environmental issues.

### SMALL AND MEDIUM SIZED ENTERPRISES (SMES)

PTAC continued to facilitate the Small and Medium-Sized Enterprise (SME) program in collaboration with the National Research Council of Canada-Industrial Research Assistance Program (NRC-IRAP) in 2017. Some of the industry's most ground-breaking innovations emerge from the SME sector, yet they often face significant barriers in bringing their ideas to market. PTAC's SME program helps SMEs navigate the Canadian hydrocarbon energy marketplace by bridging the gap between technology providers and potential customers. Through the program's events and networking opportunities in 2017, SMEs identified industry needs and tailored the alignment of their products and services based on industry requirements. SMEs with innovative near-commercial or deployment-ready technologies connected with operator support for demonstrations, field trials, and deployments. The increased market penetration and uptake of new technology is not only beneficial to the SMEs and producers involved, but bolsters industry's overall financial and environmental performance. Through the innovation support component of the program, PTAC also helped SME producers learn from successful implementations of innovative technologies among senior producers and invited them to explore scaled implementations in their own operations. Altogether, PTAC provided practical support

to 59 SMEs in 2017, and launched seven collaborative technology development projects.

PTAC hosted 17 vendor-specific Technology Information Sessions, two larger-scale information sessions, and two showcases in 2017. Each of these events focused on helping SMEs. The first information session raised awareness of the many commercial-ready technologies to improve the efficiency, cost and safety of operations that are currently available to junior and intermediate oil and gas producers. Eight providers of deployment-ready IT tools and technologies presented their solutions and answered questions about their technology. The second information session, held with support from NRCan and the CIPEC program, introduced the Canadian Upstream Oil and Gas Eco-Efficiency Handbook, highlighting deployment-ready equipment, technologies, operations, and best practices available to improve environmental performance and reduce costs. At the Mini Showcase of deployment-ready technologies, end-users were provided with access to information on available innovative environmental technologies from multiple organizations in a short amount

of time. The large SME Innovation Showcase, hosted in late 2017, invited more than 25 providers of deployment-ready, cost-effective environmental and efficiency-improvement technologies to set up exhibits that highlighted the benefits of their solutions while building business relationships with event attendees. Numerous SMEs also benefitted from presenting at PTAC-facilitated Technology Information Sessions throughout the year.

#### PIPELINE ABANDONMENT RESEARCH PROGRAM

PTAC's Pipeline Abandonment Research Program is a multi-year research program focused on the sustainable development of the Canadian pipeline industry. The program was established in 2012 following an MOU signed with the Canadian Energy Pipeline Association (CEPA) and is administered through the multi-stakeholder Pipeline Abandonment Research Steering Committee (PARSC). Projects continued to be a major focus for PARSC in 2017. The committee launched three new projects, continued work on another three, and completed a study of the water conduit effect in abandoned pipelines. The results of the study are publicly available via the PTAC website.

(L-R) Award Recipient: Sean Hiebert, Cenovus Energy (Previously ConocoPhillips), Award Presenter: Randy Cormier, Nexen Energy ULC

(L-R) Award Recipients: Mike Crabtree and Laurier Schramm, Saskatchewan Research Council, Award Presenter: Dave Collyer



## PARTNERSHIPS

The Saskatchewan Research Council, in conjunction with PTAC and Western Economic Diversification, continued to execute the Centre for the Demonstration of Emissions Reductions (CeDER) initiative in 2017. CeDER is a mobile test facility which allows for companies to field test and demonstrate their innovative air emissions reduction technologies in real-world situations. Designed to accelerate industry adoption of practical and economic technologies, the CeDER mobile facility offers independent, industry-recognized, third-party certification for technology applications. Project activities in 2017 included engineering design and the start of trailer construction, as well as meetings and support to SMEs who would benefit from the facility once constructed. PTAC also collaborated with Saskatchewan Research Council to submit funding applications for further development of CeDER in 2018 and beyond.

## PROJECTS

Innovative technology development projects are central to PTAC's mission. In 2017, PTAC facilitated a slate of 98 active projects spanning multiple technology areas. Forty-eight new projects were launched, while work continued on many ongoing initiatives. Thirty PTAC projects were completed in 2017. The PTAC collaborative model effectively leverages both funding and the varied expertise of a diverse membership to rapidly move innovative technologies from concept to implementation and commercialization. In 2017, PTAC launched, continued, and completed projects in each of the four technology areas.

### IMPROVE OIL AND GAS RECOVERY

PTAC's 'Improve Oil and Gas Recovery' technology area focuses not only on developing new methods to more effectively extract both conventional and unconventional hydrocarbon resources, but does so while mitigating environmental impact.

Building upon a successful proof-of-concept study that PTAC completed in 2016, PTAC launched the field trial of the Submerged Combustion Vaporizer (SCV) for Enhanced Oil Recovery. This project will demonstrate the technology in post-CHOPS reservoirs.

PTAC also completed the Tight Oil and Shale Gas Innovation Roadmap in 2017, proposing an initial blueprint for future technology investments in the tight oil and shale gas sector. This publication, available to the public via the PTAC website, is raising awareness of the potential for scientific research and technology development related to multistage hydraulic fracturing in unconventional tight oil and shale gas resources. The roadmap is already helping members of industry, government and academia address challenges and opportunities.

### MANAGE ENVIRONMENTAL IMPACTS

More than ever before, Canada's hydrocarbon energy industry is focused on mitigating environmental impacts and reducing GHG and methane emissions. PTAC's 'Manage Environmental Impacts' technology area dominated the 2017 project roster, with several projects rooted in other technology areas experiencing crossover with enhanced emissions reduction goals. In addition to 32 AUPRF research projects, PTAC launched 11 new projects in this technology area in 2017. PTAC simultaneously continued to pursue many ongoing collaborative research and technology development projects in this technology area.

Nine of the new projects were part of PTAC's TERE portfolio. The first project, "Technology Opportunities for Environmental Performance Improvements and Cost Reduction in the Alberta Oil and Gas Sector", will identify near-term opportunities for the demonstration and implementation of deployment-ready technologies, especially those from SMEs, that improve environmental performance and reduce costs in the oil and gas sector. The second project, "Area Methane Detection Using Work

Trucks", was launched in partnership with NRCan and CEI. This project will demonstrate, field test, and validate an advanced proprietary methane detection technology mounted on work trucks to cost-effectively identify and measure methane emissions spanning wide areas in oil and gas facilities. This technology is expected to provide a low-cost solution to manage field-wide ambient air monitoring to better identify and address unplanned emissions. Thirdly, PTAC launched a demonstration project for the prototype development and demonstration trial of the new PureJet waste gas treatment technology. Working with Alberta-based technology company Atlantis Research Labs and Husky Energy, the project will first trial the PureJet20 prototype at a Husky sweet CHOPS site and will subsequently trial the PureJet100 prototype at another Husky-operated CHOPS site. This project, titled the "Targeted PureJet Incinerators for Methane Challenges", was funded by Emissions Reduction Alberta (ERA), and is expected to conclude with a final report to the public in 2019.

PTAC also launched the "Advanced Methane Detection, Analytics, and Mitigation" (AMDAM) cluster project under the NRCan Clean Energy Innovation program, a new formal partnership between Natural Resources Canada, PTAC, and others to support research to detect and reduce methane emissions in oil and gas production. Driven by the Canadian government policy to reduce methane emissions by 40% to 45% by 2025, AMDAM will demonstrate a portfolio of near-commercial clean technologies for the detection, analytics and mitigation of methane emissions in the upstream oil and gas sector. The following seven new projects make up the AMDAM cluster, all of which were launched in 2017 and are expected to complete in 2019.

The "Advanced Methane Measurements using Novel Ground-based and UAV-based Sensors" project involves demonstration trials at an Encana site of a novel General Electric (GE) methane sensor system deployed using a ground-based platform and a UAV platform including tools and analytics for detecting leaks and emissions.

The "Methane Emission Measurement using UAVs" project will work with the University of Calgary to develop intelligent flight planning tools and algorithms to support fugitive emission localization using two different UAV-based methane detection technologies.

The "Satellite Detection of Change Algorithm for VOCs" project will develop an algorithm to use high-resolution satellite data to detect changes in emissions of methane and other volatile organic compounds (VOCs). The project will be carried out by St. Francis Xavier University with data from Cenovus Energy. This new algorithm is expected to improve the detection of emissions changes by enabling fast monitoring over wide areas.

The "Methane Abatement Project Platform Analytics (MAPP

Analytics)” project will build upon PTAC’s successful DEEPP and MAPP platforms, building and integrating methane analytical tools compatible with the Petrinex reporting system. This project is being completed by Cap-Op Energy.

The “Methane Advisor” project will partner with Process Ecology and Polar Star to demonstrate the accuracy of the Methane Emissions Advisor™ software in calculating methane, VOC and GHG emissions. The software is expected to be as accurate, or more accurate, than current emission factor/spreadsheet-based estimations of emissions. The project will identify the best opportunities for emissions reductions through analytics and improve the ease of operations.

The “Solar Instrument Air Compressor” project will demonstrate LCO Technologies’ prototype small air compressor with low energy requirement. This new technology is expected to reduce the power budget and cost of instrument air for the elimination of venting.

The “Improved Solar Electronic Control System” project includes Repsol’s demonstration of the improved Calscan electric solution (including “fail safe” electric emergency shutdown) for replacing pneumatics and eliminating methane venting, as well as a comparative evaluation of solar pumps.

Finally, PTAC played a key role in helping launch the Clean Resource Innovation Network (CRIN) in 2017. CRIN is an innovation ecosystem consisting of a network of industry stakeholders, including producers, technology providers, service and supply companies, academia, government organizations, and many others who share a common goal to increase the competitiveness of Canada’s hydrocarbon energy industry in a clean and responsible manner. PTAC is an active member of the CRIN Executive Steering Committee and plays a key role in expanding the network’s outreach within industry. CRIN does not launch R&D projects, rather the network aligns research and technology priorities to address gaps and increase innovation, enabling organizations like PTAC to facilitate and manage relevant projects. In 2017, PTAC helped launch the ‘CRIN Roadmap’ project to establish a common understanding of the various innovation and research efforts underway regarding clean tech and energy innovation in Canada.

PTAC’s TERE committee concluded two projects in the summer of 2017. The “Analysis and Reporting of a Trial of Gas Pro Compression BTEX VRU for Energy Efficiency and Emissions Reduction” project. The final report was drafted in July 2017, and results were shared with a broad audience at PTAC’s annual Air Forum in Fall 2017. The “Canadian Upstream Oil & Gas Eco-Efficiency Handbook” details field-deployable technologies and serves as an informative checklist to create better standards and consistent practices that industry can refer to when installing new builds or completing upgrades and expansions on well sites. Although the handbook was originally assembled in parallel as two separate components that respectively focused on equipment and best management practices, the steering committee soon recommended that the components be

combined. With funding from NRCan, PTAC published the Canadian Upstream Oil and Gas Eco-Efficiency Equipment and Operations Handbook to the PTAC website for industry access in August 2017. The Handbook is helping operators, asset managers, and project managers make efficient and cost-effective equipment selections, and providing them with informative operations optimization strategies for their facilities. The Handbook also serves as a rationale for facilities engineers and asset managers to advance sustainability objectives by using components that result in improved performance; many of these may have otherwise been overlooked because the benefits are not perceived to compensate for the additional costs in the short term. The Handbook also includes information on operational procedures and optimization strategies to assist operators in maximizing energy efficiency and emissions reduction benefits.

The Alberta Upstream Petroleum Research Fund (AUPRF) Program was also able to bring 25 environmental research projects to conclusion in 2017.

### IMPROVE VALUE-ADDED PRODUCTS

PTAC understands that industry stakeholders are always looking to get the most out of our world-class hydrocarbon resources, and the “Improve Value-Added Products” technology area explores research and technology development opportunities to enhance the value of oil and gas products and services.

Three new projects were launched under the direction of PTAC’s Pipeline Abandonment Research Committee (PARSC). The “Recommended Long-Term Monitoring Program from All Aspects of an Abandoned Pipeline” project will develop a recommended practical, risk-based long-term monitoring program for all aspects of an abandonment project. This recommended program will provide a common starting point for specific detailed work by pipeline operators and stakeholders, addressing both typical and special situations that may be encountered. The project will help pipeline operators, regulators and land owners when they are developing, reviewing and choosing a detailed long-term monitoring program in a specific abandonment project. The “Review of Previous Pipeline Abandonment Programs (Farmland) Project” will review the current state of pipelines that were abandoned more than 10 years ago to evaluate outcomes achieved by the various iterations of the abandonment program. This project will focus on specific pipeline segments that have not previously been addressed<sup>4</sup>. The results of this project will provide insight into the effectiveness of past programs and help inform future development. The “Analysis of Pipeline Exposure Data and Scoping Review of Exposure Scenarios” project seeks to improve understanding of the potential causes or scenarios that result in exposure of abandoned pipelines. Although these projects were categorized under “Improve Value Added Products, they experienced significant cross-over with the “Manage Environmental Impacts” technology area.

PTAC also made significant progress on ongoing PARSC initiatives in 2017. The “Review of a Previous Pipeline



Abandonment Program” project continued to examine the condition of three 20-inch diameter pipeline segments and their associated right of way, which were abandoned ~40 years ago. The study is using findings to evaluate abandonment programs and measure the validity of pipeline abandonment assumptions currently used in the industry.

Work also continued on the “Risk-Based Decision-Making Framework for Pipeline Abandonment” project, developing a framework to guide hazard and risk-based decision making by operators during the planning phases of pipeline abandonment and development of abandonment plans. The “Study of the Potential Impact of Power Lines on Corrosion of Abandoned Pipeline” project continues to review the technical literature and the state of knowledge concerning the influence of electromagnetic fields from power lines on accelerated corrosion for pipelines abandoned in place. Finally, PARSC’s “Recommended Practice for Cleaning Pipelines for Abandonment” project continued to develop recommended practices for cleaning of pipelines for abandonment.

Through PARSC, PTAC completed the “Study of the Water Conduit Effect in Abandoned Pipelines” project in 2017. This study reviewed the existing body of knowledge on water conduits and their potential environmental impacts and explored appropriate use of mitigation measures on abandoned pipelines, including but not limited to physical segmentation. PARSC analyzed the current knowledge base to determine what, if any, water conduits have historically been identified, their effect and what mitigation strategies have been or could be employed to address them. The project’s purpose was to distinguish between actual case studies and theoretical considerations for water conduits. The high-level positive and negative factors of mitigation measures have been outlined based on the research and the experience of the team members, and the analysis of the literature has also highlighted key gaps and steps that could be taken to address them. The project results report is published on PTAC’s website.

<sup>4</sup> The Project will investigate segments of the Enbridge Line 3 between Edmonton and Hardisty that were abandoned in the 1978-1980 timeframe. Pipe diameter is 34 inches, and the abandoned sections are from 0km-51.1km and 116km to 139km, with a section that was completely removed from 136.7km to 139.9km along Enbridge’s main ROW.

## REDUCE CAPITAL, OPERATING, AND G&A COSTS

PTAC’s Methane Emissions Reduction network launched the “Methane Hub” project under the joint portfolios of ‘Manage Environmental Impacts’ and ‘Reduce Capital, Operating, and G&A Costs’. PTAC began formulating a website with guidance from AUPRF’s Air Research Planning Committee (ARPC) and Methane Research Planning Committee (MRPC), and intends to launch the website in the first half of 2018. The initial purpose of the Methane Hub was to help industry contacts within the PTAC network understand the differences between current, complete and proposed PTAC projects, how they relate to each other, who the project partners are, and what stakeholder groups/committees are supporting the projects. In 2017, the project began preparations to expand outside of the PTAC network and will include methane information obtained from a range of sources such as funding organizations, research institutes, academia, industry associations, oil and gas operators, and governments.

PTAC also continued to work on the “Passive Acoustics Monitoring for steam chamber monitoring” project in 2017, currently taking place at Cenovus through in-kind contributions.

Three projects were completed in the “Reduce Capital, Operating, and G&A Costs” technology area in 2017, including the “Analysis and Reporting of a Trial of Gas Pro Compression BTEX VRU for Energy Efficiency and Emissions Reduction” project and the “Canadian Upstream Oil & Gas Eco-Efficiency Handbook”, both of which were joint-endeavours also included under the “Manage Environmental Impacts” portfolio. The “Online Oil in Water Analyzer in Thermally Enhanced Heavy Oil Recovery” project was also completed in December 2017, with the final report set for release in 2018.

## EVENTS

The success of PTAC programs and projects is rooted in multi-stakeholder collaboration. PTAC events inform and encourage cooperation and collaboration among a diverse membership, and often provide initial introductions and relationships that prove foundational for future project work. Forums communicate the results of completed research, introduce industry to new projects, and provide updates on ongoing research. Workshops encourage stakeholders to roll up their sleeves and work together to address shared challenges. Technology Information Sessions (TISs) showcase new technologies and highlight opportunities for collaboration. During 2017 PTAC facilitated:

- 21 Technology Information Sessions attended by nearly 750 participants
- 4 forums that attracted more than 650 participants
- An AGM attended by 113 PTAC members and key stakeholders
- 4 workshops that engaged nearly 180 stakeholders in meaningful discussion

# 2018 OUTLOOK

Looking forward to 2018, PTAC's target is to ensure that by 2020, our industry has the technology capacity to reduce methane emissions by 45%, and by 2030, has the capacity to reduce levels by 85%. PTAC expects that the focus of 2018 will remain largely on mitigating the environmental impact of the oil and gas industry, notably the reduction of methane and other GHG emissions. Building on the success of 2017 initiatives, PTAC has already secured several projects, program expansions, and events for 2018.

Within the 'Manage Environmental Impacts' portfolio, PTAC will work with industry, government, and innovators to reach methane emissions targets. All seven of the projects that make up the AMDAM cluster project will proceed throughout 2018. It is anticipated these projects will conclude in 2019. PTAC's Methane Hub online portal will go live in the first half of 2018, further equipping members to understand the current methane-reduction technology landscape and providing up to date, relevant information surrounding methane initiatives within our industry. In addition, the AUPRF Program will continue to address methane emissions reductions as a specified subject area within their 2018 research initiatives.

In addition to methane reduction, PTAC will pursue several other environmentally-focused projects. PTAC will continue to administer and manage the AUPRF Program in 2018. Following the selection process, which will be completed in early 2018, a full slate of practical science-based research projects will be launched addressing ecology, air, remediation and reclamation, water, well abandonment, and methane. Under the oversight of the TERE committee, PTAC will complete semi-annual updates to the Canadian Upstream Oil and Gas Eco-Efficiency Equipment and Operations Handbook. A revised edition of the online publication will be made available on the PTAC website in 2018. PTAC also plans to launch a network solely dedicated to digital technologies for oil and gas, which includes IOT, blockchain, artificial intelligence, machine learning, cyber security, etc.

Working in conjunction with the Saskatchewan Research Council and Western Economic Diversification, PTAC will continue to execute the CeDER mobile test facility in 2018. The CeDER trailer will be constructed and commissioned in 2018, and it is anticipated that the first field trials with the mobile facility will take place before the end of the year.

Balancing the significant emphasis on mitigating environmental impacts and reducing methane emissions, PTAC will also explore projects in other technology areas such as tight oil and gas, pipelines, remediation, and cost reductions.

PTAC's Tight Oil and Gas Innovation Network continues to facilitate innovation in this growing unconventional production sector. Currently, the extraction of resources from deep tight oil reservoirs is hampered by pressure limitations. In 2018, PTAC will complete and submit a proposal for Federal and Provincial funding for the development of a multilateral junction tool that can withstand the pressures associated with hydraulic fracturing. PTAC will work with its industry stakeholders working in tight oil to develop and design the tool, with the possibility of future pilot testing. This technology will reduce drilling and surface facility costs, lower GHG emissions, and mitigate land disturbance from the exploitation of deep tight oil wells.

Within the 'Improve Value-Added Products' portfolio, PTAC's Pipeline Abandonment Research Program will make significant progress in 2018. PARSC is poised to complete six research and technology development projects and disseminate the results, and is planning to launch several new projects throughout the year.

PTAC will continue to provide opportunities for members to learn about research results, explore new ideas, and network with one another in 2018. A large-scale technology showcase is planned for Fall 2018, which will not only provide service and supply companies and SMEs with a unique opportunity to highlight their technologies and services but also give operators a chance to explore a broad range of possible technology solutions. PTAC will also host a GHG reductions forum highlighting the latest research and technology applications available, and a workshop on wellbore integrity is also slated to take place in early 2018. In addition, PTAC will offer a variety of technology information sessions throughout the year, providing a platform for members (especially SMEs) to share the latest innovations and opportunities for collaboration.

No matter what new challenges and exciting opportunities the coming year holds, PTAC will continue to apply our proven collaborative model to develop and implement transformative technology, and pursue innovation that leads to positive economic, social, and environmental changes.

# SUCCESS STORIES

Over the past 22 years, PTAC has launched hundreds of collaborative research and technology development projects. While this work has resulted in many successful outcomes, the results of some projects far exceeded our expectations. The lasting impact these technologies continue to have on the oil and gas industry is a testament to the ingenuity and dedication of our PTAC members, and the power of collaborative innovation.

## **DISTRIBUTED ENERGY EFFICIENCY PROJECT PLATFORM (DEEPP) – BY CAP-OP ENERGY**

*Initial R&D investment through PTAC facilitated projects was approximately \$1,000,000. Additional investments of \$750,000 were provided by other industry partners.*

Using our collaborative model, PTAC brought together industry funding to develop the Distributed Energy Efficiency Project Platform (DEEPP). DEEPP provides operators with a digital platform to efficiently store asset performance data and quantify emission offset credits. Since the project began in 2012, the platform has quantified and registered over 250,000 tonnes of CO<sub>2</sub>e offset credits worth \$7.5M, which were associated with fuel gas savings of 46.6M m<sup>3</sup> (valued at \$4.28M). This has resulted in cost reductions of more than 35% for operators who have used the platform, and has led to the successful creation of two new jobs under Cap-Op Energy. Cap-Op projects 2017 cost savings at \$2.7M and fuel gas savings at approximately \$307K.

## **THE REMVUE® AFR AND SLIPSTREAM® TECHNOLOGY – BY SPARTAN CONTROLS**

*Initial R&D investment through PTAC facilitated projects was approximately \$400,000. Additional investments of \$2,600,000 were provided by other industry partners.*

REMVue® AFR is an advanced air-fuel ratio control system for performing a rich-to-lean conversion, as well as engine control and optimization. The system can be configured as an effective stand-alone control system, or can be integrated to work in conjunction with other hardware/software systems like the SlipStream® vent capture to make the most effective impact. The SlipStream® technology captures vented hydrocarbons and safely re-directs these gases into the air intake of a reciprocating engine in a controlled manner that allows the vent gas to be used as a supplemental fuel source (the vented gas is completely destructed in the engine, while also helping to reduce the fuel usage from the primary fuel supply). To date, Spartan's REMVue® and SlipStream® technologies have helped customers save approximately \$290M in operating costs, and have removed a total of 5.9M tonnes of CO<sub>2</sub>e from the environment, which translates to removing 1,000,000<sup>1</sup> cars from the road for 1 year.

<sup>1</sup>Calculated based on an average of 5 tonnes CO<sub>2</sub>(e) per vehicle per year.

## **SOLAR CHEMICAL INJECTION PUMP – BY TRIDO INDUSTRIES INC.**

*Initial R&D investment through PTAC facilitated projects was approximately \$100,000. Additional investments of \$120,000 were provided by other industry partners.*

Trido Industries Inc. entered the market for solar equipment to replace pneumatic powered pumps and instrument air in 2009. Their system used the latest in permanent magnet DC motors and controllers, proving to be up to 50% more efficient than the existing equipment. Then Trido joined PTAC. After presenting their technology at a Technology Information Session, Trido secured and performed several field demonstrations and sales began to grow. Since commercializing the technology, TRIDO has installed about 1,500 of its solar-power systems, powering approximately 2,500 pumps throughout Western Canada and the U.S. In the process, TRIDO has built a loyal customer base that includes Encana, Shell Canada, Cenovus Energy, Husky Energy and Peyto Exploration & Development. The technology is helping companies boost performance and improve environmental outcomes. Compared to older solar technologies, the new pump draws less power, requiring fewer solar panels and batteries. Estimates show that current installations are preventing approximately 200K tonnes a year of GHGs from being emitted—about 125 tonnes CO<sub>2</sub>e per pump.

## **THE LP VAPOUR COMBUSTOR – BY BLACK GOLD RUSH INDUSTRIES LTD**

*Initial R&D investment through PTAC facilitated projects was approximately \$140,000. Additional investments of \$1,000,000 were provided by other industry partners.*

Black Gold Rush Industries' (BGR) LP Vapour Combustors eliminate volatile organic compounds (VOCs) and BTEX emissions from industry operations. Collaborating through PTAC's TERE committee, industry invested in pilot projects to test the technology and accelerate industry uptake. Specific applications are being piloted with Canadian operators, which has resulted in more than 38,500 tonnes of CO<sub>2</sub>e offset credits per year (valued at \$1.156M per year) and the creation of 12 new jobs in 2017.

# PROJECTS OR NEW PROJECT PHASES LAUNCHED IN 2017

AUPRF's Reclamation and Remediation Research Committee recently implemented three projects that **collectively realized between \$15M-\$35M**, in annual industry savings. AUPRF invested a combined total of just \$765K in these three projects.

## IMPROVE OIL AND GAS RECOVERY

- Field Trial of the Submerged Combustion Vaporizer (SCV) for Enhanced Oil Recovery\*

## MANAGE ENVIRONMENTAL IMPACTS

- Advanced Methane Detection, Analytics and Mitigation Project
  - Phase 1.1 – Advanced Methane Measurements using Novel Ground-Based and UAV-based Sensors^
  - Phase 1.2 – Methane Emission Measurement using UAVs
  - Phase 1.3 – Satellite Detection of Change Algorithm for VOCs
  - Phase 1.4 – Methane Abatement Project Platform (MAPP) Analytics\*
  - Phase 1.5 – Methane Advisor\*
  - Phase 2.1 – Solar Instrument Air Compressor\*
  - Phase 2.2 – Improved Solar Electronic Control System\*
- Area Methane Detection Using Work Trucks
- Targeted PureJet Incinerators for Methane Challenges\*
- Technology Opportunities for Environmental Performance Improvements and Cost Reduction in the Alberta Oil and Gas Sector\*
- Clean Resource Innovation Network (CRIN) Roadmap

## REDUCE CAPITAL, OPERATING, AND G&A COSTS

- Methane Hub+

## IMPROVE VALUE-ADDED PRODUCTS

- Analysis of Pipeline Exposure Data and Scoping Review of Exposure Scenarios Project
- Recommended Long-Term Monitoring Program for all Aspects of an Abandoned Pipeline
- Review of Previous Pipeline Abandonment Programs (Farmland) Project

\*These projects were launched in concert with PTAC's SME program  
+ This project is jointly under the 'Reduce Capital, Operating, and G&A Costs' and 'Manage Environmental Impacts' technology areas  
^ These projects are a joint initiative between PTAC's TERE and AUPRF programs

## AUPRF

### Air Research Planning Committee

- Advanced Methane Measurements using Ground-Based and UAV-Based Sensors
- Aerial Emissions Detection and Mapping
- Airborne 3D Gas Imager Aerial Verification
- Development of a Highly Repeatable and Auditable, Cost-Effective Monitoring System to Locate and Quantify Emissions via Small Unmanned Aerial Systems
- Fugitive Emission Management Program (FEMP) Effectiveness Assessment – Phase IA
- Fugitive Emission Management Program (FEMP) Effectiveness Assessment – Phase IB
- Fugitive Equipment Leak Emission Factors with Advanced Monitoring and Detection Methods
- Methane Hub
- Mobile Methane Sensing Analytics for Emissions Reduction
- NSERC FlareNet Strategic Research Network
- Pilot Measurements Study for Quantifying Methane Emissions at Upstream and Midstream Oil and Gas Facilities
- Pneumatic Vent Gas Measurement
- Verification of Quantitative Optical Gas Imaging System

### Ecological Research Planning Committee

- Canada Warbler Response to Vegetation on Recovering Energy Sector Disturbances – Year 2
- Caribou Range Restoration Project: 10 Year Follow-Up Monitoring of Naturally Regenerating Seismic Lines in West Central Alberta
- Development of Remote Sensing Techniques for Regional Reclamation Monitoring of Peatlands in Alberta – Phase 2
- Efficient Monitoring of Wildlife Responses to Seismic Line Restoration in the Algar Habitat Restoration Program
- Optimization of Cost-Effective and Functionally Effective Vegetation Management Solutions for Forest Reclamation
- Redefining Designable Units (DUs): Mountain and Boreal Caribou in Alberta and BC – Phase 2



(L-R) Award Presenter: Deputy Minister Colleen Volk, Alberta Department of Energy, Award Recipient: Leah Davies, Canadian Natural Resources Ltd.



(L-R) Award Recipient: Dave Hoffman, Enbridge, Award Presenter: Randy Rudolph, Millennium EMS Solutions

#### Reclamation and Remediation Research Committee

- Development of a Chloride Water Quality Guideline Based on Hardness and Consideration for Cation Toxicity
- Low Probability Receptor Technical Reports
- Regional Approach to Assessment Background Soil Quality
- Regulatory Approval of Risk Assessment Tools
- Salt Affected Soils: Quantifying Impacts to Develop Scientifically Based Remediation Criteria for Alberta

#### Water Innovation Planning Committee

- Alberta Water Tool
- ENE Tool - Phase 2B

- Scientific Evaluation and Interpretation of Baseline Groundwater Well Testing Data Available for Alberta - Year 2 of 2
- Surface Water Diversion Website Update
- Water Sources Data Centralization Project

#### Well Abandonment Research Initiative Committee

- Definitive Gas Migration Testing: Comparative Assessment of Different Gas Migration Testing Techniques and Field Instrumentation
- Methane Emissions – Human and Ecological Health Risk based Ranking and Prioritization Tool
- Plug and Abandon Strategies for Canada's Oil & Gas Wells

## IN 2017, PTAC FACILITATED 16 TECHNICAL STEERING COMMITTEES

#### MANAGE ENVIRONMENTAL IMPACTS

- Alternative Energy Solutions Committee (AESC)
- Air Research Planning Committee (ARPC)
- Analysis and Reporting Trial of the Gas Pro Compression BTEX VRU Project Steering Committee (ARTGPC)
- AUPRF Management Committee (AUPRF)
- Canadian Upstream Oil and Gas Eco-Efficiency Handbook Project Steering Committee (CUHB)
- Ecological Research Planning Committee (ERPC)
- Methane Research Planning Committee (MRPC)
- Remediation Reclamation Research Committee (Formerly Soil and Groundwater) (RRRC)
- Technology for Emissions Reduction and Eco-Efficiency Steering Committee (TEREE)
- Technology Opportunities for Environmental Performance Improvements and Cost Reduction in the

Alberta Oil and Gas Sector – Request for Technologies Steering Committee (EPICR)

- Well Abandonment Research Initiative Committee (WARI)
- Water Innovation Planning Committee (WIPC)

#### IMPROVE OIL AND GAS RECOVERY

- Artificial Reservoir Project Steering Committee (ARPSC)
- Froth Treatment Consortium (FTC)

#### IMPROVE VALUE-ADDED PRODUCTS

- Pipeline Abandonment Research Steering Committee (PARSC)

#### SMALL AND MEDIUM ENTERPRISES

- IRAP / SME Innovation and Technology Commercialization in the Hydrocarbon Industry (SITC)

# MEMBER SERVICES

PTAC offers members a variety of opportunities to become involved in innovation, research and development, demonstration, and deployment initiatives that advance the Canadian hydrocarbon energy industry.

## **FACILITATING: Projects**

PTAC provides industry with a neutral forum to work in collaboration with one another, leveraging collective experience and expertise to identify opportunities, challenges, and potential solutions that require research and/or technology development. These discussions can lead to joint-industry projects where PTAC, as a neutral facilitator, assists with soliciting proposals and launching projects through a fair and balanced process. PTAC also identifies existing R&D to raise industry awareness and minimize duplication. PTAC may also provide up to 15% seed money to help move projects forward.

## **CONNECTING: Technology Information Sessions**

As a service to members, PTAC facilitates Technology Information Sessions (TISs) for interested companies. TISs offer member companies an opportunity to present new technologies or research and development projects to solicit interest, gather feedback, invite participation, or seek potential funding. These sessions provide benefits to both the presenting company and those in attendance. Connections are made that help both the presenters and those in attendance identify industry partners to complete proposed research or technology development, such as field tests or pilot sites. TISs also provide a targeted opportunity to report back to industry on field test or pilot results and provide information on new technology-related services. For PTAC's service and supply members, a PTAC TIS can also be an excellent method of marketing new technology to the Canadian oil and gas industry.

## **COMMUNICATING: Streamlined Communications**

PTAC's streamlined communications strategy has reduced the number of broad email blasts being sent to our members by replacing individual event notifications with an opt-in bi-monthly newsletter. This electronic publication highlights current PTAC project opportunities, new technologies, member news, upcoming events, and other initiatives addressing current industry current trends and needs.

## VOLUNTEER RECOGNITION AWARDS

2016 Service Awards (Presented at 2017 Annual General Meeting)

PTAC's volunteers are second to none, and we are pleased to recognize the outstanding service of those who go above and beyond. Award nominees are selected by a panel of their peers.

### **CORPORATE LEADERSHIP AWARD**

Encana Corporation

### **CHAIRPERSON'S AWARD**

Sean Hiebert, ConocoPhillips Canada

### **SERVICE AWARD**

Jonathan Matthews, COSIA

### **SOIL AND GROUNDWATER RESEARCH LEADERSHIP AWARD**

Debbie Tainton, Canadian Natural Resources Limited

### **COLLABORATIVE SPIRIT AWARD**

Saskatchewan Research Council

### **COMMERCIALIZING OF SME TECHNOLOGY AWARD**

Black Gold Rush Industries

### **LIFETIME ACHIEVEMENT AWARD**

David Rushford

### **OUTSTANDING SERVICE AWARDS**

Mark Johnstone

Nick McKenna, ConocoPhillips Canada

### **ECOLOGICAL LEADERSHIP AWARD**

Scott Grindal, ConocoPhillips Canada

### ENGAGING: Forums and Workshops

Focusing on broader needs or larger technical areas, PTAC forums are comprised of presentations detailing new technologies, case studies, and the objectives and results of current research. The goal of PTAC forums is to bring together the most up-to-date information from across the industry into an enriching learning experience. PTAC workshops provide opportunities for participants to work collaboratively in focused groups to clearly define research and development issues, identify potential solutions, and select the best approach to move forward. Workshops provide a venue for industry members to candidly share their needs so that R&D providers hear about issues firsthand. Solutions are formed by leveraging the collective expertise and ideas of all participants, while protecting proprietary interests. PTAC hosts all workshops and is pleased to provide the necessary facilitation, administrative support, and coordination to launch projects once identified.

### INFORMING: Knowledge Centre

The PTAC Knowledge Centre provides public access to non-proprietary technical information on commercially available oil-and-gas-related technologies pertinent to the hydrocarbon energy industry. The Knowledge Centre offers advice on access to technical databases to meet the educational, informational, and technical needs of the user community.

The Knowledge Centre provides services to SMEs, technical steering committees, project performers, researchers, and others to help identify technologies and research needs, avoid duplicate research, and monitor industry trends. Services for PTAC members include advice on technical document and journal article retrieval and contact information for subject experts in industry, government, and academia. PTAC members are invited to provide non-proprietary technical information on their technologies to PTAC for inclusion in the digital Knowledge Centre. Relevant materials are accepted on an ongoing basis.

### COLLABORATING: Technical Steering Committees

PTAC Technical Steering Committees consist of PTAC members representing various industry sectors, governments, and non-governmental organizations. These technical steering committees work to identify opportunities for collaborative research and technology development, raise awareness of existing research and technology through planning events, find solutions to challenges through the process of soliciting proposals and launching new projects, and promote involvement by informing appropriate colleagues of Technical Steering Committee activities.

## VOLUNTEER RECOGNITION AWARDS

### WATER INNOVATION LEADERSHIP AWARD

Michael Bevan, Alberta Energy  
Regulator

### AIR QUALITY R&D LEADERSHIP AWARD

Greg Unrau, Repsol Oil and Gas  
Canada Inc.

### WELL ABANDONMENT LEADERSHIP AWARD

Leah Davies, Canadian Natural  
Resources Limited

### ECO-EFFICIENCY LEADERSHIP AWARD

Alice Yu, Cenovus Energy

### PIPELINE LEADERSHIP AWARD

Dave Hoffman, Enbridge Inc.

### PRESIDENT'S AWARD

Richard Dunn, Encana Corporation

## BOARD OF DIRECTORS

(As at December 31, 2017)

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- **JoAnne Volk**, Repsol Oil & Gas Canada Inc. (WIPC)
- **Steve Wallace**, Alberta Environment and Parks (WIPC)
- **Stella Wang**, Suncor Energy (ARPC)
- **Charles Ward**, Alberta Department of Energy (TEREE, ARPC)
- **Jeff Willick**, Canadian Natural Resources Ltd. (WARI, WIPC)
- **Richard Wong**, Canadian Association of Petroleum Producers (RRRC, WARI)
- **Laura Yao**, Kairos Aerospace (TEREE)
- **Jim Yaremko**, Canadian Energy Pipeline Association (PARSC)
- **Alice Yu**, Cenovus Energy (TEREE, ARPC, CUHB, EPICR)
- **Andrea Zabloski**, ConocoPhillips Canada (TEREE, CUHB)
- **Kourosh Zanganeh**, Natural Resources Canada (TEREE)
- **Adele Zenide**, Canadian Natural Resources Ltd. (WARI)

# INDEPENDENT AUDITOR'S REPORT

## TO THE MEMBERS OF PETROLEUM TECHNOLOGY ALLIANCE CANADA:

We have audited the accompanying financial statements of Petroleum Technology Alliance Canada, which comprise the statement of financial position as at December 31, 2017 and the statements of operations, changes in net assets and cash flows for the year then ended, and a summary of significant accounting policies and other explanatory information.

### MANAGEMENT'S RESPONSIBILITY FOR THE FINANCIAL STATEMENTS

Management is responsible for the preparation and fair presentation of these financial statements in accordance with Canadian accounting standards for not-for-profit organizations, and for such internal control as management determines is necessary to enable the preparation of financial statements that are free from material misstatement, whether due to fraud or error.

### AUDITOR'S RESPONSIBILITY

Our responsibility is to express an opinion on these financial statements based on our audit. We conducted our audit in accordance with Canadian generally accepted auditing standards. Those standards require that we comply with ethical requirements and plan and perform the audit to obtain reasonable assurance about whether the financial statements are free from material misstatement.

An audit involves performing procedures to obtain audit evidence about the amounts and disclosures in the financial statements. The procedures selected depend on the auditor's judgment, including the assessment of the risks of material misstatement of the financial statements, whether due to fraud or error. In making those risk assessments, the auditor considers internal control relevant to the entity's preparation and fair presentation of the financial statements in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the entity's internal control. An audit also includes evaluating the appropriateness of accounting policies used and the reasonableness of accounting estimates made by management, as well as evaluating the overall presentation of the financial statements.

We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our audit opinion.

### OPINION

In our opinion, the financial statements present fairly, in all material respects, the financial position of Petroleum Technology Alliance Canada as at December 31, 2017 and the results of its operations and its cash flows for the year then ended in accordance with Canadian accounting standards for not-for-profit organizations.

Calvista LLP, Chartered Professional Accountants

## STATEMENTS OF FINANCIAL POSITION (As at December 31, 2017)

ASSETS	2017	2016
<b>Current</b>		
Cash & cash equivalents	\$ 941,883	\$ 1,929,282
Restricted cash & cash equivalents	4,573,282	5,398,496
Restricted short term investment	1,003,178	725,922
Short term investment	3,040,407	1,401,779
Goods & services tax recoverable	11,715	17,823
Accounts receivable & accrued receivables	2,737,201	1,237,438
Prepaid expenses	21,221	25,435
	<u>12,328,887</u>	<u>10,736,175</u>
Due from related corporation	5,559	-
<b>Property and equipment</b>	<u>10,328</u>	<u>17,703</u>
	<u>\$ 12,344,774</u>	<u>\$ 10,753,878</u>
<b>LIABILITIES</b>		
<b>Current</b>		
Accounts payable & accrued liabilities	\$ 1,741,500	\$ 1,688,614
Deferred membership revenue	425,725	413,174
	<u>2,167,225</u>	<u>2,101,788</u>
<b>Deferred contributions</b>	<u>6,375,204</u>	<u>4,567,786</u>
<b>NET ASSETS</b>		
Invested in property & equipment	11,545	17,703
Internally restricted	2,390,800	2,666,601
Reserve	1,400,000	1,400,000
	<u>3,802,345</u>	<u>4,084,304</u>
	<u>\$ 12,344,774</u>	<u>\$ 10,753,878</u>

## STATEMENTS OF OPERATIONS (As at December 31, 2017)

REVENUE	2017	2016
Project & service revenue	\$ 6,085,821	\$ 4,319,324
Membership revenue	417,053	456,970
Event revenue	90,215	216,342
Rental income	441	46,279
Project participation fee	27,951	31,944
Interest income	62,087	27,633
Miscellaneous income	487	300
	<u>6,684,055</u>	<u>5,098,792</u>
<b>EXPENSES</b>		
Direct project & service costs	5,409,610	3,671,741
Salaries & benefits	1,309,032	755,720
Rent	103,582	155,206
Direct event costs	15,310	40,304
Consulting & professional fees	27,403	22,158
Office & equipment leases	21,127	21,080
Insurance	14,123	17,219
Marketing	18,587	15,225
Volunteer recognition	8,923	6,956
Bank charges & credit card discounts	8,019	5,663
Computer & website	9,393	5,417
Printing & publications	8,878	4,456
Amortization	6,158	4,425
Training	5,783	3,442
Realized/unrealized exchange loss	86	615
	<u>6,966,014</u>	<u>4,729,627</u>
<b>Excess of revenue over expenses (Deficiency)</b>	<u>\$ (281,959)</u>	<u>\$ 369,165</u>

# MEMBERS

PTAC's membership was comprised of 210 active members at year-end 2017.

## Associations (10)

- Alberta Canada Fusion Technology Alliance
- BC Innovation Council
- Canadian Association of Petroleum Producers
- Canadian Energy Pipeline Association
- Canadian Geothermal Energy Association
- CSA Group
- Environmental Services Association of Alberta
- Innovate Calgary
- Petroleum Services Association of Canada
- TECTERRA

## Producers (18)

- Athabasca Oil Corporation
- Canadian Natural Resources Ltd.
- Cenovus Energy
- Chevron Canada Resources
- ConocoPhillips Canada
- Devon Canada Corporation
- Encana Corporation
- Enerplus Corporation
- Husky Energy
- Japan Canada Oil Sands Limited
- NAL Resources Management Ltd.
- Nexen Energy ULC
- Obsidian Energy ULC
- PetroChina Canada
- Repsol Oil and Gas Canada Inc.
- Shell Canada
- Suncor Energy
- Unconventional Gas Resources Canada

## Government (9)

- Alberta Department of Energy
- Alberta Economic Development and Trade
- Alberta Energy Regulator
- Alberta Environment and Parks
- British Columbia Oil and Gas Commission
- Canada Revenue Agency - Calgary CTSO SR & ED
- Environment Canada
- National Research Council - Industrial Research Assistance Program
- Saskatchewan Ministry of Energy and Resources

## Individuals (12)

- Scott Bell
- Jamie Callendar
- Bernard Dumanowski
- Dave Franko
- Sonia Glubish
- Eric Lloyd
- Bob Mick

- Ken Putt
- George Rhodey
- Earle Shirley
- Murray Todd
- Henry van der Sloot

## Learning Institutions (4)

- Carleton University
- Southern Alberta Institute of Technology
- University of Alberta
- University of Calgary

## Research Providers (17)

- Alberta Innovates
- Alberta Sulphur Research Ltd.
- Canada Chemical Corporation
- Canada Institute for Photonic Innovations
- fRI Research
- Gas Technology Institute
- General Electric Canada/GGO
- Genome Alberta
- Innocorps Research Corporation
- InnoTech Alberta
- Natural Resources Canada
- Petroleum Technology Research Centre
- Priddis Environmental Solutions Ltd.
- Saskatchewan Research Council
- Strategic Timelines
- Terrestrial Energy Inc.
- zEroCor Tubulars Inc.

## Transport/Midstream (2)

- Keyera Energy Ltd.
- TransCanada Pipelines Ltd.

## Venture Capital (1)

- First Merchants Capital Partners Inc.

## Service and Supply (137)

- 3M Canada - Oil and Gas Division
- Acceleware Ltd.
- Advisian
- Agar Canada Corporation Ltd.
- AgriPower Inc.
- AMEC Foster Wheeler Environment & Infrastructure
- AMGAS Services Inc.
- AOMS Technologies
- ARCADIS Canada Inc.
- Area 51 Machine Design Inc.
- Atlantis Research Labs Inc.
- Auracle Geospatial Science
- Baseline Regulatory Compliance Services Ltd.
- Belca Soft Corporation
- BGGGoPlan Inc.
- BgtL LLC
- Black Gold Rush Industries
- Blair Air Systems Inc.
- Blue Source Canada ULC
- Blue Spark Energy
- Calscan Energy Ltd.
- Cap-Op Energy Inc.
- CJS Production Technologies
- Clearstone Engineering Ltd.
- CNTRAL Inc.
- Computer Modelling Group Ltd.
- Core Laboratories Canada Ltd.
- C-Sinc Technologies Ltd.
- Dashboard Canada Ltd.
- Deloitte – Research and Development, Tax
- Delta Remediation Inc.
- DXD Consulting
- Eagle Sky Energy Services Ltd.
- Enersoft Inc.
- Ensol Systems
- EnviroApps
- Envirossoft Products Inc.
- Envirotech Engineering
- Equilibrium Environmental Inc.
- Exaltexx Inc.
- Expansion Power
- Extreme Telematics Corp.
- Ferus Inc.
- FieldCap Inc.
- FLIR System Inc.
- Gas Pro Compression
- GCHEM Ltd.
- geoLOGIC Systems Ltd.
- GHG Solutions Corp.
- Global Analyzer Systems Ltd.
- GO Pal Technologies Ltd.
- Go-By Design Inc.
- Golder Associates
- Goliath Snubbing Ltd.
- Gowlings
- Greatario Covers Inc.
- GreenPath Energy Ltd.
- Halliburton Group Canada
- Harris Corporation
- Hatch Ltd.
- Heavy Oil Solutions
- Hicks & Associates Intellectual Property
- Higher Ground Consulting
- IBM Canada – Energy Branch
- Ingu Solutions Inc.
- INO
- Integrated Environments Ltd.
- Integrated Sustainability
- IronSight
- ISIT International
- JET Solutions Inc.
- Kairos Aerospace
- Katch Kan Limited
- Kenilworth Combustion Ltd.
- Kepler Communications
- Kinetica Ventures
- KPMG High Technology Practice Group
- LCO Technologies
- LiDAR Services International
- LOOKNorth
- LuxMux Technology Corporation

- Maapera Analytics
- mAIRsure LLC
- Major Drilling Group International Inc.
- Matrix Solutions Inc.
- MBM Intellectual Property Law
- McCarthy Tetrault LLP – Technology Group
- Micotan Petroleum Software Solutions
- Millennium EMS Solutions Ltd.
- MNP LLP
- MWDPlanet and Lumen Corporation
- Nakeyan Environmental Consulting Inc.
- New Paradigm Engineering Ltd.
- Newalta
- N-Solv Corporation
- OilPro Oilfield Production Equipment Ltd.
- Onsite 3D Ltd.
- Oplii
- Osprey Informatics
- Petro Niche Technology Ltd.
- Petrospec Engineering Ltd..
- Portfire Associates Inc.
- Process Ecology Inc.
- RJ Oil Inc.
- ROSEN Canada Ltd.
- RWDI Air Inc.
- Schlumberger Canada Ltd.
- SeekOps Inc.
- SENSIT Technologies – ITM Instruments
- Simark Controls
- Sky Hunter Corporation
- SNC Lavalin – Environment and Water
- SNC Lavalin – Studies and Developmental Projects
- Solstice Canada Corp.
- Spartan Controls Ltd – Efficiency Group
- Suez North America
- Tecvalco
- Terra Water Systems LP
- Terrapin Geothermics Inc.
- Terrapro Group
- Tetra Tech Inc.
- The Delphi Group
- TOG Systems Ltd.
- Total Combustion Inc.
- Trace Associates Inc.
- Transworld Technologies Inc.
- Trido Industries Inc.
- TSGI Corporation
- Tundra Process Solutions Ltd.
- Validere
- Veolia Water Solutions & Technologies
- VizworX Inc.
- Wave Control Systems Ltd.
- WaVv Strategic Consulting
- Westview Engineering
- Winterhawk Technologies Ltd.
- Zeel

# PERSONNEL

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