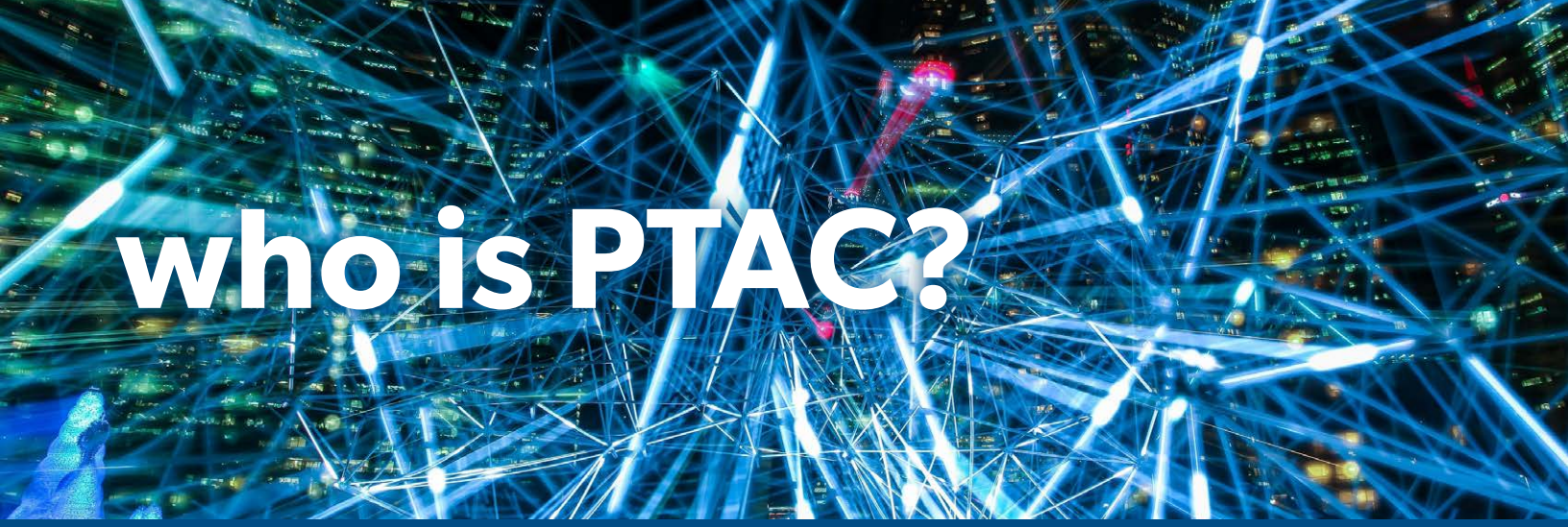
innovating a sustainable future

BRINGING TOGETHER TECHNOLOGY, PEOPLE & IDEAS

2021-2022 ANNUAL REPORT

PTAC PETROLEUM TECHNOLOGY ALLIANCE CANADA



who is PTAC?

OUR MISSION

Petroleum Technology Alliance Canada (PTAC) is a neutral, not-for-profit association with a mission to facilitate and manage innovation, collaborative research and technology development, demonstration, and deployment for a responsible Canadian hydrocarbon energy industry.

OUR VISION

To help Canada become a global hydrocarbon energy technology leader.

OUR PURPOSE

To facilitate collaborative R&D and technology development to benefit all stakeholders in the Canadian hydrocarbon energy industry by:

- Raising awareness of innovative technology solutions, matching industry challenges with solutions.
- Building an innovation ecosystem by bringing stakeholders together to identify challenges and opportunities, and to provide a collaborative space to launch innovative projects that address them.
- Promoting industry participation in the resulting research, technology development, lab and field testing, demonstration, commercialization, and deployment, as well as assisting with securing funding from a variety of sources.
- Facilitating the transfer of commercial technologies from other industrial sectors and jurisdictions for application in the hydrocarbon energy industry.
- Advocating for innovative, sustainable hydrocarbon systems.

REDUCE EMISSIONS

MANAGE ENVIRONMENTAL IMPACT

DEVELOP SUSTAINABLE RESOURCES

PROMOTE ECONOMIC GROWTH

2021-22 impact by the numbers

9 PTAC STAFF

229 MEMBER ORGANIZATIONS

FACILITATED **114** PROJECTS IN FY21

EARNED A RECORD **$12.3 MILLION** IN REVENUE

FACILITATED **818** PROJECTS SINCE INCEPTION

11 MILLION TONNES (MT) **CO_2e** ANNUAL GHG EMISSIONS REDUCED

PTAC FACILITATED:

- Development of **9** methane mitigation technologies with the collective capacity to reduce methane emissions from the oil and gas sector by **37%**.
- Field-testing of **23** methane mitigation technologies with the collective capacity to reduce methane emissions from the oil and gas sector by **39%**.
- Deployment/Demonstration of **16** methane mitigation technologies and projects with the collective capacity to reduce methane emissions from the oil and gas sector by **48%**.
- Completion of **18** Product-Market Fit Assessments in 2021-22 (with the financial support of NRCan/IRAP) to help Cleantech SMEs prosper.
- Launch of **22** consortia engagements in 2021-22 to help SMEs achieve economic prosperity.
- Development of Technology and Best Practices that Reduce Industry Cost by **$93M/year**.
- AUPRF's **56** Multi-Disciplinary Research Projects (**21** launched, **30** ongoing, **5** completed) addressing Air, Ecological, Remediation/Reclamation, Water, and Well Abandonment.
- **818** Collaborative Projects completed since inception, driving innovation in a wide variety of technology areas.

message from the board

Technology drives the modern oil and gas industry. It touches every aspect of the business - how we extract resources; how we control costs; how we mitigate environmental impact; how we communicate. Innovation and technology development have been key to finding our feet again following the global pandemic. As we head into the future, it is the only way we will keep pace with calls to deliver a cleaner, more profitable oil and gas sector.

Today's complex challenges require holistic solutions. The low-hanging fruit in resource extraction has been picked clean; demand for energy continues to grow and environmental impact is a top concern. This past fiscal year, PTAC has once again proved innovation, sustainability, and profitability can go hand in hand – but the catalyst in today's market is collaboration.

PTAC's roster of more than 100 collaborative projects, programs, and partnerships is helping to position Canada's hydrocarbon energy industry for future success. In 2021/22 the organization hit a record revenue of $12.3 million – the highest revenue PTAC has ever posted. These highlights increased stakeholder investment in collaborative innovation throughout the value chain. PTAC also posted record project revenue hitting $11.9 million, which is 50% higher than any other year. This financial stability has allowed PTAC projects, programs, and networks to tackle more complex problems and develop even more robust solutions.

Much of this innovation and collaboration has been focused on methane reduction, the fastest and most cost-effective approach to mitigating GHG emissions. In 2021, PTAC achieved the lofty target of developing, field testing, and commercializing technologies capable of collectively reducing methane emissions from the oil and gas sector by 45%, a year ahead of our 2022 target. The nine methane mitigation technologies developed through PTAC's collaborative model have the collective capacity to reduce oil and gas sector's methane emissions by 37%. PTAC facilitated the field testing of an additional 23 technologies with the capacity to reduce oil and gas methane emissions by 39%, and deployed another 16 projects with the capacity to reduce oil and gas emissions by 48%.

Our vision is that PTAC will help build viable technology capacity capable of reducing methane emissions by 90% by 2030. With our members we will develop options that are economic, operationally robust and maintainable.

PTAC published the **Methane Detection & Mitigation Initiatives Report** in December 2021, which outlines in detail how PTAC, in collaboration with our broad spectrum of member organizations, built sufficient technology capacity to achieve the goal of reducing methane emissions from the oil and gas sector by 48%. It also discusses how PTAC is helping industry producers understand methane emissions trends from various sources so they might optimize the implementation of new technologies. This insight will help fugitive emissions management programs to achieve mitigation targets at the lowest cost. Wider distribution through digital publications such as **Natural Gas World** and **Research Money** helped us both connect with and increase our profile among a wider range of stakeholders and members of the public.

Although methane reduction is critical, PTAC's ongoing collaborative projects also helped industry manage environmental impacts (air emissions, water management, biodiversity protection, well closures and abandonment, and site reclamation), develop technologies to increase sustainable resource recovery and promote economic growth of the sector. Among these were numerous projects addressing challenges such as flaring, pipelines, effective adoption of digital technologies, and the application of drones for reducing costs in the oil sands.

In addition to a full complement of field projects, PTAC continues to facilitate the **Alberta Upstream Petroleum Research Fund** (AUPRF) delivered in partnership with CAPP and EPAC. To date, the AUPRF program has conducted 474 environmental research projects addressing air research with a focus on methane, water issues, ecological and biodiversity, remediation and reclamation, and well abandonment at a total cost of $180 million. Oil and gas producers provided $31.4 million and secured financial leveraging of six to one.

A recent evaluation of the AUPRF program concluded that these collaborative, science-based environmental research projects have saved industry $93 M in operating costs per year. This past year, AUPRF continued progress on 30 ongoing projects and facilitated the completion of five projects. Each of these projects provide practical, science-based research to fill knowledge gaps related to the intersection between environmental science and oil and gas exploration and development. Research results will assist in the development of smart policies, regulations, and best practices.

Innovative ideas often come from the little guy – but these small companies can lack the resources to effectively test and commercialize these innovative technologies. Ensuring alignment with industry needs, PTAC continued to deliver a variety of services and programs focused on helping bring more innovative technologies to market, including facilitating our SME program offered in collaboration with the National Research Council – Industrial Research Assistance Program (NRC-IRAP).
In the past year, 11 new projects were tested at the Canadian Emissions Reduction Innovation Consortium (CanERIC) network of testing facilities. This consortium now consists of 14 producers and

PTAC BOARD OF DIRECTORS

(as at March 31, 2022)

Kevin Stashin, Chair
Independent

Joy Romero, Vice-Chair
Executive Advisor, Innovation, CNRL

Cheryl Trudell, Chair-Elect
Joint Interest Production Manager, Imperial

Soheil Asgarpour
President & CEO, PTAC

Matt Bryan
Managing Director, Schlumberger Canada Ltd

Brian Doucette
Director, Environmental Excellence, Suncor Energy

Mike Ekelund
Independent

Lois Garrett
Independent

Nicole Harbauer
Trade Commissioner, Global Affairs Canada

Andrew Noseworthy, Ex-Officio
Assistant Deputy Minister, Clean Technology (ISED) and Special Advisor to the President, Energy & Strategic Initiatives (ACOA)

Laurie Pushor
President & CEO, Alberta Energy Regulator

Ken Putt
Independent

Justin Riemer
Assistant Deputy Minister, Prairies Economic Development Canada

William Rosehart
Dean, Schulich School of Engineering, U of C

Randy Rudolph, F&A Committee Chair
Associate VP, Canada Environment Business Line

Laurier Schramm
Independent

Murray Todd
Independent

John Zhou
VP, Clean Resources, Alberta Innovates

16 universities & research centres in Canada and the United States who have dedicated more than a billion dollars' worth of field and lab facilities. By securing funds from Alberta Innovates and NRCan, and with industry support, PTAC has been able to help SMEs field test their technologies at no cost to them. So far, three technologies have been assessed in the lab, nine technologies have been developed and/or field tested, and six technologies are undergoing additional evaluation.

As part of our services to members, PTAC also conducted 18 product-market-fit assessments for SMEs last year. These reports and analysis helped both cleantech SMEs and oil and gas producers better understand the current marketplace and see how a particular technology in development might align with industry needs. However, even when a technology is field tested and proven to be cost-effective, smaller companies still face the challenge of increasing the market uptake of that technology.

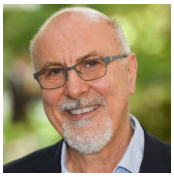
Responding to this challenge, PTAC launched the Systematic Third-Party Validation of Environmental and Economic Performance of Methane Reduction Technologies Consortia (STV) and the Methane Consortium Program (MCP). These programs contribute up to 75% of the cost of equipment and installation, a financial incentive that is already encouraging Canadian producers to invest in getting first-hand experience with the new technologies. To date, the MCP has resulted in producers installing 103 pieces of equipment including seven site electrifications, 42 pump optimizations, 26 smart electric pumps, 14 grid-powered electric pumps, 12 instrument air systems, one facility of the future, and one new internal combustion engine modernization. In the past fiscal year, the STV facilitated 46 on-going projects, which funded the deployment of 14 innovative technologies.

Building on recent accomplishments, PTAC looks forward to launching new projects and initiatives in the coming year. We are currently working with members representing industry, government, and regulatory agencies to assess numerous projects proposed for 2022/23. Focused on solving the most relevant industry challenges, these proposals range from enhanced optical imaging sensors to investigation of methane emissions from tanks to new forms of cement alternatives, to understanding indicator species in different habitats across Canada.

The pressures of climate change are a global concern, and we know that many of the challenges and solutions facing our industry go beyond Canada's borders and international partnerships is key to tackling this issue. In 2021/22 PTAC added another successful international collaboration to our growing record, establishing a new relationship with the **Net Zero Technology Centre** in Aberdeen, Scotland. Looking to the future, PTAC plans to expand our focus on international collaboration even further, intentionally supporting global sales of Canadian cleantech products and technologies. Strategic programs such as trade missions will promote and highlight innovative Canadian technologies, and PTAC will market locally hosted technology exhibitions to an international audience. We will expand the existing directory of Canadian Technology providers to include a list of services and technologies available to international customers. PTAC and our networks will also broaden the focus of current technology matchmaking services to connect Canadian technology providers with export customers.

These new ambitions are only possible because of the impressive performance PTAC experienced in 2021, and that success in turn was built upon a solid foundation of trust earned over the past 26 years. The 2021 surge in funding and industry support for PTAC's collaborative technology development projects is a testament to the work of the dedicated volunteers who serve on PTAC's Board of Directors, technical steering committees, networks, and project committees. Thank you for sharing your time and expertise.

As our industry rebounds from the pandemic, we are emerging stronger and more prepared than ever to innovate our sustainable future. We can't wait to see what creative solutions our collaboration will spark next!



Soheil Asgarpour
Ph.D., FCAE, FCIM, FCSSE, P.Eng.
President & CEO

Kevin Stashin
Chairperson

leveraging innovation

THE PTAC COLLABORATIVE MODEL

The PTAC collaborative model connects diverse stakeholders to cost-effectively pursue research and development projects to address current and future challenges. PTAC provides neutral facilitation and project management.

WHY COLLABORATION?

Bringing together the unique skills and perspectives of producers, research providers, governments, academics, transporters, and service and supply companies leverages their respective expertise, influence, and capacity. Collaboration promotes a holistic approach to projects that includes perspectives from throughout the value chain, sparking fresh ideas and cross-discipline conversations that lead to efficiencies and innovation. Mobilizing funding from all stakeholders enables the pursuit of large research and development projects that would be too costly for an individual organization to tackle on their own. Risks are mitigated. Sights are set higher. Success is shared.

REDUCE COSTS.

MITIGATE RISK.

GROW IDEAS.

REACH HIGHER.

SUCCEED TOGETHER.

innovative projects

PTAC continues to align collaborative technology development initiatives with industry to drive the adoption of cleaner energy production in a low carbon economy.

- **11 MT CO_2e** Annual GHG Emissions Reduced by these Technologies*
- **171 MT CO_2e** Estimated Cumulative GHG Reduction by 2030*

**Potential total reduction (2012 – 2030) when technologies deployed at commercial scale*

$11.89M IN PROJECT REVENUE

74 NEW PROJECTS LAUNCHED

40 ONGOING PROJECTS

148 PROJECTS COMPLETED

PROJECTS LAUNCHED IN FY21

- SME Innovation Product-Market Fit (18 Engagement Projects)
- SME Innovation – Product Consortium Development (22 Engagement Projects)
- Predictive Emissions Management System (PEMS)
- Reduction Pathways Digital Twin
- Electrical Generator Test Phase II; six techs[1]
- Tank Vent Studies (Project 1 and Project 2)[1]
- Combustor Challenge/Combustor Desktop Study/Questionnaire[1]
- Low-Rate Meters (Ventbusters/Ventsentinel) Project Scopes 1 and 2 (4 projects)[1]
- Clear Rush Co Compressor Dry Gas Seals & Pneumatics Destruction Efficiency Project[1]
- Zero Emission Heavy Oil (Brownfield) Site Project[1]
- Pipeline Blowdown/Incineration Project[1]
- NSRC FlareNet Strategic Network[2]
- Methods for Estimating Emissions from Tanks[2]
- State of Science on Emission Rate Thresholds for Upstream Petroleum Industry Leaks Corresponding to a Range of ppm Concentration Thresholds[2]

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PROJECTS LAUNCHED IN FY21 (continued)

- Evaluation of Current & Emerging Emission Quantification Tools[2]
- Evaluation of Surface Casing Vent Flows at Inactive Wells: Database Analysis and Field Measurements in Alberta[2]
- Plug and Abandon Strategies for Canada's Oil & Gas Wells (Year 4 of 4)[2]
- Minimum Acceptable Emissions and Closure Guidelines for Leaking Abandoned Wells[2]
- Development of a Quantitative Framework for Methane Emissions from Soil Gas Migration Issues in the Oil and Gas Sector[2]
- Agronomic Receptor Evaluation for Direct Soil Contact[2]
- Finalization of Research and Preliminary Selenium Soil Quality Guideline Derivation[2]
- Drilling Waste Compliance[2]
- Development of a Chloride Water Quality Guideline Based on Hardness and Consideration for Cation Toxicity[2]
- Plant Uptake of Petroleum Hydrocarbons and Salt (NaCl) and Derivation of Soil-to-Plant Uptake Factors[2]
- Evaluation of Reclamation Practices on Forested Upland and Peatland Well Sites
- Low Probability Receptor Demonstration Project[2]
- Re-Evaluation of F2 and F3 Petroleum Hydrocarbon Management Limits[2]
- Regulatory Approval of Risk Assessment Tools[2]
- Soil and Groundwater Guideline Calculator[2]
- Background Metals and Salinity Database and Analysis Tool[2]
- Standardizing Risk Assessment Approaches Based on Residual Mass vs. Numerical Endpoints[2]
- Alberta Water Tool – Open Access[2]

[1]*Projects launched as part of the CanERIC network*

[2]*Projects launched by the AUPRF program*

spotlight on collaboration

HANDS ACROSS THE POND

The global oil and gas sector continues to seek solutions to eliminate methane and GHG emissions. Through the hard work of members and volunteers, PTAC has helped Canada's hydrocarbon energy industry develop a robust research and development ecosystem. Now, they are working to collaborate further afield.

> "INDIVIDUALLY, WE ARE ONE DROP. TOGETHER, WE ARE AN OCEAN."
>
> – RYUNOSUKE SATORO

The **Net Zero Technology Centre** (NZTC) in Aberdeen, Scotland recognized that collaborating with PTAC might allow them to leverage the organization's expertise in delivering high-quality technology research. The NZTC was created through funding from the UK and Scottish governments to maximize the potential of North Sea oil and gas. Their purpose, just as PTAC's, is to work in collaboration with the sector to develop and deploy technology solutions to reach an affordable net zero emissions target by 2050.

In October 2021, PTAC and NZTC began a new collaboration. The first step in this collaboration is a project to assess how using alternative products in place of cement can reduce or eliminate methane emissions from surface casing vent flows (SCVF). North Sea oil and gas producers share many of the same challenges that Canadian operators and producers face in eliminating these emissions. However, their challenge is particularly acute as the timeline for decommissioning wells is fast approaching. Collaboration is key to developing innovative, effective solutions within that timeframe.

As PTAC and NZTC work together to achieve likeminded mandates, PTAC is excited about this burgeoning long-term relationship. Together, these two organizations can significantly expand the development of solutions to achieve net zero.

innovative connections

PTAC facilitates several industry networks and consortia that launched projects, encouraged collaboration, and informed effective regulations to secure an effective, sustainable Canadian hydrocarbon energy industry.

Alberta Upstream Petroleum Research Fund

AUPRF is a unique collaboration between the Government of Alberta, the Alberta Energy Regulator, and industry focused on pursuing practical, science-based research projects to address knowledge gaps in the understanding and management of high-priority environmental and social matters related to oil and gas exploration and development in Alberta. Their work assists in the development of smart policies, regulations, and best practices for the sustainable development of oil and gas resources in Alberta. The AUPRF program is managed by PTAC in collaboration with the Canadian Association of Petroleum Producers (CAPP) and the Explorers and Producers Association of Canada (EPAC). In 2021-22, AUPRF continued to support vital scientific research while also establishing revised Terms of Reference.

Canadian Emissions Reduction Innovation Consortium (CanERIC)

CanERIC is an international network of emissions reduction test facilities with a vision to meet the global emissions reduction challenge by providing practical, streamlined support for validation, bench testing, and field testing of innovative technologies. During 2021-2022, CanERIC launched 11 new projects and completed five others. In addition to supporting technology development, CanERIC believes that developing students in higher education and technicians early in their careers is a critical aspect of technology transfer. Working with a variety of universities and technical schools in 2021-22, CanERIC helped develop 23 young people into Highly Qualified Personnel. Many will pursue future employment with government and industry focused on methane reduction.

Digital Innovation Network (DIN)

Digital technologies are changing the face of Canada's hydrocarbon energy industry, and this network is focused on accelerating the effective adoption of digital technologies to increase resource extraction, improve financial performance, and encourage growth of the sector. This past year, DIN, in collaboration with the Clean Resource Innovation Network, supported networking webinars and is getting ready for return to in person events in the fall of 2022. Project development proceeded at an active pace, resulting in the launch of two new projects aimed at reducing GHG and methane emissions.

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Methane Consortia Program (MCP)
The MCP works to increase market uptake of commercial technologies aimed at significantly reducing methane emissions. The program leverages the deployment of methane projects in the PTAC inventory and demonstrates GHG reductions in the near term (6-12 months). This will increase the sector's capacity to deliver additional GHG reductions and create economic and employment opportunities in the medium term, developing new methane technologies while opening the door to greater GHG reductions. In 2022, the MCP completed 88 subprojects. The installations supported by the project will reduce GHG emissions by 90 tonnes per year in the near term. The full anticipated adoption of the technologies will reduce GHG emissions by a cumulative 100 million tonnes by 2050.

Methane Emissions Reduction Network (MERN)
This Network is working to launch market-driven R&D projects to reduce methane emissions and provide uniform, neutral and complete communications to all stakeholders operating within the methane space. Their Methane Hub educates stakeholders about the current challenges facing industry, informs them about existing technologies and R&D currently underway, and encourages the development of market driven solutions. In 2021-22, the Network, in collaboration with CRIN, organized and participated in forums, workshops, and Technology Information Sessions to share the latest developments in methane reduction technology, as well as raise awareness and increase uptake of innovative, cost-effective oil and gas practices.

NRC-IRAP SME Program
PTAC's SME program, facilitated in collaboration with National Research Council Industrial Research Assistance Program (NRC-IRAP), helps Small and Medium Enterprises navigate the changing oil and gas marketplace. In 2021-22, PTAC helped to complete 18 Product Market Fit and 22 Project Consortium Development engagements. The PTAC projects launched in 2021-22 involved nine IRAP clients, with a total project value of $4.6M. Since 2019, the cumulative emissions reductions in Canada from PTAC and IRAP facilitated projects are 60 MT CO_2e in 2030 and 320 MT CO_2e in 2050.

spotlight on connections

THE PTAC-CRIN INNOVATION COLLABORATION

The emergence of the **Clean Resource Innovation Network** (CRIN) is recognized as one of the most effective technology innovation networks in Canada. CRIN started in 2016, largely with contributions from major oil and gas producers including Cenovus Energy, Husky, Suncor, Canadian Natural, Imperial, ConocoPhillips Canada, and MEG Energy and with PTAC's support. The network evolved to create a pan-Canadian network of networks that positions Canada as the global leader in clean hydrocarbons from source to end use.

In 2019, CRIN received a $100 million investment from the Federal Government in recognition of the value of our oil and gas resources and the need to create a cohesive network of the tremendous people and entities across Canada working hard to enhance industry's environmental performance. Since then, CRIN has been actively driving research and development towards commercialization and adoption, not only within the oil and gas industry but for all end users.

With research and development focused elsewhere, the availability of funding has always posed a profound challenge to cleantech development. While PTAC, through its member organizations, has created a focus on the technology and business process requirements to reduce oil and gas environmental footprints, the demand for funding has often exceeded what is available.

CRIN did not fall into the trap of creating a new process that duplicate what was already working and confusing those involved in the research space. Instead, CRIN sought collaborators in the innovation space and found PTAC. Over the years, PTAC has developed a robust best practice network to collaborate on projects and innovation. Of considerable value is the fact that industry works with governments and regulators to develop solutions that are acceptable to all. This network was already highly effective but when it became clear CRIN would enhance that effectiveness, a true partnership was born.

Together the folks at CRIN and PTAC both work to target the sector's key knowledge gaps and challenges. Together, their streamlined processes get new technology solutions and business processes developed and deployed. While focused on helping the oil and gas sector reduce methane emissions, this partnership continues to demonstrate how working together results in much more being accomplished. Through their trusted collaboration, new projects vital to helping the sector evolve a more environmentally sustainable approach, continue to be launched via an expedited process.

In addition to their work on methane emissions, PTAC and CRIN also collaborate on research projects related to land use as well as industry events and conferences designed to reduce barriers to cleantech innovation. The annual **Net Zero and Methane Reduction Conference** is an example of how working together helps convene stakeholders from industry, government, regulatory bodies, researchers and more to discuss opportunities, challenges, innovations, and new practices that target emissions.

With no shortage of ongoing challenges on the horizon, PTAC and CRIN know it will take everyone working together to ensure the long-term sustainability of Canada's oil and gas industry.

innovative people

PTAC members representing multiple organizations from throughout the value chain dedicated time and expertise to move PTAC initiatives forward.

15 TECHNICAL STEERING COMMITTEES

250+ VOLUNTEERS

COMMITTEES

AIR RESEARCH PLANNING COMMITTEE[3]

Moruf Aminu	Encana
Jacob Bayda	Saskatchewan Ministry of Energy and Resources
James Beck	Suncor Energy
Don D'Souza	BC Oil and Gas Commission
Randy Dobko	Alberta Environment and Parks
Richelle Foster	Canadian Natural Resources Limited
Colin Hennel	Bonavista Energy Corporation
Sean Hiebert	Cenovus
Neuczki Mathurin	TC Energy
Johnny Matta	Environment and Climate Change Canada
Don McCrimmon	Canadian Association of Petroleum Producers (CAPP)
Sean Mercer	Imperial
Rekha Nambiar	Suncor Energy
Graham Noble	Saskatchewan Ministry of Energy and Resources
Filiz Onder	Encana
Koray Onder	TC Energy
Gerald Palanca	Alberta Energy Regulator
Amanda Stevado	Environment and Climate Change Canada
Carolyn Ussher	Alberta Energy Regulator

ECOLOGICAL RESEARCH PLANNING COMMITTEE[3]

Mark Boulton	Suncor Energy
Lisa Bridges	Alberta Energy Regulator
Carol Engstrom	Independent
Ben Hale	Husky Energy
Lori Neufeld	Imperial
Shane Patterson	Alberta Environment and Parks
Krista Phillips	Canadian Association of Petroleum Producers (CAPP)
Danielle Plommer	Ovintiv
Jeremy Reid	Canadian Natural Resources Limited
Jennifer Shalagan	Cenovus
Jordan Smith	Canadian Natural Resources Limited

ENERGY UTM STEERING COMMITTEE

Jeremy Byatt	AIRmarket Inc.
Bruce Duong	Alberta Innovates
Lindsay Mohr	AIRmarket Inc.
Dennis Niles	TELUS
Tania Rizwan	TC Energy
Stan Tumoth	TC Energy

ELECTRIC DUMP VALVE ACTUATOR STEERING COMMITTEE

Wes Barrett	Linear Motion Technologies
Ronda Foster	Linear Motion Technologies
Owen Henshaw	Cenovus Energy
Sean Hiebert	Cenovus Energy
Patrick Kitchin	Whitecap Resources
Ray Lambert	Cenovus Energy
Brad Morello	Shell Canada Limited
Brian Van Vliet	Spartan Controls
Charles Whitehead	Linear Motion Technologies
Jim Wilson	Linear Motion Technologies

IM3S STEERING COMMITTEE

Richelle Foster	Canadian Natural Resources Limited
Thomas Fox	Highwood Environmental Management
Claude Ghazar	Alberta Innovates
Chris Hugenholtz	University of Calgary
Jessica Shumlich	Highwood Environmental Management

INDUSTRY SOLUTIONS STEERING COMMITTEE[4]

Committee members represent the following leading organizations:

ATCO
Bonavista Energy Corporation
Cenovus Energy
Chevron Canada Resources
Canadian Natural Resources Limited
Imperial Oil Limited
Inter Pipeline Ltd.
NuVista Energy
Ovintiv
Petronas
Suncor Energy
TC Energy
Total USA
Whitecap Resources
Teine Energy Ltd.
ARC Resources
Murphy Oil Company
Natural Resources Canada
Alberta Innovates
Alberta Energy Regulator
Saskatchewan Research Council
Canadian Energy Pipeline Association

INFRASTRUCTURE STEERING COMMITTEE[4]

Committee members represent the following leading organizations:

CanmetENERGY
Carleton University
CMC Research Institutes
CSU
Innotech Alberta (2 sites)
Polytechnic Montreal
SAIT
Saskatchewan Research Council
St. Francis Xavier University
University of Alberta
University of Calgary
University of Waterloo
University of Windsor
Natural Resources Canada
Alberta Innovates
Alberta Energy Regulator
Canadian Energy Pipeline Association

IRAP/SME INNOVATION AND TECHNOLOGY COMMERCIALIZATION IN HYDROCARBON INDUSTRY

Tamer Al-Ramahi	NRC–IRAP
Arvinder Kainth	NRC–IRAP
Ron Quick	NRC–IRAP

METHANE CONSORTIA PROGRAM STEERING COMMITTEE

Heather Carmichael	Alberta Environment and Parks
Chris Hugenholtz	University of Calgary
Monica Micak	Alberta Environment and Parks
Gerald Palanca	Alberta Energy Regulator

PUREJET STEERING COMMITTEE

Aaron Baugh	Emissions Reduction Alberta
Owen Henshaw	Cenovus Energy
Janelle Mravcak	Atlantis Research Labs
Vladimir Mravcak	Atlantis Research Labs

REMEDIATION RECLAMATION RESEARCH COMMITTEE[3]

Sara Blacklaws	Alberta Energy Regulator
Christopher Boyd	Shell Canada Limited
Nadia Cruicshank	Alberta Energy Regulator
Jason Desilets	Cenovus
Linda Eastcott	Imperial
Shawn Glessing	Cenovus
Sonia Glubish	Canadian Natural Resources Limited
Paul Hartzheim	Canadian Association of Petroleum Producers (CAPP)
Tom Knapik	Plains Midstream Canada ULC
Susan McGillivray	Alberta Environment and Parks
Jeff Mills	Orphan Well Association
Premee Mohamed	Alberta Environment and Parks
Jack O'Neil	COSIA
Rick Rohl	ARC Resources
Devin Scheck	BC OIL & GAS COMMISSION
Debbie Tainton	Canadian Natural Resources Limited
Lisa Warren	Husky Energy

STV STEERING COMMITTEE

Richelle Foster	Canadian Natural Resources Limited
Claude Ghazar	Alberta Innovates
Patrick Kitchin	Whitecap Resources
Morgan Wrishko	Cenovus Energy

TECHNOLOGY FOR EMISSIONS REDUCTION AND ECO-EFFICIENCY (TEREE) PROGRAM

Mike D'Antoni	GreenPath Energy
Moruf Aminu	Ovintiv
Joshua Anhalt	GreenPath Energy
Brenna Barlow	Radicle
James Beck	Suncor Energy
Jamie Callendar	Callendar Energy Services
Don D'Souza	Government of British Columbia
Yonathan Dattner	Luxmux Corporation
Cam Dowler	Spartan Controls
Bruce Duong	Alberta Innovates
Richelle Foster	Canadian Natural Resources Limited
Thomas Fox	Highwood Environmental Management
Kevin Heal	Radicle
Owen Henshaw	Cenovus Energy
Sean Hiebert	Cenovus Energy
James Holoboff	Process Ecology
Roy Hunt	Advisian
Mark Jamieson	Alberta Energy
Paul Jiapizian	Environment Canada
Arvinder Kainth	NRC – IRAP
Derek Kelly	Natural Resources Canada
Patrick Kitchin	Whitecap Resources
Milos Krnjaja	Alberta Energy Regulator
Derek L'Hirondelle	SFC Energy Canada
Ray Lambert	Cenovus Energy
Michael Lawson	Alberta Energy Regulator
Logan Leduc	Environment Canada
Neuczki Mathurin	TC Energy
Andrew McClausland	Radicle
Sean Mercer	Imperial Oil Limited
Kelly Newnham	Advisian
Chelsea O'Connor	SFC Energy Canada
Connor O'Shea	Westgen Technologies
Koray Onder	TC Energy
Kirk Osadetz	CMC Research Institutes
Gerald Palanca	Alberta Energy Regulator
Ron Quick	NRC – IRAP
Rao Ravi	Spartan Controls
Cooper Robinson	Radicle
Cassandra Schostek	Alberta Energy Regulator
Jessica Schumlich	Highwood Environmental Management
Monica Sippola	Kuva systems
Scott Smith	Cenovus Energy
Ryan Streams	Kairos Aerospace
Lisa Studzinski	Enerplus
Mark Summers	Emissions Reduction Alberta
Greg Unrau	Repsol
Brian Van Vliet	Spartan Controls
Charles Ward	Alberta Department of Energy
Morgan Wrishko	Cenovus Energy
Kourosh Zanganeh	Natural Resources Canada
Adele Zenide	Canadian Natural Resources Limited

WATER INNOVATION PLANNING COMMITTEE[3]

Jarred Anstett	Murphy Oil Company
Sarah Belak	Tourmaline
Michael Bevan	Alberta Energy Regulator
Courtney Blackmore	MEG Energy

continued on the next page

Neil Fricke	Suncor Energy
Rodney Guest	Suncor Energy
Anil Gupta	Alberta Environment and Parks
Scott Hillier	Cenovus
Paul Martin	ConocoPhillips Canada
Matt Mclean	Cenovus
Tara Payment	Canadian Association of Petroleum Producers (CAPP)
Scott Rayner	MEG Energy
Susan Satterthwaite	Alberta Environment and Parks
Geoff Webb	Canadian Natural Resources Limited
Leah Wilson	Ovintiv

WELL ABANDONMENT RESEARCH INITIATIVE COMMITTEE[3]

Emile AbouKhalil	Alberta Energy Regulator
Leah Davies	Imperial Oil Limited
Claudette Fedoruk	Canadian Association of Petroleum Producers (CAPP)
Shawn Forster	Cenovus
Ben Fraser	Imperial Oil Limited
Wade Hartzell	Canadian Natural Resources Limited
Cassidy Juhasz	Crescent Point Energy
Ryan McDowell	Crescent Point Energy
Benjamin Ringrose	Orphan Well Association
Alexandra Robertson	Alberta Energy Regulator
Dave Samuelson	Cenovus
Rajan Varughese	Alberta Energy Regulator
Richard Wong	Cenovus

[3]*These committees are part of the AUPRF program*
[4]*These committees are part of the CanERIC network*

"OFTEN WHEN YOU THINK YOU'RE AT THE END OF SOMETHING, YOU'RE AT THE BEGINNING OF SOMETHING ELSE."

– FRED ROGERS

spotlight on advocacy

CHAMPION OF INNOVATION: SEAN HIEBERT

Innovation is more than ideas. No matter how groundbreaking an idea might be, it takes people working together to make that idea a reality. One of PTAC's greatest strengths is a membership of volunteers willing to step up and do the hard work of innovation.

Sean Hiebert is an active member of the PTAC Air Research Planning Committee (ARPC) and has played an important role as project/industry champion for a number of priority R&D projects within PTAC.

Sean has had the fortunate experience to work with Cenovus Energy, ConocoPhillips Canada, and the Alberta Energy Regulator (AER) over the last 15 years. Sean's industry roles have allowed him to scope and execute a large number of energy efficiency/emission reduction projects, including a large-scale Emerald Award winning $14 Million project. He is also extremely proud of his ground-setting work related to Alberta's alt-FEMP Framework, which was one of his main focus areas during a recent secondment with the AER.

Today, Sean is one of the Emissions Management Engineers at Cenovus Energy and serves as the CRIN Methane Technology Theme Lead. These roles have kept him quite busy in the development of new technologies to reduce oil and gas emissions. He understands the importance of knowledge sharing and collaboration, and maintains an extreme passion for technology development, and deployment.

Sean is well-regarded as a leading innovator, and is dedicated to continuing to champion new ideas and help develop solutions to Canadian energy emissions challenges.

> "THE WORLD NEEDS DREAMERS, AND THE WORLD NEEDS DOERS. BUT ABOVE ALL WHAT THE WORLD NEEDS MOST ARE DREAMERS THAT DO."
>
> – SARAH BAN BREATHNACH

innovative events

8 TECHNOLOGY INFORMATION SESSIONS

3 WEBINARS

2 TRAINING EVENTS

1500+ ATTENDEES

2 SHOWCASES

2 FORUMS AND MEETINGS

24 NEW EXHIBITORS

2021-22 EVENTS

- Accelerating the Mitigation of GHG Emissions in the Upstream Oil & Gas Sector TIS
- Certification Of Mineral Soil Pads in The Boreal Region – Decision Framework and Support Tools: Field Verification Training Session
- Decarbonization Approach, Delivering Net Positive Revenue Streams TIS
- E2E Energy Solutions Inc. announcing details of its Enhanced Geothermal Reservoir Recovery System TIS
- Getting Started: Monitoring Methane with Alternative Technologies to Achieve Greater Emissions Reductions TIS
- Guide to Variance Justifications for Reclamation Certification of Wellsites and Associated Facilities on Forested Land: Field Verification Training Session
- How Energy Industry Firms Can Prepare for Blockchain Adoption TIS
- Lunch & Learn – A Practical Approach to Digital Transformation
- Net Zero & Methane Emissions Reduction Conference 2021
- PermianChain Technologies TIS
- PTAC 2021 Virtual Innovation Showcase – Fall Intake
- PTAC Knowledge Transfer Session: New Draft Wellsite Certification Guidance Documents for Sites in the Boreal Forest
- Repositioning the Oil & Gas Sector Through an End-to-End TIS
- Reducing HSE Impacts and Operational Costs with Continuous AI-Powered Leak Detection Cameras TIS
- Taking Credit for Responsibly Produced Oil and Gas: An Interactive Mini-Conference
- 24th Annual General Meeting & 25th Anniversary Celebration
- Virtual Innovation Showcase – Spring 2021

PTAC EVENTS:

- Communicate best practices and inform smart regulations
- Encourage cross-discipline collaboration
- Facilitate increased market uptake of new and emerging technologies that reduce environmental impact and increase sustainable resource production
- Spark ideas and opportunities to work towards a clean energy future
- Provide interactive opportunities to network, share ideas, connect projects

spotlight on innovation

GATHERING AROUND THE GOAL OF REDUCING EMISSIONS

Over the past decade, it became increasingly clear that reducing methane emissions is the fastest, most cost-effective approach to mitigate GHG emissions. In November 2021, 1,026 registrants gathered online for PTAC's **Net Zero & Methane Emissions Reduction Conference**. This four-day event brought together leading decision makers and industry experts representing 31 countries across five continents, united by their collective goal of achieving net-zero emissions by 2050.

Each day, a different respected keynote speaker addressed emissions reduction from their unique perspective. The lineup of keynote speakers included government representatives Honourable Jason Nixon, Alberta Minister of Environment and Parks, Deputy Minister Bev Yee, and Assistant Deputy Minister John Moffet. They shared recent updates to oil and gas regulations and policies and examined industry's readiness to meet mandated methane emissions targets. On the final day of the conference Associate Minister Dale Nally and Dr. David Layzell, Director of the Canadian Energy Systems Analysis Research (CESAR) Initiative at the University of Calgary shared their thoughts on the future and what it might take to truly arrive at NetZero in the oil and gas industry.

The 13 virtual sessions addressed a range of topics within three different streams: Carbon Capture, Utilization & Storage, Methane Emissions Reduction, and Hydrogen. A diverse slate of 70 speakers reported on active research, illuminated pressing challenges, introduced new ideas, and identified potential technology solutions to help our industry achieve emissions reduction goals. Participants in all three streams asked insightful and engaging questions, which often sparked interactive discussions.

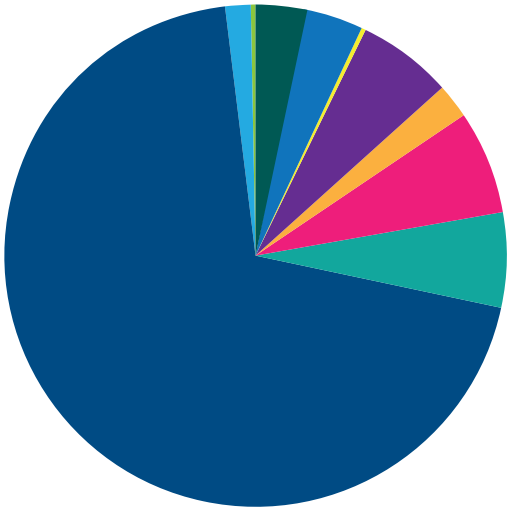
A virtual exhibition hall featuring 27 exhibitors and sponsors gave participants an opportunity to discover new products and find out about innovative services in the emissions reduction ecosystem. PTAC has been working on initiatives to reduce methane emissions for more than a decade. The excitement was palpable when PTAC announced at the conference that in FY21 they met and exceeded their long-term goal of increasing technology capacity enough that industry could reduce its methane emissions by 45% by 2025 at a cost of less than $\$5/CO_2e$.

> "WE HAVE NOT INHERITED THE EARTH FROM OUR PARENTS, WE HAVE BORROWED IT FROM OUR CHILDREN."
>
> – MODERN PROVERB ADAPTED FROM WENDELL BERRY

This achievement is huge, but it is just a milestone in a longer journey. PTAC and the many organizations represented at the conference continue to develop new technologies and advocate for a NetZero oil and gas industry.

innovative members

229 PTAC MEMBERS
49 NEW PTAC MEMBERS JOINED IN FY21



- Associations (8)
- Government (9)
- Engineering, Procurement, and Construction Companies (1)
- Individuals (14)
- Learning Institutions (5)
- Producers (15)
- Research Providers (14)
- Service and Supply Companies (159)
- Transportation/Midstream (3)
- Venture Capital (1)

MEMBERS

ASSOCIATIONS

Alacrity Foundation
Alberta Canada Fusion Technology Alliance
BC Innovation Council
Canadian Association of Petroleum Producers (CAPP)
Clean Resource Innovation Network (CRIN)
Environmental Services Association of Alberta (ESAA)
Explorers and Producers Association of Canada
Petroleum Services Association of Canada (PSAC)

GOVERNMENT

Alberta Department of Energy
Alberta Economic Development and Trade
Alberta Energy Regulator
Alberta Environment and Parks
British Columbia Oil and Gas Commission
Environment Canada
Global Affairs Canada
Natural Resources Canada
Saskatchewan Ministry of Energy and Mines

INDIVIDUALS

ABBOTT Energy & Environmental Consulting/ART
Bob Mick
Canadian Eagle
Dave Rushford
Dr. Hafez Balavi
Earle Shirley
Eric Lloyd
Fracknowledge
Kathairos Solutions Inc.
Ken Putt
LMK Environmental Consulting/Mark Beasse
Murray Todd
Schooner Consulting
Shunde Yin- University of Waterloo

LEARNING INSTITUTIONS

Polytechnic Montreal
SAIT
University of Alberta
University of Calgary
Carleton University

PRODUCERS

Bonavista Energy Corporation
Canadian Natural Resources Limited
Cenovus Energy Inc.
Chevron Canada Resources
ConocoPhillips Canada
Ember Resources Inc
Enerplus Corporation
Free Rein Resources
Imperial
Japan Canada Oil Sands Limited
NuVista Energy
Ovintiv (Encana Corporation)
Revitalize Energy Inc.
Suncor Energy
Whitecap Resources

"NO ONE CAN WHISTLE A SYMPHONY. IT TAKES A WHOLE ORCHESTRA TO PLAY IT."

– H.E. LUCCOCK

ENGINEERING, PROCUREMENT, AND CONSTRUCTION COMPANIES

Worley Parsons Canada Services Ltd.

TRANSPORTATION/ MIDSTREAM

Keyera Energy Ltd.
TransCanada PipeLines Ltd.
ATCO

RESEARCH PROVIDERS

Alberta Innovates
Alberta Sulphur Research Ltd.
BC Research Inc.
Bureau Veritas
CMC Research Institutes
FRI Research
Gas Technology Institute
Genome Alberta
InnoTech Alberta
Patro Research
PTRC - Petroleum Technology Research Centre
Saskatchewan Research Council
Strategic Timelines
Waterline Resources Inc. - Environmental Team

VENTURE CAPITAL

First Merchants Capital Partners Inc.

SERVICE AND SUPPLY COMPANIES

24/7 Compression
4Blue
Acceleware Ltd.
AECOM
AGAT Laboratories
AgriPower Inc
Air Market
Akine Well Optimization Services Inc.
Alumni Technical Solutions
Amazon Web Services
AMGAS Services Inc.
Anax Power
Arolytics
ASSIST Energy Services
Atlantis Research Labs
Barrel Eye
Blue Source Canada ULC
Boreal Laser
Breama Inc.
Bridger Photonics
Calscan Energy Ltd.
Carbon Connect International
Caron Measurement & Controls
Challenger Technical Services'
Clairifi Inc.
Clear Rush Co
CLEAResult
Clearstone Engineering Ltd.
CNTRAL Inc.
Cognitive Systems
Computer Modelling Group Ltd.
COOEC Canada Company Ltd.
Cream Energy Group
Crimson Regulatory
Cyanic Automation
Deep Cryogenics
Drift Resource Technologies
Drishya AI
DV8 Energy
DXD Consulting
E2E Energy Solutions Inc
Eadie Oil Inc.
Earthmaster Environmental Strategies Inc
Emerging Fuels Technology Inc.
Emission Rx
enSift Corp.
Envirosoft
EnviroVault LP
Eosense
Equilibrium Environmental
Expansion Power
Expeto Wireless Ltd.
Extreme Telematics Corp.
EZOPS Inc
FERST Environmental
Fiberbuilt
FieldCap
FLIR System Inc.
Fluidstream
Galatea Technologies Inc.
Gas Pro Compression
GCHEM Ltd.
GCL Environmental Ltd
General Energy Recovery Inc (GERI)
GeoGen Technologies Inc.
geoLOGIC systems Ltd.
GHGSat Inc.
Global Power Technologies
Golder Associates
GreenPath Energy Ltd.
Grid Environment Ltd.
H2Sweet Inc.
Halliburton Group Canada
Hatfield Consultants
Heath Consultants
Highwood Emissions
Hydro Pacific Pumps
Hydrodine Catalutics Ltd.
ING Robotics, RAZI
Ingu Solutions Inc.
INO
Integrated Sustainability Consultants Ltd.
Intricate Group Inc.
Ionada Carbon Solutions Limited
Ironline Compression Limited Partnership
Kairos Aerospace
Katch Kan Limited
KPMG High Technology Practice Group
Kuva Systems
LCO Technologies
LiDAR Services International
Linear Motion Technologies Canada
Lux Modus Ltd.
Luxmux Technology Corporation
Marathon Compression Corporation
Matidor
McIntosh Perry Energy Limited
Memphore
Millenium EMS Solutions Ltd.
Montrose Environmental Group Inc
Muddy Boots Online
MWD Planet
National Silicates
New Oil Generation
New Paradigm Engineering Ltd.
North Shore Environmental Consultants
Northern Oil Research
OilPro Oilfield Production Equipment Ltd.
Oscar Drilling Solutions
Osperity Inc (Osprey Informatics)
Pacer Chemical
PermianChain Technologies Inc.
Portfire Associates
Proactive Environmental Rentals
Process Ecology Inc.
ProductionAR
Qnergy
Qube Technologies Inc
Radicle Balance (Cap-Op Energy / TriCore Carbon Solutions)
Rheaume Engineering Inc.
Robotic Aviation Systems
ROSEN Canada
RWDI
Schlumberger Canada Ltd.
Seal Well Inc.
SeekOps
SensorUp
ServiceEcho
Silvacom
Simark Controls (SFC Energy LTD)
Sirius Instrumentation & Controls Inc.
SLR Consulting (division-based)
Smitholeum
Spartan Controls
Surface Solutions
Synanos
Teck Resources Limited
Telops
Tetra Tech
Thin Air Labs
Tomahawk Energy Services Limited Partnership
Total Combustion Inc.
Trace Associates
TriAcc
TSGI Corporation
V2H North America
VEERUM
Ventbuster Instruments Inc.
Vertex
Vista Projects
Vizworx Inc.
VL Energy Ltd.
wave 9
WE Generation
West Country Energy Services
Westgen Technologies Inc
Winterhawk Well Abandonment Ltd.
World Class Contractor and Construction
Zenoba Energy (Proteum Energy)

auditor's report

To the Directors of Petroleum Technology Alliance Canada

OPINION

We have audited the financial statements of Petroleum Technology Alliance Canada (the "Organization"), which comprise the statement of financial position as at March 31, 2022, and the statements of operations, changes in net assets and cash flows for the year then ended, and notes to the financial statements, including a summary of significant accounting policies.

In our opinion, the accompanying financial statements present fairly, in all material respects, the financial position of the Organization as at March 31, 2022, and its results of operations and its cash flows for the year then ended in accordance with Canadian accounting standards for not-for-profit organizations.

BASIS FOR OPINION

We conducted our audit in accordance with Canadian generally accepted auditing standards. Our responsibilities under those standards are further described in the *Auditor's Responsibilities for the Audit of the Financial Statements* section of our report. We are independent of the Organization in accordance with the ethical requirements that are relevant to our audit of the financial statements in Canada, and we have fulfilled our other ethical responsibilities in accordance with these requirements. We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our opinion.

BDO Canada LLP
Chartered Professional Accountants

Calgary, Alberta

PTAC Petroleum Technology Alliance Canada

Statement of Financial Position

As at

	March 31, 2022	March 31, 2021
ASSETS		
Current		
Cash	**$ 2,714,115**	$ 2,311,891
Cash and cash equivalents- restricted (note 3)	**3,262,846**	5,247,876
Restricted short-term investment (note 3)	**6,484,970**	7,422,307
Goods and services tax receivable	**68,478**	13,586
Accounts receivable and accrued receivables	**787,807**	1,011,272
Prepaid expenses	**28,164**	21,077
	13,346,380	16,028,009
Restricted long term investment (note 3)	**-**	1,420,411
Property and equipment (note 4)	**2,573**	1,838
	$ 13,348,953	$ 17,450,258
LIABILITIES		
Current		
Accounts payable and accrued liabilities	**$ 2,166,865**	$ 2,081,977
Deferred membership revenue	**80,578**	35,889
	2,247,443	2,117,866
Deferred contributions (note 5)	**6,453,881**	10,464,953
	6,453,881	10,464,953
NET ASSETS		
Invested in property and equipment	**3,792**	3,057
Internally restricted (note 11)	**2,643,837**	2,864,382
Reserve	**2,000,000**	2,000,000
	4,647,629	4,867,439
	$ 13,348,953	$ 17,450,258

PTAC Petroleum Technology Alliance Canada

Statement of Operations

For the year ended

		March 31, 2022 (12 months)		March 31, 2021 (15 months)
Revenue				
Project and service revenue (notes 10 & 14)	**$**	**11,892,217**	$	8,209,424
Membership revenue		**290,922**		463,204
Event revenue (notes 10 & 14)		**40,132**		58,092
Interest income		**27,242**		76,480
Miscellaneous income		**367**		413
		12,250,880		8,807,613
Expenses				
Direct project and service costs		**10,903,907**		6,911,322
Salaries and benefits		**1,306,426**		1,436,241
Rent and parking		**95,356**		106,650
Other expenses		**165,001**		90,646
		12,470,690		8,544,859
Excess of revenue over expenses	**$**	**(219,810)**	$	262,754


"WE CANNOT SOLVE OUR PROBLEMS WITH THE SAME THINKING WE USED WHEN WE CREATED THEM."
– ALBERT EINSTEIN

PTAC PETROLEUM TECHNOLOGY ALLIANCE CANADA

For more information about PTAC projects, events, or membership contact us at:

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500 – 5 Avenue SW
Calgary, Alberta T2P 3L5

Phone: 403.218.7700 | Email: info@ptac.org